June 9, 2009 CD09-0139

Mr. Dane Finerfrock
Executive Secretary
Utah Radiation Control Board
Utah Water Quality Board
P.O. Box 144850
Salt Lake City, Utah 84114-4850

Re: Radioactive Material License #UT2300249 and Ground Water Quality Discharge Permit No. UGW450005: Class A South/11e.(2) Embankment Revised Application and Response to Completeness Review.

Dear Mr. Finerfrock:

On January 4, 2008, Energy*Solutions* submitted a request for approval of an 11e.(2) embankment design change. The design change would permit disposal of both LLRW and 11e.(2) waste within the current footprint of the 11e.(2) embankment. Under a cover letter dated November 26, 2008, DRC provided response through a completeness review prepared by URS. Energy*Solutions* hereby submits response to the completeness review and a revised amendment request.

Please contact me at 649-2000 with any questions regarding this submittal.

Sincerely,

Daniel B. Shrum
Senior Vice President, Regulatory Compliance

enclosure

cc: Loren Morton, DRC (w/ encl.)
John Hultquist, DRC (w/ encl.)

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering, the information the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

ENERGYSOLUTIONS' RESPONSE TO COMPLETENESS REVIEW OF "AMENDMENT REQUEST; CLASS A SOUTH/11E.(2) EMBANKMENT"

REVISION 0
JANUARY 4, 2008

Energy*Solutions* Response to Completeness Review of "Amendment Request; Class A South/11e.(2) Embankment" Revision 0, January 4, 2008

Throughout this document, the initial comment is quoted in italics, followed by Energy*Solutions'* response.

GENERAL COMMENTS

1. ***Incorporating by Reference**: Repeatedly throughout the Amendment Request (AR), the Licensee states that what is requested is similar to what has already been approved as justification that this request also can be approved without providing additional information. As the Division has consistently declared in response to similar statements offered in support of previous requests, the Licensee must provide specific, narrowly focused citations to previous documents containing justifications and the supporting analyses.*

   Moreover, each time the Licensee incorporates material by reference, it must also demonstrate that the bases for previous situation (to which the reference applies) are sufficiently similar to those that exist in the current situation that the cited results apply directly without revision. If such demonstration cannot be made, the Licensee must either provide new analyses or justifications for the requested action or revise the request.

Energy*Solutions* Response: Revision 1 of the amendment request has been prepared with this comment in mind.

2. ***Information Defining 11e.(2) Disposal Embankment and Its Operation:** The AR is focused on how the plan impacts the Class A license conditions but does not address how the proposed design changes will affect the 11e.(2) facility site boundaries, design, construction/operations, environmental monitoring, closure, and the associated license conditions. The AR does not address how proposed changes will comply with all of the byproduct disposal requirements in R313-24, groundwater protection requirements in R317-6, and other applicable and relevant regulations. No discussion is provided to describe how these changes will impact the stability and performance modeling assumptions, design, and operation of the 11e.(2) facility.*

   No discussion is provided to describe how the current embankment, designed under the 11e.(2) regulations, will meet the Class A LLRW regulations. Neither is any discussion provided to describe how the 11e.(2) and LLW regulations differ and how the proposed system will satisfy both.

   Further, no discussion is provided to describe the current embankment conditions. This discussion should include the amount and location of existing waste in the 11e.(2) disposal embankment. All modifications to the existing embankment should be compared to the existing conditions.

Energy*Solutions* Response: Revision 1 of the amendment request has been prepared with this comment in mind. A discussion of current conditions has been added to section 1.2.3 of the amendment request. Note also that current conditions are briefly discussed in section 3.3.1.1 of revision 0; this discussion has been carried forward into revision 1.

3. ***Stand-Alone Amendment Request****: As the Licensee provides new and revised information that affects the proposed design, construction, and operation, it should incorporate all new and revised information into the AR so that the AR at all times is a stand alone document that fully describes and justifies the requested action. Revised or new text, tables, figures, exhibits, attachments, appendices, and other materials made a part of the AR should be explicitly identified as revised and tracked through the AR review and approval process.*

Energy*Solutions* Response: Revision 1 of the amendment request has been prepared with this comment in mind.

4. ***Submission of Electronic Copies****: As the Licensee is subject to R113-12-111, the AR and all attachments to the AR must be in an acceptable electronic format. The electronic version of the AR received as a PDF was not completely searchable, and pages from the Construction QA/QC manual and other sections of the submission were distorted by copy fade and are not considered true, legible copies of the original documents. The electronic submission failed to meet the standard of the UAC R113-12-111, included below for reference:*
   - *(1) All submissions to the Executive Secretary not exempt in paragraph R313-12-111(5) shall also be submitted to the Executive Secretary in electronic format. This requirement extends to all attachments to these documents.*
   - *(2) The electronic copy shall be a true, accurate, searchable and reproducible copy of the official submission, except that it need not include signatures or professional stamps.*
   - *(3) All electronic copies shall be submitted on a CD or DVD nonrewritable disc, except that documents smaller than 25 megabytes may be submitted by email.*
   - *(4) All documents shall be submitted in one of the following electronic formats, at the choice of the submitter:*
     - *(a) A searchable PDF document (a document that may be read and searched using Adobe Reader); or*
     - *(b) A Microsoft Word document.*

   Please revise the AR to meet these requirements.

Energy*Solutions* Response: UAC R113-12-111 appears to be a typographical error; intended to be a reference to UAC R313-12-111. UAC R313-12-111 had an effective date of April 11, 2008. Revision 0 of the amendment request was submitted January 4, 2008 and therefore pre-dates these requirements. Revision 1 of the amendment request complies with the new requirements.

SPECIFIC COMMENTS

1. ***Acceptability of Co-Locating 11e.(2) and LLRW Disposal Embankments****: The Licensee must provide detailed plans for disposal site closure and stabilization, pursuant to UAC*

R313-25-9. The contradictory statements made in AR §1.4 must be resolved and documentary evidence provided to support each element of the statements that:

> *"EnergySolutions will retain ownership of the land [emphasis added], and will be responsible for site closure, as well as the long-term maintenance and monitoring of the disposal site. In accordance with UAC R313-24-4 and 10 CFR Part 40.28, the ownership of the land will be transferred [emphasis added] to the Department of Energy (DOE), another Federal Agency designated by the President, or the State of Utah. The land will be transferred at to no cost to the DOE. The DOE or other designated agency will be responsible under the general license for custody of and long-term care of the site, including monitoring, maintenance, and emergency measures necessary to protect the public health and the safety and other actions necessary to comply with the standards."*

The EnergySolutions RML #UT2300478 for 11e.(2) is under timely renewal with UDRC. The EnergySolutions (May 15, 2007) 11e.(2) license renewal application (11e.(2) LRA, Revision 3) Round 1 Interrogatory Responses contains documentation from the DOE regarding acceptance of the currently licensed facility upon closure (ibid., Attachment 2). Documentation provided lists the specific site conditions which qualify the Clive 11e.(2) site for DOE acceptance of the facility. The proposed co-location with LLRW wastes changes the site conditions. Therefore, the Licensee must provide written evidence showing that the US DOE will accept the stabilized 11e.(2) disposal embankment for its Long-Term Stewardship Program with the new site conditions. The Licensee must state and describe the impacts of any conditions or requirements DOE imposes that are unique to the proposed facility owing to its singular configuration (that of being co-located and integrally constructed with an LLRW disposal facility). The AR provides no description of the final disposition of the proposed 11e.(2) facility.

Information must be provided to give reasonable assurance that the LLRW embankment design and operation will be compatible with the disposal site closure and stabilization plan and will lead to disposal site closure that provides reasonable assurance that the performance objectives of URCR R313-25-19 will be met.

Energy*Solutions* Response: Energy*Solutions* has contacted the DOE to request this documentation. We understand that it is under preparation and request that DRC technical review of the proposed design continue while it is pending.

2. ***Impact on 11e.(2) License:*** *Section 1.1 of the AR states "the EnergySolutions RML #UT2300478 for 11e.(2) does not require amendment with this action". However, there are several license conditions identified below which appear to indicate the need for amendments to the 11e.(2) license:*

   - *UT 2300478 License Condition 9.3 states:*

     > *Authorized use is for the receipt, storage, and disposal of 11e.(2) byproduct material in accordance with the statements description and representations contained in the licensee's application……*

     The documents referenced and the license renewal application for the 11e.(2) byproduct facility includes no information about the proposed change in the facility boundaries, or *vertical clay barrier to constructed between the 11e.(2) and Class A portions of the disposal embankment, about how actions on one side of the vertical clay barrier might affect conditions on the other, nor compliance with other requirements.*

- *UT 2300478 License Condition 9.4 states:*

  b) *The licensee shall obtain a license amendment pursuant to UAC R313-22-28, prior to implementing a proposed change, test, or experiment if the change test, or experiment would:*

  ii *Result in any appreciable increase in the likelihood of occurrence of a malfunction of a structure, system or component (SSC) important to safety previously evaluated in the license application (as updated).*

  v. *Create a possibility for an accident of a different type than any previously evaluated in the license application (as updated);*

  vi. *Create a possibility for a malfunction of an SSC with a different result than previously evaluated in the license application (as updated);*

  The proposed use of the 6-foot-thick vertical clay barrier wall between the 11e.(2) waste and the Class A portions of the disposal embankment must be described and justified in light of these license conditions and applicable regulatory requirements.

- *UT 2300478 License Condition 10.8 states:*

  The license shall operate the facility in compliance with the following specifications;

  a) *The maximum bulk mass of waste disposed of annually will not exceed* 4.536×10^5 *tons….*

  b) *The open cell area will not exceed 64,858* m^2*….*

  e) *The maximum volume of waste that may be stored as in-cell bulk storage on site prior to disposal will not exceed* 8.418×10^4 m^2*….*

  Section 1.3.1 of the AR indicates a change would be made in the CQAQC manual to provide for stockpiling 11e.(2) waste, for operational flexibility. However, the AR does not explain how this change affects compliance with license condition indicated above.

  Section 1.3.1 of the AR also states that the deadline for storage in the 11e.(2) waste stock-pile will need to be extended. This change will require a revision to the RML #UT2300478 license and contradicts the statement in Section 1.1 that no change to the RML #UT2300478 is needed.

- *The AR directly relates to drawings, procedures, and waste storage limits controlled by the RML #UT2300478 for 11e.(2) waste. Specifically, License Condition 13.1 requires:*

  Except as specifically provided otherwise in this license, the Licensee shall conduct its program in accordance with the statements, representations, and procedures contained in the documents, including any enclosures, listed below. The Utah

> *Radiation Control Rules, Utah Administrative Code R313 shall govern unless the statements, representations, and procedures in the Licensee's application and correspondence are more restrictive than the rules.*

No documentation has been submitted to show that the requirements, statements, procedures, and representation within the 11e.(2) license in general and within License Condition 13.1 in particular will not change or will not need to be changed.

Energy*Solutions* Response: Regarding UT 2300478, condition 9.3: In a letter dated March 6, 2008, DRC concurred with Energy*Solutions'* proposal that the 11e.(2) license renewal application would be revised following agreement on the Class A South/11e.(2) embankment design.

Regarding UT 2300478, condition 9.4: This condition was removed in DRC amendment 5 to the license.

Regarding UT 2300478, condition 10.8: This condition sets maximum limits which will not be exceeded under the proposed Class A South/11e.(2) embankment. Section 1.3.1 of the amendment request has been revised to clarify this point. The annual deadline for stockpile placement in the 11e.(2) is contained only in the 11e.(2) license application and the LLRW and 11e.(2) CQA/QC Manual. As discussed above, the license application will be addressed following agreement on the Class A South/11e.(2) embankment design. Revised text for the LLRW and 11e.(2) CQA/QC Manual was included in the amendment request; this change is carried forward in revision 1.

Regarding UT 2300478, condition 13.1: The license closeout condition will be reviewed and updated together with the revised renewal application, as discussed above.

3. ***References Provided****: Each reference cited in Section 11 should be used in the AR. The list of references below is taken from Section 11 but the references are not otherwise cited in the AR. If these documents contain information critical to the AR, the text should discuss the referenced information and provide justification that it is indeed applicable.*

- *CEntry, "Overpack Design". submitted to DRC on March 20, 2003*
- *Envirocare of Utah, Inc., "Application for License Amendment: Containerized Class A, B, and C LLRW Disposal," December 13, 2000*
- *Envirocare of Utah, Inc., "Durability Assessment of Concrete Overpacks", submitted to DRC on March 10, 2003*
- *Envirocare of Utah, Inc., "Engineering Justification Report: Addendum", October 2, 2001*
- *Envirocare of Utah, Inc., "Quality Control Inspection List", submitted to DRC on June 11,2003*
- *Envirocare of Utah, Inc., "Request for License Amendment: Containerized Class A LLRW Disposal", April 12, 2001*
- *Envirocare of Utah, Inc., "Safety Evaluation Report", August 1998*

- *Envirocare of Utah, Inc., "Safety Evaluation Report", June, 2001*
- *Envirocare of Utah, Inc., "Siting Evaluation Report", May 2, 2000*
- *USNRC, "Final Environmental Impact Statement to Construct and Operate a Facility to Receive, Store, and Dispose of 1 le.(2) Byproduct Material Near Clive, Utah", Docket Number 40-8989, August, 1993.*
- *Whetstones Associates, "Envirocare of Utah Class A, B, & C Cell Infiltration and Transport Modeling", August 1, 2000*
- *Whetstone Associates, "Envirocare of Utah Class A Cell Infiltration and Transport Modeling", Whetstone, July 19, 2000*

The list below discusses references cited in the text but not included within Section 11. A full citation for these documents is needed to accurately locate the documents for review. Several of these documents appear to be revisions of other documents. The difference in revisions, and the correct applicable material should be concisely referenced.

- *Section 1.2.1 references Class A LLRW RML License Renewal Application June 20, 2005. This reference is not in the reference list. The reference section cites Envirocare of Utah, Inc., Radioactive Material License Renewal Application, March 16, 1998; and Envirocare of Utah, Inc., Radioactive Material License Renewal Application, provided to DRC on July 2, 2003. These references are not cited in the document text.*
- *Section 2.3.2 references AMEC, "Report: Combined Embankment Study, Envirocare," December 13, 2005; AMEC, "Round 2 Interrogatories and Response, Class A Embankment Height Study, EnergySolutions Facility Near Clive, Utah," April 28, 2006; AMEC, "Interrogatory Statement and Response, AMEC Interrogatory Response Letter Dated April 28, 2006, Class A Embankment Height Study, EnergySolutions Facility Near Clive, Utah," May 22, 2006. These references are not in the reference list.*
- *Section 2.3.2 references Application for 11e.(2) Radioactive Material License Renewal, February 17, 2006. This reference is not in the reference list.*
- *Section 2.6.2 references Whetstone, December 7, 2007. This reference is not in the reference list.*
- *Section 3.1.5 references Appendix J of "Pre-licensing Plan Approval Application" Dated March 15, 2000. This reference is not in the reference list.*
- *Section 7.1.1 references an EnergySolutions Radiation Protection Program without specifying if it is part of the EnergySolutions "Radiation Safety Manual," Rev. 7, August 4, 2006.*

Energy*Solutions* Response: Revision 1 of the amendment request has been prepared with this comment in mind.

4. ***Vertical Clay Barrier:*** *The Licensee must demonstrate that the proposed design change will satisfy all regulatory requirements related to:*

- *The buffer zone (see UAC R313-25-7(2), 25-25(8), and UAC R313-24-4 (10 CFR 40 Appendix A Introduction),*

- *The ability of the environmental monitoring program to detect releases from the facility (see UAC R313-25-7(2), 25-7(12), 25-23(2), 25-23(11), 25-25(8), 25-26, 25-28(2), and UAC R313-24-3, and*
- *Stability of the disposal unit and cover system (see UAC R313-25-7(2), 25-8(4), 25-11(6), 25-22, 25-25(9), and UAC R313-24-4 (10 CFR 40 Appendix A Introduction))*

The vertical clay barrier within the Class A South/11e.(2) disposal embankment is proposed to separate the Class A waste portion from the 11e.(2) waste portion of the reconfigured embankment (see Section 3.1.3 of the Januar9y 4, 2008 AR and Drawings V3 and V6). The vertical clay barrier that forms the barrier between the two portions of the disposal embankment is an engineered barrier according to UAC R313-25-2 This engineered barrier will also allow Class A waste to be disposed in much closer proximity to disposed 11e (2) waste. This engineered barrier and its projected performance have not previously been described, analyzed, or reviewed. The proposed change is major in scope, purpose, and possible effect on waste containment and the environment. The design basis, characteristics, and design of the engineered barrier and impact on the existing embankment must be justified in the AR.

The vertical clay barrier is a new principal design feature that must be comprehensively analyzed with respect to its required principal and secondary functions, design criteria, characteristics, and projected performance. Specifically, the effects of the vertical clay barrier on the following functions must be described, evaluated, and justified:

- *Structural stability (including slope stability, settlement, and differential settlement), considering normal and abnormal conditions.*
- *Infiltration and contaminant transport modeling under open-cell and closed conditions, considering normal and abnormal conditions for both the LLRW and 11e.(2) portions of the proposed embankment. Emphasis here must be on how the presence of the vertical clay wall does not change the long-term performance of either disposal cell to protect the underlying groundwater for at least 500 years.*
- *Environmental monitoring under or through the vertical clay barrier and between the two disposal embankments that enables correct attribution of environmental releases and impacts. See Item 6 for additional discussion of Environmental Monitoring.*
- *Means of ensuring that the vertical clay barrier will physically and hydraulically isolate the two types of wastes, including the means to ensure that surface water contacting the Class A waste will not flow across the top of the vertical clay barrier and into the 11e.(2) portion of the embankment, throughout the operational period of the embankment, considering normal and abnormal conditions.*
- *Control of lateral movement of pore-liquids between the Class A LLRW and the 11e.(2) portions of the embankment, both during operations and following closure of the embankment, considering normal and abnormal conditions.*
- *Ability of the proposed vertical clay barrier to resist degradation due to weathering, erosion, and freezing temperatures.*

The applicant also should provide information on the projected performance of the vertical clay barrier with regard to each required principal design function and each secondary *design function/complementary aspect under the applicable normal and abnormal conditions.*

<u>Energy*Solutions* Response:</u> See item 9 below for detailed discussion of the buffer zone. See item 6 below for detailed discussion of environmental monitoring. The following discussions have been incorporated into section 3 of the revised amendment request:

- Structural stability: This was evaluated by comparing the clay barrier soil properties to those that were used in various technical evaluations performed for past and current permits. Since the barrier wall material will consist of native silts and clays which are currently used extensively on the cover and liner systems for the current embankments, their properties are well established. The minimum strength of the barrier wall material exceeds that of a majority of the waste that will be replaced by the wall. As detailed in the SMN&A technical analysis[1], the barrier wall material has suitable strength properties, such that the embankment stability will be unaffected.

  The referenced technical analysis also evaluated total and differential settlement issues. Both of these types of settlement are time dependent, so the degree of settlement that occurs after cover placement depends on how much time is allowed between topping out the waste column and placing the final cover. It is common practice to place temporary cover and to allow time for settlement to occur. Consistent with current permits, settlements of the final waste surface are monitored at various locations to allow engineers to better estimate when projected future total and differential settlements will be compatible with the final cover criteria.

- Infiltration and contaminant transport modeling: For the open cell condition, precipitation that falls on the embankment footprint either evaporates or migrates to localized low spots over approved liner or placed wastes. When fluids accumulate, they are contained by a berm and are collected and transported to lined ponds for subsequent evaporation. The Ground Water Quality Discharge Permit, condition I.E.7, requires that stormwater be removed from the disposal cells as quickly as possible after a storm event. This approach will not change with the barrier wall; although runoff will be directed as discussed in the LLRW and 11e.(2) CQA/QC Manual, work element – Class A South/11e.(2) Clay Barrier, specification "Runoff Control".

  For the closed cell condition, the top cover system will have a lower permeability than the bottom liner, and no accumulation of water within the cell will occur. Infiltration and contaminant transport modeling was performed for those conditions to satisfy the current license requirements[2]. Long-term moisture conditions within the embankment will become steady state, and will be controlled by the permeability of the cover and liner systems.

[1] Class A South/11e(2) Embankment Barrier Wall Stability Evaluation, SMN&A, May 20, 2009
[2] Energy*Solutions* Class A South Cell Infiltration and Transport Modeling, Whetstone Associates, December 7, 2007

For the closed cell condition, the flux of moisture across the liner was considered to be uniform across the embankment footprint. That case will not change when the barrier wall is added, as supported by the very slow infiltration rate derived from the infiltration model (0.276 cm/yr under the top slope; 0.286 cm/yr under the side slopes). Contaminant transport modeling for the 11e.(2) portion of the embankment is unaffected by the design change, since the 11e.(2) cover system is unchanged.

- Environmental monitoring: Please refer to item 6 below.

- Physical and hydraulic isolation: Physical isolation is provided by a wall of compacted inert silty clay material, with a minimum separation distance of 12 feet. The clay barrier will always be constructed in advance of waste placement and will be a minimum of one foot higher than the adjacent wastes on both sides. The location of the clay barrier will be marked with high visibility cones or other similar markings to ensure that operations personnel are aware of the physical barrier and the waste placement limits. A debris fence will be placed on the clay barrier to minimize the potential for windblown debris to migrate between waste types. The debris fence will be removed and replaced during each phase of barrier construction.

  Hydraulic isolation is also provided by the clay barrier due to its geometry and the use of very low permeability material. The clay barrier will be constructed to the same density and permeability specifications as $1x10^{-6}$ cm/sec clay liner and radon barrier. Rain water and surface water runoff will be directed away from both sides of the clay barrier by constructing and maintaining the top of the waste materials at a two percent slope that falls away from the wall alignment. The one foot minimum vertical projection of the wall, along with a minimum two percent falling slope within the first 100 feet of the waste surface, will ensure that no water ponds or flows along the barrier wall between the two waste types. The sloping surface of the waste will be established on the 11e.(2) side of the wall, at the onset, but the 100 foot wide criteria will not be met until the wall is high enough to allow room between the wall and the previously placed waste. Additional details on surface water isolation are discussed in item 8 below.

  Subsurface hydraulic isolation during the operational period will be provided by contrasts in permeability and contrasts in hydraulic gradient. For the general case, wastes will have much higher permeability than the barrier wall, and moisture will follow the more permeable path. Since waste material placed within 100 feet of the wall will also be sloped away from the wall at a minimum of two percent, if infiltration encounters a layer of low permeability waste, then the fluid will migrate laterally away from the barrier wall until it can find another downward path within the cell. As this happens the fluids migrate progressively further from the wall.

  The hydraulic gradient within the embankment will be downward due to gravity. Fluids will not migrate across the barrier wall because the hydraulic gradient across the wall will essentially be zero. If there is any lateral component to the gradient, there will be a strong bias for it to be away from the wall due to the falling slope of the placed waste layers. Once any fluids reach the bottom of the cell, during the open cell condition, they will migrate laterally across the liner to an accumulation point where they will be removed.

- Lateral movement of pore liquids: The potential for lateral movement of liquids between the cells was addressed in the previous section. This section addresses potential movement of residual moisture that remains in the barrier wall material after construction.

  Movement of pore liquids within a fine grained soil mass can only occur when driving forces are greater than the capillary tension forces which cause soil to retain moisture. Driving forces are derived from gravity, pressure provided by some source of water, or from an adjacent material with a higher capillary tension than the barrier material. Except for the case where there is minor redistribution of moisture within small, localized areas (such as achieving localized moisture equilibrium of materials immediately after placement) movement of pore fluids also requires a source and a destination for the fluid.

  The potential source of replenishment water consists of precipitation. Since the layers of compacted waste will be constructed with a top slope that falls away from the barrier wall, at approximately two percent grade, there will be no accumulation of water immediately adjacent to the barrier wall, and thus no driving force. In addition, since various waste streams are received and placed within the cells, the overall embankment will consist of alternating layers with varying permeability. When precipitation does remain within the waste, it will progressively migrate downward in a stair stepping manner, away from the barrier wall.

  Although the barrier wall material will have a natural affinity to attract and retain moisture, that moisture affinity will be satisfied at the time the wall is being constructed, as part of the normal moisture conditioning and compaction process. Those pore fluids will remain within the barrier on a long term basis, held by capillary tension.

- Resisting degradation: The exposed portion of the clay barrier wall will be subject to potential degradation due to weathering and erosion, in the same manner as the clay materials that are used for the liner and cover systems. To the extent that moisture or density is degraded at an exposed surface of the clay barrier wall, the material will be reworked to meet the original specification, before additional materials are placed. If material is eroded away, it will be replaced. These potential impacts on the barrier wall will be assessed and rectified in the same manner as currently required for the liner and cover. Please refer to the LLRW and 11e.(2) CQA/QC Manual, work element – Class A South/11e.(2) Clay Barrier, specifications “Clay Barrier Drying Prevention,” “Cold Weather Placement of Clay Barrier,” and “Spring Start-Up”.

Design criteria, specifications, and projected performance under normal and abnormal conditions is discussed in section 3 of the revised amendment request and summarized in tables 3.3, 3.4, and 3.5.

***5. <u>Material Specifications and Procedures</u>**: The Licensee must provide information to support its analyses demonstrating that the facility can be constructed and remain stable as required in UAC R313-25-7(2), 25-8(4), 25-11(6), 25-22, 25-25(9), and UAC R313-24-4 (10 CFR 40 Appendix A Introduction). Material specifications must be provided for the vertical clay barrier and must respond to the demands of the design criteria identified (e.g., maximum allowable permeability and other material / engineering properties) and used in required analyses. The specific procedures required to achieve the conditions identified by design criteria and material specifications must be stated. The CQA/QC Manual needs to provide additional details regarding the procedures for constructing and testing of the vertical clay barrier. Such additional information should include the methods and tests used during construction of the vertical clay barrier and operation of the embankment to ensure that required functions and design criteria for the vertical clay barrier will be met.*

Information provided for the vertical clay barrier that relates to its required functions and design criteria that must be addressed include, but is not limited to:

- *The required maximum allowable permeability for the completed clay barrier, and compaction procedures and clay material moisture conditioning needed to meet that permeability criterion;*
- *Engineering properties and characteristics of the clay barrier, including, but not limited to: chemical / mineral composition, USCS soil classification, plastic index, minimum dry density, grain size distribution or gradation limits, minimum and maximum moisture content at placement, lift thickness, etc.*
- *Measures to prevent or minimize desiccation cracking of, frost/weathering-related damage to, and erosion damage to the constructed portion of the vertical clay barrier throughout the embankment operational period, especially when incremental construction of the vertical clay barrier is not occurring and clay lifts are not being added and compacted;*
- *Measures for inspecting the vertical clay barrier throughout the embankment construction/operational period to ensure that permeability and surface water drainage requirements are being maintained;*
- *Measures for ensuring the structural stability of the vertical clay barrier, given uncertainties in the differing rates of waste receipts between the two portions of the embankment; and*
- *Testing procedures for demonstrating that the design objective/design criteria are being achieved during construction and embankment operations.*

<u>**Energy*Solutions* Response:**</u> The revised amendment request includes a revised LLRW and 11e.(2) CQA/QC Manual as Attachment 3. Specifically:

- Permeability and compaction: see Work Element – Class A South/11e.(2) Clay Barrier, specifications "permeability" and "compaction".
- Clay barrier properties and characteristics: See Work Element – Class A South/11e.(2) Clay Barrier, specifications "clay barrier material" and "lift thickness".
- Clay barrier protection from weathering: See Work Element – Class A South/11e.(2) Clay Barrier, specifications "clay barrier drying prevention", "cold weather placement of clay barrier", and "spring start-up".

- Inspections: See Work Element – Class A South/11e.(2) Clay Barrier, specifications "permeability" and "clay barrier drying prevention". Also note that the Ground Water Quality Discharge Permit, Appendix J, requires daily inspection of the embankments for any accumulated precipitation. Condition I.E.7 of the GWQDP requires that standing contact water be removed from the embankments prior to any other area of the facility.
- Structural stability will be ensured through building the clay barrier concurrent with adjacent waste lifts. An overbuild limit is included in the CQA/QC Plan; Work Element – Class A South/11e.(2) Clay Barrier, specification "clay barrier construction". Also, see response to item 10 below for details.
- Test procedures are provided in Appendix B to the LLRW and 11e.(2) CQA/QC Manual, which was included with the initial amendment request; and will not be revised from current standards for this amendment.

6. ***<u>Environmental Monitoring</u>****: The AR does not describe how the monitoring system will provide early warning and discretely distinguish potential radionuclide releases from the Class A and/or the 11e.(2) portions of the embankment, as required by UAC R313-25-7(12), R313-25-23(2); R313-25-23(11), R313-25-26, R313-24-4(b), and R317-6-6.9]. A high potential exists that releases from the 11e.(2) portion will be masked by releases from the Class A portion of the embankment, or vice versa.*

In the case of groundwater, the water gradient in the vicinity of the proposed clay curtain wall is predominantly southwest to northeast. The AR does not describe how the proposed monitoring will be able to provide early warning of potential radionuclide releases and discretely distinguish which portion of the modified embankment generated the release of materials. Discussion in AR §4.4.3 inadequately addresses the need to positively identify the sources of contaminants detected in groundwater monitoring wells. Greater definition is required of the paths contaminants might follow upon release from either the Class A waste and/or 11e.(2) waste portions of the embankment.

While the four proposed monitoring wells in the vertical clay barrier are located at the very edge of the Class A waste, and appear to be in close proximity to the waste source term [in accordance with UAC R317-6-6.9(A)]. However, the wide spacing of these wells leaves the possibility that releases could be undetected if they came from a liner defect between the monitor well locations. Under these circumstances, a contaminant plume would not be detected until it had passed under the 11e.(2) Cell and arrived at monitoring wells on the north or eastern margin of that cell. Ignoring groundwater flow directions and using a perpendicular path from the vertical clay barrier to the east 11e.(2) Cell monitoring wells (e.g. MW-20), the resulting travel path would be over 1,000 ft. This distance is significantly greater than the corresponding 250-foot topslope design basis that has been used for all other previous transport models approved hereto at the site. As a result of these longer flow paths, significant delay would result in detection of a contaminant release. Therefore, additional justification is needed regarding the number of wells and maximum well spacing distance along the north-south vertical clay curtain wall. At a minimum, it appears that additional monitoring wells need to be located along the vertical clay barrier to discretely monitor the Class A waste in the combined embankment. Please provide additional justification for the number and location of these additional wells.

Adequacy of the system proposed to monitor contaminant migration must be demonstrated. The presence of contaminants in the vadose zone should be monitored before they enter the aquifer where they can mix with contaminants from other sources. Consideration needs to be given to constructing and monitoring sumps in the bottom of the Class A waste portion of the embankment to hasten the detection of potential releases from respective portions of the disposal embankment. This means that collection lysimeters must be constructed under the LLRW portion of the embankment along the western margin of the clay curtain wall. Please revise the design to incorporate an adequate number of collection lysimeters along the eastern margin of the LLRW waste area. Please provide engineering details regarding design and construction of each lysimeter pan and its corresponding access pipe.

The AR must provide equivalent analyses of the environmental monitoring program for other environmental transport pathways, such as transport of contaminants through air. If the changes in the environmental monitoring program require additional or modified procedures, then these procedures must be provided. Information on the environmental program must be provided to give reasonable assurance that the proposed disposal site is located so that nearby facilities or activities (including particularly the adjacent 11e.(2) portion of the disposal embankment) will not significantly mask the environmental monitoring program, as per UAC R313-25-23(11).

The Licensee must describe how it will collect pre-operational monitoring data along the eastern margin of the LLRW embankment where the wells are to be installed. Information also needs to be provided on how these wells will be protected during construction of the embankment. Because the wells are to be installed with directional drilling or as horizontal wells before clay liner construction, access to them will be sub-horizontal. In the event that there were to be settlement of the embankment foundation, there is a potential that the well casing could be distorted or sheared, thereby preventing pump maintenance or replacement.

Information must be provided to give reasonable assurance that during construction and operation of the proposed embankment, the environmental monitoring program will produce data that provides early warning of releases of waste from the disposal embankment.

Information and description should describe how air monitoring, radon monitoring, and direct gamma monitoring will be conducted for the LLRW, separate and distinct from similar monitoring for the 11e.(2) embankment

Energy*Solutions* Response: The following discussion has been incorporated into Section 4.4.3 of the revised amendment request.

Groundwater monitoring system design and feasibility is addressed in “Responses to Utah DRC Comments 6, 7, 9 and 16 relating to the Class A South/11e.(2) Cell Permit Amendment Request,” Environmental Resources Management (ERM), June 5, 2009. This report has been provided as an attachment to the amendment request. This approach provides reasonable assurance that releases from the Class A portion can and will be detected beneath the clay barrier before they have migrated under the 11e.(2) portion of the embankment.

The ERM report does not address collection lysimeter construction. Drawing 07021-V1, rev. 1 has been modified to add 3 collection lysimeters, bringing the total to 7 for the embankment. This collection lysimeter network is consistent with the spacing approved by DRC via letter dated August 27, 2008. This letter approved a July 15, 2008 Energy*Solutions* submittal proposing coverage of one lysimeter per 350,000 to 400,000 square feet of waste placement area. Two lysimeters are located in close proximity to the barrier wall.

Environmental monitoring will be performed in accordance with the current approved Environmental Monitoring Plan per Radioactive Material License #UT 2300249, condition 26. This plan was recently revised and re-issued to incorporate LLRW and 11e.(2) environmental monitoring into a single program. The current approved version is revision 0, dated November 24, 2008. The Environmental Monitoring Plan does not require separate and distinct air, radon, or direct gamma monitoring for any particular embankment or waste type; rather, the dose and contamination limits apply at facility boundaries accessible to members of the public regardless of source. Therefore, no further revision to the environmental monitoring program is needed.

7. ***<u>Installation of Groundwater Monitoring Wells</u>:*** *Additional information is needed to explain how the proposal complies with the requirements of UAC R313-24-4 [R317-6-6.3, and R317-6-6,9], and R313-25-26. The four horizontal monitoring wells proposed for installation beneath the proposed vertical clay barrier (see Section 4.4.3 of the January 4, 2008 AR and proposed wells GW # 1 through GW # 4 shown on Drawing U3) must be:*

- *Installed at the proper locations*
- *Constructed of appropriate, inert materials, and in a reliable, adequate manner,*
- *Constructed to yield adequate volumes of groundwater during each scheduled groundwater sampling event and provide representative data on chemical and physical conditions or groundwater immediately downgradient of the Class A South waste portion of the proposed embankment.*

The proposed methodology for installing these wells (either directional drilling or horizontal placement prior to cell construction) must be thoroughly described. Moreover, demonstration must be provided with reasonable assurance that these monitoring wells can be successfully installed, accessed, operated, and maintained during the entire life of the facility, including pre-operations, disposal operations, and post-closure periods. Well configuration must allow ready and easy access for pump replacement. Given the width of the vertical clay barrier and the horizontal distance between the proposed screen position and the south edge access for the directional drilling (or horizontal well construction), the lateral deviation between each installed and intended position must be very small (a few feet or less) to ensure that each monitoring well would be directly below the vertical clay barrier. Well locations needs to be closely coordinated to prevent conflict with the required collection lysimeters and their access pipes along the eastern margin of the LLRW waste. As a result, the corridor under the vertical barrier could become extremely congested in light of these collection lysimeters and the need for additional well screens that may be needed to provide a well spaced monitoring well network on the east side of the LLRW waste.

Additionally, because the perforated zone (screened interval) in each such proposed monitoring well would be horizontally or sub-horizontally inclined (apparently never been attempted at this site), additional information is required regarding the feasibility of screen *and sandpack construction and configuration. Also, the effectiveness of providing reliable samples at the required monitoring frequency and the potential effects of groundwater elevation changes over time (in the area of these proposed wells) on the viability of using these proposed wells for groundwater monitoring must be evaluated*

Additional information must be provided that identifies how the required high degree of well installation accuracy in the drilling will be achieved. Currently available technologies might offer a high degree of accuracy for directional drilling, with documented cases demonstrating accuracy as high as 0.1% of drilling distance (or even better accuracy) over the length of drilling that would be required for this embankment. However, the applicant has not provided adequate information or details regarding identified the attitude control methods to be used. Additional information must be provided on:

- *Technology to be employed for the directional drilling*
- *Expected range of lateral deviations for the wells for the technology to be used*
- *Attitude control technology to be used/methods to be used to verify well installation accuracy*
- *Possible contractors that can provide the required service, including referrals to and records of any previous experience they have with directional drilling.*

Additional information must be provided to demonstrate that the proposed horizontally or subhorizontally-inclined monitoring wells comply with pertinent, applicable regulatory requirements and guidelines specified in R317-6, with respect to well construction and to collection and analysis of groundwater samples. Additional information must be provided to demonstrate that the proposed monitoring wells (GW # 1 through GW #4) will be able to provide reliable groundwater samples in sufficient volumes to permit representative groundwater monitoring immediately downgradient of the Class A waste portion of the embankment. Steps must be taken in the well design to avoid excess screen length that could lead to borehole dilution and groundwater quality bias.

Applicable groundwater well construction and groundwater sampling and analysis guidance for horizontally or subhorizontally-inclined groundwater monitoring wells must be provided, along with information demonstrating that the proposed horizontally or subhorizontally-inclined monitoring wells will comply with applicable guidance.

Energy*Solutions* Response: Please refer to the discussion in "Responses to Utah DRC Comments 6, 7, 9 and 16 relating to the Class A South/11e.(2) Cell Permit Amendment Request," Environmental Resources Management (ERM), June 5, 2009. This report is provided as Attachment 7 to the revised amendment request.

***8. Drainage Features of Proposed Embankment**: The Licensee must demonstrate the adequacy of the proposed design for directing surface water runoff from the proposed embankment at velocities and gradients that will not result in erosion that will require ongoing active maintenance in the future, as required by R313-25-24. The design to prevent internal erosion must be presented and justified. Since the LLRW cell consists of a sacrificial soil layer sandwiched between two filter layers under the riprap that do not exist in the 11e.(2)*

cover system, the transition for the LLRW cover system to the 11e.(2) cover system with difference features must be described in detail and long-term performance analyzed and justified. The ability of up-slope LLRW areas to conduct internal drainage off of the embankment, across and away from the down-slope 11e.(2) area must be addressed.

The design of perimeter drainage ditches must be justified, either through reference to existing justification (with demonstration that the existing justification applies to the proposed design) or by providing new analyses based in the proposed design. In either case, the justification must demonstrate that the proposed drainage ditch designs are adequate not only to accommodate runoff from the proposed embankment, but also discharge from the Vitro Ditch at the northeast corner of the proposed embankment.

Energy*Solutions* Response: The design to prevent internal and external erosion was already presented in the amendment request, at section 3.2.2. Furthermore, internal and external drainage concerns were accounted for in the submitted design. In order to assure that the Type B filter layer in the Class A South cover and the Filter Zone of in the 11e.(2) cover suitably drain at the transition, the east peak of the top slope was moved to the east approximately 67 ft. Aside from the very peak of the embankment, internal and external drainage at the transition flows parallel to the transition. In the immediate area of the east peak, the cover layers slope away from the transition for both the Class A South and the 11e.(2) embankments. Attention was paid to the various cover layers at the transition to make sure that the LLRW cover system fully covers the LLRW waste and that the 11e.(2) cover system fully covers the 11e.(2) waste. Since the LLRW cover drainage system is more robust than the 11e.(2), the overlapping of some of the LLRW cover layers on the 11e.(2) side of the clay barrier does not negatively impact the 11e.(2) cover performance.

The design of perimeter drainage ditches was already presented in the amendment request, at section 3.2.5. As stated therein, these analyses are applicable to the Class A South/11e.(2) embankment because the embankment shape is essentially identical to that of the currently permitted 11e.(2) embankment geometry. More specifically, the surface (storm water runoff area) of the Class A South/11e.(2) embankment is identical to the current permitted 11e.(2) embankment and the geometry of the drainage ditch around the embankment (included the portion that receives discharge from the Vitro Ditch) is also unchanged. Therefore, new analyses are not required for the proposed Class A South/11e.(2) embankment drainage ditches.

9. ***Buffer Zone****: As defined in Section 1.2 of NUREG-1573, a ". . . buffer zone is that portion of the disposal site that is controlled by the Licensee and which lies under and between the disposal units and any disposal site boundary. The buffer zone provides controlled space to establish monitoring locations that are intended to provide an early warning of radionuclide movement." An adequate buffer zone is required for LLRW disposal by UAC R313-25-2, R313-25-7(2), and R313-25-25(8).*

Further, UAC R313-25-7(2) requires the Licensee to describe certain design features, including "… the adequacy of the size of buffer zone and potential mitigation measures." With this in mind, since 1992 the DRC has approved a wide buffer zone around each disposal cell, from the edge of the waste to the Point of Compliance well. Nominally, this is a distance of 90 feet. It amounts to even a larger distance when you consider 2 cells are *adjacent to one another, there's 90 feet or more available for each, e.g., LARW and Mixed Waste Cell, or the LARW and 11e.(2) Cell, etc.. So, it appears that the current proposal is a major departure from the previous approved approach. Consequently, the Licensee will have to justify and argue before the public why a 6-foot space between the LLRW and 11e.(2) waste rather than 180-feet is now acceptable.*

In 1992, DEQ engineering staff determined that the size of buffer zone was large enough to do both groundwater and other environmental monitoring, and construct mitigation measures to control groundwater pollution, e.g., slurry walls, a pumping well networks, permeable reactive treatment walls, etc. The critical concern was excavation for a slurry wall somewhere near the toe of the embankment. In that case, a 30-foot deep trench would be cut to a depth below the water table and would have to be benched in order to keep the trench walls stable enough for slurry placement. In 1992 the Division concluded there was enough room outside of the toe of the LARW embankment, and inside Section 32 to excavate the necessary benches and trench, should the LARW Cell leak.

This type of mitigation would not be as feasible in the situation now proposed for the CAS Cell, considering that: 1) the top of the cover system, near the vertical clay barrier wall , is more than 25 feet above the natural grade. Hence a larger vertical distance would have to be excavated – producing a wider horizontal distance to provide the benches required to get down to the water table, and 2) the wider excavation would disturb and expose a significant amount of 11e.(2) and/or LLRW waste - resulting in more exposures to workers and greater potential for releases to the environment.

The proposed design does not provide the location and dimensions of any buffer zone between the LLRW and 11e.(2) waste for the proposed embankment change (see AR, Attachment 2). Further, the buffer zone coordinates provided in Table 7 of the AR (p. 37) do not correspond with those shown on the engineering drawings in Attachment 2. Please reconcile this discrepancy and revise the engineering design drawings to clearly show the limits of the buffer zone between these two types of waste. From the drawings provided it appears the modified embankment does not have an adequate buffer zone on all sides of the Class A waste portion of the proposed Class A South/11.e(2) embankment. Part of the area that would normally be the low-level waste buffer zone is occupied by 11e.(2) waste and/or the vertical clay barrier. While the probability of unexpected radionuclide releases to groundwater might be small, the proposed configuration does not meet the requirement for a buffer zone in which radioactive releases could be detected early and mitigative measures could be taken, pursuant to the LLRW requirements of UAC R313-25-7(2). Please justify why a 6-foot wide clay wall is adequate for purposes of both monitoring and contaminant mitigation.

Transport models used to date for LLRW performance assessment have relied on this 90-foot horizontal distance between the edge of waste and the monitoring wells to help provide 500 years of time before groundwater contaminants exceed their respective Ground Water Quality Standard (GWQS). This was also the same horizontal distance assumed in the 12/7/07 Whetstone Associates transport report (p. 81) for the CAS Cell.

The proposed design calls for a 6-foot wide clay curtain wall between the LLRW and 11e.(2) waste. Assuming that the Licensee is able to place the monitoring well screen in the exact middle of that interval a 3-foot horizontal travel distance is provided. Even if the angle of *the groundwater flow relative to the disposal unit boundary is accounted for, this disposal and resulting travel time will be much less than previously estimated. Certainly, the 12/7/07 Whetstone Associates model for the CAS Cell does not represent what will be constructed. This difference on physical conditions must be addressed in transport modeling. Please provide a new groundwater flow and contaminant transport model to simulate the discrete behavior of each disposal embankment, including the Class A and 11e.(2) wastes in the proposed cell.*

Energy*Solutions* Response: The following discussion has been added to section 3.1.12 of the amendment request. As shown on revised drawings series 07021, the vertical clay barrier has been increased to 12 feet wide. A horizontal monitoring well will be located 2 feet from the eastern edge of the Class A waste placement area; providing 10 feet of space for corrective action if needed in the future. Groundwater flow in the region is generally to the northeast.

This is consistent with the current monitoring network and minimum area available for corrective action. In the current network, the groundwater monitoring point of compliance is located 90 feet from the edge of waste, in order to remain close to the source term while providing for a reasonable well spacing network. The Ground Water Quality Discharge Permit, Table 7, defines the buffer zone for each embankment as 100 feet from the edge of waste. Therefore, the effective area available for corrective action around each embankment, if and when a concern is identified in the compliance monitoring well, is a 10-foot wide corridor.

This area is adequate in terms of time because groundwater moves slowly, on the order of one foot per year. Therefore, a 10-foot wide buffer zone allows roughly 10 years of time to design and implement a corrective action before contaminants might cross outside of the buffer zone.

This area is adequate in terms of space because it is feasible to design a groundwater capture and treatment system that fits in a 10-foot wide area. See also "Responses to Utah DRC Comments 6, 7,9 and 16 relating to the Class A South/11e.(2) Cell Permit Amendment Request," Environmental Resources Management (ERM), June 5, 2009.

Buffer zone coordinates have been updated and corrected in Table 7 of the amendment request and the drawings.

An addendum to the 12/7/07 Whetstone infiltration and transport model is being prepared to address the last paragraph of this comment and will be forwarded under separate cover. This addendum will evaluate impacts of having the point of compliance located 2 feet from the toe of waste rather than the 90 feet currently modeled. The 12/7/07 infiltration and transport model is retained with the revised amendment request, since it continues to address conditions applicable to the north, west, and south sides of the embankment.

10. ***Constructability****: In accordance with UAC R313-25-7(6) and R313-25-7(10), the sequencing of construction activities in the Class A waste and 11e.(2) waste portions of the proposed disposal embankment must be better defined. Analyses must be provided that identify and evaluate how the construction sequences might have to be revised, should LLRW and 11e.(2) waste not arrive a optimal rates that best support the concurrent development of* *the co-located disposal units and the proposed vertical clay barrier. Despite uncertainties in relative waste receipt rates, the constructability of the proposed disposal embankment must be demonstrated. As a minimum, the Licensee must address the possibility that:*

- *11e.(2) waste will be received at a rate that does not allow construction of the vertical clay barrier on a schedule that allows disposal activities in the Class A waste portion of the embankment to proceed without delay.*
- *LLRW will be received at a rate that does not allow construction of the vertical clay barrier on a schedule that allows disposal activities in the 11e.(2) waste portion of the embankment to proceed without delay.*

The methods and structures required to construct the vertical clay barrier must be specifically identified to demonstrate that the vertical clay barrier can be constructed with confidence that its characteristics will conform to its specifications. The methods used to integrate successive clay lifts with previous clay lifts to prevent layering of the clay or seams between clay lifts must be described and specified.

Given that the LLRW side of the clay barrier wall might raise to an elevation above current level of 11e.(2) waste, the Licensee must demonstrate that contact stormwaters will NOT flow eastward over the 11e.(2) waste. Were such flow to occur 11e.(2) waste could become contaminated with mobile fission products, for which the 11e.(2) cell was never designed to contain or control.

Energy*Solutions* Response: This section addresses steps for construction of the barrier wall, surface water runoff management, and discusses how Energy*Solutions* will deal with differing rates of waste receipts between the Class A South and the 11e.(2) cells. This discussion has been added to section 3.3 of the amendment request.

Clay Barrier General Requirements: The clay barrier will be constructed using native clay materials compacted to at least 95% of a Standard Proctor and will have an in-place permeability of no greater than $1x10^{-6}$ cm/sec. The completed clay barrier will be at least 12 ft wide. One and one half to one side slopes (at a maximum) will be constructed when placing lifts. The clay barrier will be constructed such that the top of the clay barrier will be maintained at a minimum of one foot above the surface of the adjacent waste (loose or compacted), and completed waste lifts will slope away, for at least 100 ft on the Class A side, from the wall at a minimum of two percent . Specific construction and quality control specifications have been added to the LLRW & 11e.(2) CQA/QC Manual for the construction of the clay barrier and associated waste placement activities. Please see Attachment 3 to the amendment request.

Storm Water Management General Requirements: Temporary runoff control berms will be constructed around the 11e.(2) and Class A waste placement areas in accordance with the current LLRW and 11e.(2) CQA/QC Manual, Work Element – General Requirements, specification “Runoff Control During Project”. The current 11e.(2) runoff control berm on the west side of the 11e.(2) cell will serve as the runoff control berm on the west side of the 11e.(2) lift area(s) and on the east side of the Class A lift area(s) during the initial construction phase. During subsequent construction of the barrier and surrounding waste lifts, the clay barrier combined with waste lift sloping will prevent runoff from crossing from the Class A waste cell to the 11e.(2) cell. The waste on both sides of the clay barrier will be placed and sloped, at least two percent, to divert storm water runoff away from the clay barrier and to the toe of the cells. This sloped waste area will extend at least 100 ft to the west of the barrier for the Class A side and as much as reasonably possible on the 11e.(2) side of the barrier.

Conceptual Construction Plan: The proposed location of the clay barrier will require the relocation of previously disposed 11e.(2) waste. Drawing 07021-U2 shows the current toe of waste in relation to the proposed location of the clay barrier. In general, the plan is to start on the north side of the embankment and work south. The anticipated sequence of construction includes the following (all work will be performed in accordance with the proposed LLRW and 11e.(2) CQA/QC Manual found in Attachment 3):

Initial Clay Barrier Construction and Waste Placement:

1. All liner for the 11e.(2) cell is already constructed. Liner for the Class A South cell will be constructed to the west as needed to provide capacity to receive Class A wastes.
2. New runoff control berms will be constructed as needed around waste placement areas. The existing runoff control berm west of the current 11e.(2) waste toe will be utilized during the initial construction phase of the clay barrier.
3. Existing placed 11e.(2) material will be excavated to within 12" of the top of clay liner as needed to prepare for the construction of the clay barrier. The excavation wall will be sloped as needed to prevent inadvertent collapse. The removed waste will be stockpiled within the 11e.(2) cell for later replacement.
4. Protective cover will be removed within the footprint of the 12' wide clay barrier wall and stockpiled within the 11e.(2) cell for later replacement as 11e.(2) waste.
5. Once the top surface of the clay liner in established, the liner surface will be roughened to ensure adequate tie-in. The first lift of clay barrier material will then be placed and tested. Subsequent lifts will be constructed per the CQA/QC Plan.
6. When the wall is at least 4 feet higher than the liner elevation, then the first lift of 11e.(2) waste can be placed on the east side of the barrier wall and the first lift of Class A waste can be placed on the west side of the barrier wall. Both Class A and 11e.(2) wastes will be placed with a minimum two percent slope away from the wall. On the Class A side of the wall the 2 percent slope will extend at least 100 ft perpendicular to the wall. On the 11e.(2) side of the wall the waste will slope at two percent until it intercepts existing placed waste

Subsequent Clay Barrier Wall Construction and Waste Placement:

7. Subsequent clay barrier lifts will be placed on top of preceding waste lifts such that the top of the clay barrier wall is always at a height at least 1 ft above the immediately adjacent waste, whether that waste is in a loose or compacted lift.
8. Successive lifts of 11e.(2) wastes will be placed within the cell such that the lowest elevations are maintained as far as possible from the wall alignment, until a minimum of 100 ft from the barrier wall can be achieved. The waste lifts shall be constructed and sloped to maintain drainage away from the barrier wall and into the 10 ft waste offsets between the waste and the runoff control berms
9. During this same time frame Class A wastes can be placed on the Class A South side of the barrier wall. Depending on the amount of 11e.(2) waste being received, Class A

waste can either be placed against the barrier wall, or at a separate location to the west (at least 100 ft away from the clay barrier) where it can be placed to elevations higher than the barrier wall. Class A waste placed to higher elevations than the barrier wall will continue to be subject to runoff controls provided in the LLRW and 11e.(2) CQA/QC Manual, Work Element – Class A South/11e.(2) Clay Barrier, specification "Runoff Control". Waste lifts shall be constructed such to maintain drainage away from the barrier wall and into the 10 ft waste offsets between the waste and the runoff control berms.

The rate of waste receipts for both sides of the embankment cannot be reliably predicted more than a few months in advance. The plan dimensions and capacity of the 11e.(2) side will be fixed once the wall is started. Wastes will be placed on that side beginning along the wall. Bulk waste placement capacity in the Class A and Class A North cells will provide buffer for times that Class A waste receipts exceed 11e.(2) waste receipts. After the Class A and Class A North embankments are full, differing relative rates of receipt for each waste type may be managed by having two disposal locations for bulk Class A waste in the Class A South/11e.(2) embankment – one at the barrier wall location and a second location starting at least 100 ft away from the barrier wall. Class A bulk waste receipts consistently exceed 11e.(2) waste receipts; for the rare, short-term case that 11e.(2) waste receipts exceed Class A, this material will be stockpiled until Class A bulk waste receipts permit barrier wall construction. As a last resort, clean fill materials (placed according to waste placement specifications) may be used as a substitute for waste on either side of the clay barrier to balance the construction of the embankment.

***11. <u>Geotechnical Stability of Foundation Soils</u>**: Additional information is required pursuant to UAC R313-24-4 (10 CFR 40.31, 10 CFR 40 Appendix A Criterion 1, 4, and 5A[2]), R313-25-3, and R313-25-7(1 and 2) The Licensee must provide a basis for concluding that the loading conditions on the foundations soils is unchanged from what has been previously approved. The Licensee must also demonstrate that foundation soils will be stable under expected new loading conditions, considering both static and dynamic conditions. All possible loading conditions that might drive differential settlement within foundation soils must be addressed and evaluated.*

<u>Energy*Solutions* Response:</u> The following discussion has been added to section 3.2.3 of the revised amendment request. Geotechnical stability of the foundation soils were reviewed by comparing the loading condition associated with the barrier wall material to loading from various waste materials. Typical unit weights for various materials are presented below. Properties for the liner and cover systems are not presented because those systems are not affected by the addition of the barrier wall.

LARW Debris	101 PCF
CLSM	120 PCF
Clay Liner & Clay Barrier wall material	123 PCF
Waste soils (24 random samples)	102.4 to 139.5, with an average of 123 PCF

The switch from placing waste to using clay material for the barrier wall location will produce no increase in the loading condition to the foundation soils, because these materials have the same typical unit weights. In fact, the foundation soils are capable of supporting much higher loading conditions, as described in the report[3] that was prepared for the proposed increase in height for the current Class A embankment. That study indicated that the embankment could be raised by at least 18 feet. As documented in various previous license submittals for all the embankments at Clive, and as summarized in reference no. 3, the foundation conditions in the Class A South/11e.(2) footprint are considered equivalent to the conditions analyzed in the AMEC report.

12. ***Design Criteria and Characteristics***: *Additional information is required by UAC R313-24-4 (10 CFR 40.31, 10 CFR 40 Appendix A Criterion 4), R313-25-7(2), R313-25-7(3), R313-25-7(10) Although AR Table 3.2 summarizes the impacts of thicker Type B filters, a similar tabulation should be presented to demonstrate that the design bases and criteria for the principal design features are comparable and that the proposed design feature characteristics are comparable and appropriate. Any differences should be explained and justified. Information comparable to that presented in Table 3-3 through 3-5 of the 2005 LRA should be presented.*

Energy*Solutions* Response: Design criteria, specifications, and projected performance under normal and abnormal conditions is discussed in section 3 of the revised amendment request and summarized in tables 3.3, 3.4, and 3.5.

13. ***Long-Term Stability for 11e.(2) Cell***: *The AR does not but must address the requirements stated in UAC R313-24-4 and 10 CFR 40 Appendix A Criterion 4(c):*

> *Embankment and cover slopes must be relatively flat after final stabilization to minimize erosion potential and to provide conservative factors of safety assuring long-term stability. The broad objective should be to contour final slopes to grades which are as close as possible to those which would be provided if tailings were disposed of below grade; this could, for example, lead to slopes of about 10 horizontal to 1 vertical (10h:1v) or less steep. In general, slopes should not be steeper than about 5h:1v. Where steeper slopes are proposed, reasons why a slope less steep than 5h:1v would be impracticable should be provided, and compensating factors and conditions which make such slopes acceptable should be identified.*

The effects of the Class A portion of the disposal embankment on the long-term stability of the embankment, as they relate to performance of the 11e.(2) portion of the embankment must be described. Moreover, compliance with the requirements of 10 CFR 40 Appendix A Criterion 6(1) must also be demonstrated, considering the presence and potential effects of the vertical clay barrier, e.g., control of radiologic hazards for at least 1,000 years and limited release of radon gas.

Energy*Solutions* Response: Cover slopes for the 11e.(2) portion of the embankment are unchanged from the current approved design; thus the criterion is met. The clay barrier will be

[3] Geotechnical Study, Increase in Height and Footprint, Envirocare LARW Facility, AMEC, May 25, 2005.

constructed of clay meeting the specification for lower radon barrier (i.e., maximum permeability of 1 x 10^{-6} cm/sec); and the full radon barrier thickness and 11e.(2) cover system design will be maintained over all 11e.(2) wastes. Please refer to details H and I on drawing 07021-V6.

*14. **Sharing of Construction and Operating Equipment and Personnel**: Additional information is required by UAC R313-15-406, R313-25-7(6), R313-25-7(10), R313-25-7(11), R313-24-4 (10 CFR 40.31, 10 CFR 40.61) The AR must describe the extent to which construction and operating equipment and personnel will be shared between the Class A waste and 11e.(2) waste portions of the disposal embankment. Procedures for decontaminating equipment prior to transfer between portions must be provided and justified. Personnel control procedures between the 11e.(2) and Class A South portions of the facility must be clearly described and illustrated*

Energy*Solutions* Response: The following discussion has been added to Section 4.3 of the amendment request. Class A and 11e.(2) waste will be placed in the Class A South/11e.(2) embankment using shared equipment, facilities, and personnel. This approach continues long-standing practice and controls at the Clive facility. Specifically, controls to minimize cross-contamination of Class A and 11e.(2) wastes are provided at RML #UT 2300249, condition 51. These controls are implemented via site operating procedure CL-LM-PR-001, *Equipment and Facility Labeling Requirements*, provided as an attachment to the revised amendment request.

*15. **Operating Procedures**: Additional information is needed pursuant to UAC R313-25-7(6), R313-25-7(10), R313-24-4 (10 CFR 40.31, 10 CFR 40.61) The AR must describe the means the Licensee will use to ensure that waste accepted for disposal in one portion of the disposal embankment is not mistakenly directed to or disposed of in the other. The AR does not, but must, describe how operations involving multiple waste types within the same fence-line will be conducted. The AR should specifically address how 11e.(2) and LLRW will be controlled to prevent delivery to the incorrect embankment. Descriptions should include but not be limited to: waste receipt and placement controls, training, emergency plans, QA/QC, prevention of cross-contamination, operations activities, document control, and review and internal audit.*

Changes to existing emergency and contingency plans required to respond to new conditions and situations that have not previously been considered should be identified and justified.

Energy*Solutions* Response: As discussed in response to comment 14 above, a discussion of waste segregation controls has been added to Section 4.3 of the amendment request. These controls are mature, having been a component of the shared LLRW and 11e.(2) facilities for some 15 years since the initial licensing of the 11e.(2) disposal cell. This amendment request does not propose to modify existing practices or controls regarding waste management from receipt through disposal, and review should therefore be limited to the engineering design of the proposed Class A South/11e.(2) embankment. Nonetheless, additional discussion of the requested subjects has been added to Sections 4.1 and 4.2 of the revised amendment request.

The existing emergency response plan has been reviewed and is unaffected by the proposed new disposal cell. The plan addresses general types of emergency, and does not specify different responses for the Class A, Class A North, and 11e.(2) disposal cells. Haul routes to the cell location already exist, and waste management practices at receipt and unloading facilities will be unchanged in relation to this request. This discussion has been added to Section 4.5 of the revised amendment request.

16. ***Remedial Action****: An evaluation of potential complications that might result during remedial action in one or the other disposal embankment is required pursuant to UAC R313-25-7(2) and R313-24-4 (10 CFR 40 Appendix A Criterion 1). The remedial action required to address a problem on one side of the clay curtain wall must not create or induce disturbance of the other side. A satisfactory demonstration will show how all remedial or mitigation actions that might be required in the future will be contained within an adequately sized buffer zone that separates the LLRW from the 11e.(2) waste, see discussion above. The effects of these potential complications on surety arrangements must be addressed. The regulatory complications must also be addressed.*

Energy*Solutions* Response: Please refer to the discussion of buffer zone and remedial action options provided in response to item 9 above.

17. ***Performance of 11e.(2) Cell Cover Affected by Class A Cover****: Additional information is required pursuant to UAC R313-24-4 (10 CFR 40 Appendix A Criterion 4).Water is expected to flow laterally through the filter zone of the LLRW cover system into the filter zone of the 11e.(2) cover system. The effects of such flows from the Class A to the 11e.(2) cover portion of the embankment must be addressed. Water that flows from the surface of the Class A cover and onto the 11e.(2) cover may adversely affect the 11e.(2) cover performance (namely infiltration). Please revise the 11e.(2) Cell infiltration and contaminant transport models to address this issue.*

Energy*Solutions* Response: The reviewer has mis-read the drawings in reaching the conclusion that "*Water is expected to flow laterally through the filter zone of the LLRW cover system into the filter zone of the 11e.(2) cover system.*" As shown on drawings 07021-V2 and 07021-V3, grade breaks on the surface of the upper 5 x 10^{-8}cm/sec permeability radon barrier clay for the Class A South/11e.(2) embankment have been designed to minimize drainage from the LLRW cover system into the 11e.(2) cover system, or vice versa. The eastern peak of the top slope is located directly over the clay barrier wall, so that preferred drainage paths are parallel to the clay barrier wall. See also drawing 07021-V6, details H and I, for side slope and top slope cover transitions. This discussion has been added to Section 3.1.1 of the revised amendment request.

18. ***11e.(2) Cell Radon Barrier****: Additional information is required by UAC R313-25-25(6), and R313-24-4 [10 CFR 40 Appendix A, Criterion 6(1)]. Demonstrate that the radon barrier is sufficiently thick at the transition between the 11e.(2) waste and the Class A waste to satisfy the requirements for limiting radon release from the stabilized embankment. The 11e.(2) cell requires a thicker radon barrier than the Class A cell. At the transition between the 11e.(2)*

waste and the Class A waste, the design must include a sufficient thickness and permeability of clay radon barrier to prevent radon from the 11e.(2) waste from escaping via the potentially preferential pathway through the thinner Class A radon barrier.

The AR does not, but must, discuss compliance with the radon release requirements detailed in 10 CFR 40 Appendix A Criterion 6(5). These requirements "apply to any portion of a licensed and or disposal site". Any such portions must be based on the current license UT 2300478, including the area which will be used for the disposal of Class A waste.

Energy*Solutions* Response: See drawing 07021-V6, details H and I, for side slope and top slope cover transitions. These transitions demonstrate that the full thickness of 11e.(2) radon barrier is maintained over all 11e.(2) waste and into the area over the clay barrier wall. Furthermore, the clay barrier wall has been assigned a permeability specification of no greater than $1x10^{-6}$ cm/sec; which is identical to the lower radon barrier specification. Therefore, the 12-foot wide clay barrier wall will prevent radon migration to the Class A side of the embankment; and the full thickness of radon barrier is maintained over the 11e.(2) side of the embankment. This discussion has been added to Section 3.0 of the amendment request.

*19. **Radium Concentration in Near-Surface Soils**: The AR does not indicate how the proximity of the Class A waste will impact the radium levels in the near surface cover, as required in UAC R313-24-4 and 10 CFR 40 Appendix A Criterion 6(5) for the 11e.(2) Cell. Additionally, specific requirements exist in the license which may require modification. For example, UT 2300478 License Condition 10.2 states:*

The licensee shall analyze and adequately characterize;

b) The following key radon attenuation model parameters during placement….

c) The distribution of the Ra-226 and Th-230 concentrations in the 11e.(2) byproduct material ….

The Licensee should describe how the changes in the size and configuration of the disposal embankment might impact the radon attenuation model and values of the parameters used. The Licensee should describe how the placement of Class A waste in close proximity to the 11e.(2) disposal embankment might require modifications to the distribution of Ra-226 and Th-230 in the upper 3 meters of the embankment.

Energy*Solutions* Response: It is not clear how "…the proximity of the Class A waste…" could impact radium levels in the near surface cover. Existing controls on Ra-226 and Th-230 concentration for the upper 10 feet of the embankment are unaffected. These controls are provided at RML #UT 2300478, condition 10.9.c. The clay barrier will be 12 feet thick, and specified to match the lower radon barrier construction specifications; therefore, there is not an un-analyzed lateral pathway for radon.

*20. **Occupational Radiation Exposure Discussion without a Corresponding ALARA Evaluation**: The AR does not consider or evaluate the potential for changes in occupational exposure from new onsite transportation routes, facility configurations, and operating* *modes, as required by UAC R313-15-101, R313-15-406. While these changes may appear to create minor or imperceptible changes to occupational radiation exposure, each routing, activity, and geometry change, plus changes to forecasted receipt rates of Class A and 11e.(2) material must be described and evaluated to document their impact rather than being categorically dismissed. Section 7.0 and subordinate sections refer to a Radiation Protection Program and an ALARA program not expressly identified in the reference section. Section 7.0 and the subordinate sections do not provide, or refer to, a detailed, specific ALARA evaluation of the planned configuration, tasks, and anticipated radiation design features, and how this shall differ from the existing cell operation. Please provide the required evaluations.*

Energy*Solutions* Response: The following discussion has been added to section 7.1 of the amendment request. The Class A South/11e.(2) embankment was presented to and discussed by the Clive Radiation Safety Committee in accordance with the ALARA program. The committee's review and ALARA evaluation is provided as attachment 8 to the revised amendment request.

***21. Availability of Clay and Rock for Embankment Closure**: Additional information in needed pursuant to UAC R313-24-4 (10 CFR 40, Appendix A, Criterion 4) and R313-25-7(2) Only the most cursory mention is made in AR §1.2.2.5 that ". . . construction materials are comprised of native clays and native rock from a local quarry". Availability of adequate supplies of clay and rock possessing required characteristics and required to construct all proposed embankments and the associated economic cost must be demonstrated.*

Energy*Solutions* Response: The following discussion has been incorporated into section 2.5.4 of the revised amendment request.

Energy*Solutions* estimated the difference in material quantities for the redesigned embankment compared with site wide cover material needs. Table 2.1 summarizes these estimates. The quantity of clay material required for the Class A South/11e.(2) embankment is reduced by approximately 187,000 cubic yards, since the Class A radon barrier is thinner than the 11e.(2) radon barrier. Conversely, the rock materials needed to construct the Class A South cover system will increase by approximately 164,000 cubic yards. The total volume of rock materials needed for remaining cover construction for the entire site is estimated at 1,316,000 cubic yards.

In a letter to DRC dated November 21, 2007 (CD07-0373), Energy*Solutions* provided an independent assessment of the volume and type of rock available at the Grayback Hills gravel pit 24. This is one of several pits in the region; and Energy*Solutions*' contract area alone contains approximately 1.1 million cubic yards of proven rock materials. The adjoining pit areas contain several hundred thousand additional cubic yards of material. In addition, there are other developed and undeveloped rock sources in the Grayback Mountains; the South Grayback Pit currently has at least 600,000 cubic yards of material remaining. The economic cost associated with using pit 24 for cover rock is currently incorporated into the LLRW and 11e.(2) sureties.

***22. <u>Upstream Drainage Area</u>**: Additional information is required pursuant to UAC R313-24-4, (10 CFR 40 Appendix A Criterion 4), and R313-24-7(2), The adequacy of both proposed operational and proposed post-closure drainage structures (such as ditches and berms) to handle potential volumes and rates of runoff water from nearby disposal areas and undisturbed upstream drainage areas must be demonstrated. Appropriately selected design basis precipitation events should be identified and justified for operations and post-closure conditions.*

<u>Energy*Solutions* Response:</u> Please refer to the response to item 8.

***23. <u>Discharge of Groundwater within the Disposal Site</u>**: The Licensee must demonstrate that the hydrogeologic unit used for disposal does not discharge ground water to the surface within the disposal site. Although this area has been approved for 11e.(2) disposal, this is a LLRW disposal requirement (UAC R313-25-23(8)) and must be addressed. If previous evaluations of this matter have been reported, a specific citation and justification that its conclusions are applicable to this area must be provided.*

<u>Energy*Solutions* Response:</u> This issue was already addressed in Section 3.1.1, at the end of the second paragraph:

> Groundwater does not need to be directed away from the disposal cell, since the lowest top of liner elevation is 6 feet above the highest recorded elevation for the upper, unconfined aquifer. The lowest top of liner elevation will be at approximately 4261.30 feet above sea level (see the southwest corner of the liner on drawing 07021-V1); the highest recorded elevation for the upper, unconfined aquifer is 4255 feet above sea level.

The discussion has been retained in revision 1 of the amendment request. Furthermore, much of the area of this embankment has been excavated to or near to the liner elevation; groundwater discharge has never been observed to the surface.

ENERGYSOLUTIONS
LICENSE AMENDMENT REQUEST: CLASS A SOUTH/11E.(2) EMBANKMENT

REVISION 1
JUNE 9, 2009

1.0 GENERAL INFORMATION

1.1 INTRODUCTION

Energy*Solutions* LLC (Energy*Solutions*) requests that the Utah Division of Radiation Control (DRC) review and approve a design change to the 11e.(2) disposal embankment. This design change constitutes an amendment to both Radioactive Material License (RML) # UT 2300249 (the Class A LLRW license) and Ground Water Quality Discharge Permit No. UGW450005. Proposed changes to these documents are provided in redline/strikeout format as Attachment 1a and 1b to this Amendment Request. Energy*Solutions* has performed a review of the 11e.(2) RML #UT 2300478, and has determined that no amendment to specific license conditions will be required. 11e.(2) RML #UT 2300478 is currently in timely renewal. If this LLRW license amendment is approved, the 11e.(2) license renewal application will be updated to reflect the new design and that renewal process completed for the new design.

This amendment would permit disposal of both LLRW and 11e.(2) waste within the current 11e.(2) embankment footprint, with a clay barrier separating the waste types. Similar clay barriers have previously been approved and constructed to segregate NORM from LARW; and LARW mobile from non-mobile waste types in the now-closed LARW embankment. The purpose of this amendment request is to convert existing approved 11e.(2) disposal capacity to LLRW capacity. The overall embankment footprint and geometry is not changed; except minor changes needed to address the transition between cover designs for LLRW and 11e.(2) wastes. Overall disposal capacity at the Clive facility is not increased.

The existing 11e.(2) embankment will be re-named the Class A South/11e.(2) embankment. The LLRW portion of the embankment will be located to the west of existing 11e.(2) waste in the embankment. Please see engineering drawing series 07021 provided as Attachment 2 to this Amendment Request.

The LLRW portion of the proposed Class A South/11e.(2) embankment will be constructed to the approved engineering specifications applicable to the existing Class A and Class A North embankments; with one significant change. The lower (Type B) filter zone material in the LLRW portion of the side slopes of the Class A South/11e.(2) embankment will be thicker than it is for the Class A and Class A North embankments. The increased thickness facilitates drainage off of the larger surface area of cover, reducing infiltration and ensuring that the groundwater protection standards will be met. See section 1.2.2.6 below for further discussion.

The 11e.(2) portion of the proposed Class A South/11e.(2) embankment will be constructed to the approved engineering specifications applicable to the existing 11e.(2) embankment. Additional construction specifications and transition details apply to the clay barrier between LLRW and 11e.(2) waste disposal areas.

Waste placement in the embankment will follow the existing approved LLRW & 11e.(2) Construction Quality Assurance/Quality Control (CQA/QC) Manual (currently approved as Rev. 23d, November 10, 2008). As discussed in section 1.3.1 below, Energy*Solutions* proposes to revise the CQA/QC Manual to add a new work element for construction of the clay barrier between Class A and 11e.(2) disposal areas. See also Attachment 3. As waste placement in the existing Class A and Class A North embankments nears completion, LLRW waste disposal operations will move to the LLRW portion of the Class A South/11e.(2) embankment.

In order to evaluate potential groundwater impacts from the Class A South/11e.(2) embankment, Attachment 4 provides "Energy*Solutions* Class A South Cell Infiltration and Transport Modeling", December 7, 2007. This report was prepared by Whetstone Associates consistent with previous groundwater modeling performed for embankments at the Clive facility.

Because this amendment request, if granted, would permit additional Class A LLRW placement in a new embankment, the following text focuses on Class A LLRW procedures and controls. All existing license requirements and basis for 11e.(2) waste placement is incorporated by reference and will generally not be discussed below.

1.1.1 IDENTITY OF APPLICANT

Energy*Solutions,* LLC is a Utah limited liability corporation with its principal place of business located at the Clive disposal facility described in Section 1.2 below. Corporate headquarters are located at 423 West 300 South, Suite 200, Salt Lake City, UT 84101.

Energy*Solutions*' directors are as follows:

R. Steve Creamer
Chairman, Chief Executive Officer
423 West 300 South, Suite 200
Salt Lake City, UT 84101

Board Members/Managers:

Jordan W. Clements
Director
Peterson Partners, LLC
299 South Main, Suite 2250
Salt Lake City, UT 84111

J.I. Everest II
Director
423 West 300 South, Suite 200
Salt Lake City, UT 84101

David B. Winder
Director
490 16th Avenue
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Director
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E. Gail de Planque, Ph.D.

Director
11136 Powder Horn Drive
Potomac, MD 80854

Lance L. Hirt
Director
Lindsay, Goldberg & Bessemer
630 Fifth Avenue, 30th Floor
New York, NY 10111

Robert Whitman
Director
FranklinCovey Co.
2200 West Parkway Blvd.
Salt Lake City, UT 84119

1.1.2 QUALIFICATIONS OF APPLICANT

1.1.2.1 TECHNICAL QUALIFICATIONS

As a corporation, Energy*Solutions* has 20 years of experience with the design, construction, management, engineering, and operation of radioactive waste disposal embankments. Since receiving its first radioactive material license in 1988, Energy*Solutions*, formerly Envirocare, has constructed a naturally occurring radioactive material (NORM) disposal embankment, a low-activity radioactive waste (LARW) disposal embankment, a RCRA mixed radioactive and hazardous waste disposal (Mixed Waste) embankment, the Class A and Class A North disposal embankments, and a uranium- and thorium-mill radioactive tailings 11e.(2) disposal embankment.

There will be no change to the waste types received, waste placement procedures, or basic embankment design systems; therefore, Energy*Solutions*' past experience translates directly to the Class A South/11e.(2) embankment.

1.1.2.2 FINANCIAL QUALIFICATIONS

Energy*Solutions,* LLC is a subsidiary of Energy*Solutions*, Inc. a publicly held corporation. In accordance with UAC R313-25-33(6), Energy*Solutions* is required to submit a financial statement annually to DRC. These financial statements demonstrate on an ongoing basis that Energy*Solutions* is financially qualified to carry out licensed activities.

In addition, Energy*Solutions* maintains comprehensive sureties. These sureties are calculated to ensure that all costs associated with facility closure and post-closure monitoring are accounted for, thereby protecting the State of Utah against any default by the company.

As detailed in Section 10 below, Energy*Solutions* will fund existing surety instruments in an amount adequate to close the Class A South/11e.(2) embankment in compliance with the approved design specifications; therefore, existing information regarding financial qualifications is adequate for the Class A South/11e.(2) embankment.

1.1.3 ORGANIZATIONAL STRUCTURE

Detailed requirements and qualifications for significant organizational positions are described in Energy*Solutions'* Class A LLRW license, Condition 32, Appendix I (currently approved revision is Rev. 21, February 9, 2009).

There will be no changes to the organization for purposes of constructing the Class A South/11e.(2) embankment.

1.2 GENERAL FACILITY DESCRIPTION

Operations are conducted in Section 32, Township 1 South, Range 11 West, SLBM, Tooele County, Utah. This location is known as Clive, Utah (also referred to as South Clive). Energy*Solutions'* Clive disposal facility will be referred to herein as the facility. The Class A South/11e.(2) embankment will be located completely within Section 32. Engineering Drawing 07021-G1 illustrates the location of the Class A South embankment in relation to other site facilities.

Energy*Solutions'* Class A LLRW RML and 11e.(2) RML allow for the disposal of specified radioactive wastes in accordance with specified conditions and restrictions. Waste receipt, management, and disposal operations of LLRW waste at the proposed Class A South/11e.(2) embankment will be conducted in accordance with the Class A RML. Similarly, 11e.(2) waste will be managed in accordance with the 11e.(2) RML.

Aside from the Class A South/11e.(2) embankment, there will be no change to existing facilities as part of this amendment request.

1.2.1 LAND USE

Most of the land within a 10-mile radius of the site is public domain administered by the Bureau of Land Management. Engineering drawing 07021-G1 in Attachment 2 delineates the property owned by Energy*Solutions*. Additional information regarding land use near the site is located in Section 1.2.2 of the 2005 Class A LLRW RML License Renewal Application (June 20, 2005; hereafter referred to as the 2005 LRA).

Land use in the immediate vicinity of the site will not be affected by the Class A South/11e.(2) embankment, since the embankment is located entirely within the licensed area of Section 32.

1.2.2 PRINCIPLE FEATURES

1.2.2.1 RESTRICTED AREAS

Any area utilized for waste unloading, hauling/handling, and placement in the Class A South/11e.(2) embankment will be considered a restricted (or controlled) area as defined in 10 CFR 20.3(a)(14). Any person working within the restricted area is assigned, and must wear, a personnel monitoring badge to measure their exposure to radiation.

The fence is conspicuously posted with "Caution -- Radioactive Materials" signs bearing the standard radiation symbol. Other signs are posted as appropriate. In accordance with the existing Clive radiation protection program document, Revision 3, June 25, 2007, the restricted area boundary may change as waste placement proceeds in the Class A South/11e.(2) embankment. There will not, however, be any changes to the requirements for control of the restricted areas as a result of the Class A South/11e.(2) embankment.

1.2.2.2 SITE BOUNDARY AND BUFFER ZONE

Energy*Solutions* controls, through fences, gates, and security monitoring, all access to property at the Clive facility. In addition, all restricted/controlled areas are fenced. Upon completion of the embankment, it will be permanently fenced and posted, leaving a minimum 94 feet of buffer zone between the toe of waste and the fence. This allows room inside of the fence for an inspection roadway and groundwater monitoring wells.

A buffer zone of at least 300 feet is maintained between the closest edge of any embankment (i.e., toe of waste) and the outside site boundary or property line. A buffer zone of at least 100 feet is maintained between the closest edge of any embankment and the Vitro site fence.

Class A South/11e.(2) embankment buffer zones are largely the same as buffer zone dimensions approved for the current LARW, Class A, Class A North, Mixed Waste, and 11e.(2) embankments. Note that a smaller buffer zone exists between Class A and 11e.(2) wastes in the Class A South/11e.(2) embankment. See also Sections 3.1.11 and 3.2.11 below.

1.2.2.3 GROUNDWATER USERS

No domestic water use occurs within 10 km of the facility.

1.2.2.4 UTILITY SUPPLIES AND SYSTEMS

Utility information was provided in the 2005 LRA (Section 1.2.3.4).

1.2.2.5 CLASS A SOUTH/11e.(2) EMBANKMENT

The proposed embankment design is shown in detail in engineering drawing series 07021. The construction materials are comprised of native clays mined on Sections 5 and 29, located directly south and north of Section 32; and native rock from a local quarry.

1.2.2.6 COVERS

Cover design for the Class A South/11e.(2) embankment is detailed on drawing 07021-V7.

The cover for the LLRW portion of the Class A South/11e.(2) embankment will have identical components, specifications, and construction procedures to the currently approved Class A and Class A North embankment cover; with one significant change. The lower (Type B) filter zone material in the side slopes of the LLRW portion of the Class A South/11e.(2) embankment will be thicker than it is for the Class A and Class A North embankments. The increased thickness facilitates drainage off of the larger surface area of cover, reducing infiltration and ensuring that the groundwater protection standards will be met. See section 1.3.1 below for further discussion.

The cover for the 11e.(2) portion of the Class A South/11e.(2) embankment will have identical components, specifications, and construction procedures to the currently approved 11e.(2) embankment. A transition area between the LLRW and 11e.(2) portions of the embankment will be constructed as detailed on drawing 07021-V5 and discussed further in section 1.3.1 below.

1.2.2.7 SURFACE WATER CONTROL FEATURES

During construction, the Class A South/11e.(2) embankment will be surrounded by run-on berms (as illustrated on drawing 07021-V1). Run-on berms are designed to prevent stormwater run-on, from ambient precipitation in the vicinity of the facility, into the emplaced waste before final cover is built.

Run-off berms are used during operation of the facility to ensure that precipitation that falls on emplaced waste is collected and does not carry contamination off of the site. Because run-off berm locations necessarily move as new portions of the disposal embankment are opened for waste placement, these operational features are necessarily not depicted on facility design drawings. These surface water controls have been utilized at the Clive facility for nearly 20 years.

In addition, internal controls will be needed at the Class A South/11e.(2) embankment to prevent Class A contact water from draining into emplaced 11e.(2) waste. Because the isotopes associated with 11e.(2) waste are a subset of those associated with Class A LLRW, contact stormwater will be managed to drain from 11e.(2) areas into Class A areas. This is consistent with existing approvals for water management under the GWQDP. See the revised CQA/QC Manual, work element "Class A South/11e.(2) Clay Barrier", specification: "Runoff Control", provided in Attachment 3. Following closure, drainage ditches will be constructed around the proposed embankment to facilitate efficient water removal. Further details are provided in Sections 3.1.4 and 3.2.4 below.

1.2.2.8 INTRUDER BARRIERS

This topic is addressed in the 2005 LRA (Section 1.2.3.8). Upon completion, permanent fencing will surround the facility. Further details are provided in Sections 3.1.8 and 3.2.8 below.

1.2.2.9 MARKERS

Permanent granite markers will be placed at the facility to identify the location and type of disposal material as described in the 2005 LRA (Section 1.2.3.9). These markers are similar to those markers currently marking the Vitro embankment located at the site.

1.2.2.10 BOUNDARIES AND MARKERS

This topic is addressed in the 2005 LRA (Section 1.2.3.10). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

1.2.2.11 SURVEY CONTROL PROGRAM

This topic is addressed in the 2005 LRA (Section 1.2.3.11). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

1.2.2.12 SITE UTILIZATION PLAN

This topic is addressed in the 2005 LRA (Section 1.2.3.12). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

1.2.2.13 SUPPORT FACILITIES

This topic is addressed in the 2005 LRA (Section 1.2.3.13). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

1.2.2.14 ADMINISTRATION BUILDINGS

This topic is addressed in the 2005 LRA (Section 1.2.3.14). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

1.2.2.15 STORAGE AND WASTE HANDLING AREAS

This topic is addressed in the 2005 LRA (Section 1.2.3.15). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

1.2.2.16 DECONTAMINATION AREAS

This topic is addressed in the 2005 LRA (Section 1.2.3.16). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

1.2.2.17 PHYSICAL SECURITY

Site security procedures for the Clive facility are provided in the Site Radiological Security Plan (LLRW RML Condition 54, currently approved as revision 3, May 5, 2008). There will be no changes to the Site Radiological Security Plan for construction of the Class A South/11e.(2) embankment.

1.2.2.18 EQUIPMENT AND EQUIPMENT STORAGE

This topic is addressed in the 2005 LRA (Section 1.2.3.18). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

1.2.2.19 EXCAVATED MATERIALS AREA

This topic is addressed in the 2005 LRA (Section 1.2.3.19). There will be no change in management of excavated materials for the Class A South/11e.(2) embankment.

1.2.3 CURRENT EMBANKMENT CONDITIONS

Drawing 07021-U2 provides an overlay of the proposed Class A South/11e.(2) embankment design with the surveyed edge of 11e.(2) waste placement as of August 25, 2008. From this figure, it is evident that the proposed division between Class A and 11e.(2) wastes is basically located at the western edge of existing 11e.(2) waste placement, with a small area of 11e.(2) waste to be relocated. Section 3.3 below discusses waste relocation and construction activities for building the barrier wall.

1.3 SCHEDULES

Energy*Solutions* (previously Envirocare) has conducted NORM waste disposal operations at the Clive facility since 1988. LLRW disposal operations began in 1991. Mixed waste disposal operations have been conducted since 1992. 11e.(2) disposal operations began in November of 1993. Energy*Solutions* will continue placing 11e.(2) waste in the Class A South/11e.(2) embankment throughout the licensing process in accordance with existing approvals. LLRW waste placement could begin shortly after approval of the amendment request, depending on the status of waste placement in the Class A and Class A North embankments.

1.3.1 CONSTRUCTION

Construction of the Class A South/11e.(2) embankment liner and cover will be conducted on a cut and fill basis. This will allow for the construction of disposal embankment space as disposal capacity is needed and for the capping and completion of embankment areas as they are filled. Construction of both the liner and the cover systems will progress throughout the active life of the disposal facility.

Furthermore, construction of the clay barrier between LLRW and 11e.(2) wastes in the Class A South/11e.(2) embankment is planned to proceed generally from north to south, with bulk waste lifts brought up concurrently with the clay barrier between waste types. CQA/QC language to control construction of the clay barrier is provided in the draft revised LLRW and 11e.(2) CQA/QC Manual provided as Attachment 3.

Generally, the Clive facility receives much less 11e.(2) waste than Class A LLRW. In order to provide additional operational flexibility for stockpiling 11e.(2) waste to bring up this side of the Class A South/11e.(2) embankment, longer-term stockpiling within existing volume limits found at RML #UT 2300478, condition 10.8.e may be needed. Therefore, the attached CQA/QC Manual revision removes the former stockpile ("in-cell bulk disposal" in the CQA/QC terminology) placement deadline of August 31 each year.

The attached LLRW and 11e.(2) CQA/QC Manual also includes a revised settlement monitoring plan for the Class A South/11e.(2) embankment. See Figure 4 of Attachment 3 to this amendment request.

1.3.2 OPERATIONS

Energy*Solutions* estimates that receipt of wastes and disposal operations may continue for up to 20 years.

1.3.3 CLOSURE

Closure of the Class A South/11e.(2) embankment will take place during normal operations. As new areas are constructed, the filled areas will be covered to meet final design specifications before being closed. Closure activities will include a settlement monitoring program prior to cover construction as provided in the LLRW and 11e.(2) CQA/QC Manual, work element "Temporary Cover Placement and Monitoring." This program will continue unchanged for the Class A South/11e.(2) embankment. Upon final closure of all disposal embankments, the site will be decommissioned and the long-term surveillance period will begin.

1.4 INSTITUTIONAL INFORMATION

In accordance with a letter dated November 18, 1987, from the Director of the Bureau of Radiation Control (the agency has since been named the Division of Radiation Control), and in accordance with R447-25-9(2) an exemption was granted, allowing for disposal activities on privately owned land at Clive. A supplemental exemption was granted on March 8, 1991. These exemptions were not specific to a particular disposal embankment or land area. On March 16, 1993, Envirocare and the Utah Department of Environmental Quality entered into an Agreement Establishing Covenants and Restrictions related to

LLRW disposal activities on privately owned land. This Agreement specifically applies to all of Section 32, less the defined property of the Vitro embankment. Energy*Solutions* continues to be bound by this Agreement.

Accordingly, since it will be located entirely within Section 32, the Class A South/11e.(2) embankment is addressed by the existing land ownership exemption for LLRW management and disposal.

For the Class A disposal cells, Energy*Solutions* will retain ownership of the land, and will be responsible for site closure, as well as the long-term maintenance and monitoring of the disposal site. In accordance with 10 CFR Part 40.28, the ownership of the 11e.(2) disposal facility will be transferred to the Department of Energy (DOE), another Federal Agency designated by the President, or the State of Utah. The land will be transferred at no cost to the DOE. The DOE or other designated agency will be responsible under the general license for custody of and long-term care of the site, including monitoring, maintenance, and emergency measures necessary to protect the public health and the safety and other actions necessary to comply with the standards.

It is anticipated that the State of Utah will retain a function in the post-closure activities at the site in an oversight role.

Funds for the closure, remediation and long-term surveillance of the facility are discussed in Section 10 below. Upon State of Utah request to draw upon the irrevocable letter of credit established at Zions First National Bank, funds are maintained in trust for the benefit of the State of Utah with Wells Fargo Bank. Furthermore, the State of Utah has established a Perpetual Care Fund with a target initial minimum balance of $100 million at the conclusion of the post-closure monitoring period (i.e., year 101 after site closure). The Perpetual Care Fund is funded by an annual payment and earnings accrued to the fund cash balance. Surety funds are in place to ensure the initial target balance is available in the case of premature facility closure.

1.5 MATERIALS INCORPORATED BY REFERENCE

Energy*Solutions* has summarized the references listed in each Section as Section 11 of this License Amendment Request.

1.6 CONFORMANCE TO REGULATORY GUIDES

To the extent practicable, the information presented in this amendment request conforms to the recommendations provided in "Standard Format and Content of a License Application for a Low-Level Radioactive Waste Disposal Facility" (NUREG-1199, USNRC, January 1991).

A complete list of regulatory guides applied to facility design is included in Section 1.6 of the 2005 LRA.

1.7 SUMMARY OF PRINCIPLE REVIEW MATTERS

Energy*Solutions* requests that DRC issue a license amendment for the proposed Class A South/11e.(2) embankment.

Energy*Solutions* has reviewed LLRW RML #UT 2300249, 11e.(2) RML #UT 2300478, and GWQDP No. UGW450005, as well as supporting documents for each. The embankment liner, waste placement, and cover systems for LLRW are identical (except the Type B filter thickness as noted above) to the existing Class A and Class A North embankments; therefore, many RML and GWQDP conditions and supporting documents are unaffected by the proposed Class A South/11e.(2) embankment. Similarly, liner, waste placement, and cover systems are unaffected for 11e.(2) wastes.

Revisions to the LLRW RML and GWQDP are provided in redline/strikeout format in Attachment 1a and 1b respectively.

2.0 SITE CHARACTERISTICS

Site characteristics of the Clive site have been the subject of many investigations and regulatory reviews. Because this basic information about the site is not affected by the Class A South/11e.(2) embankment, the most recent summary found in section 2 of the 2005 LRA is incorporated by reference.

2.1 GEOGRAPHY, DEMOGRAPHY, AND FUTURE DEVELOPMENTS

2.1.1 SITE LOCATION AND DESCRIPTION

2.1.1.1 LOCATION OF THE FACILITY

The Clive site is on the eastern edge of the Great Salt Lake Desert, 3 miles west of the Cedar Mountains, 2.5 miles south of Interstate 80, and 1 mile south of a switch point called Clive on the tracks of the Union Pacific Railroad system. The facility is located at approximate latitude 40^{o} 41' 18" North, longitude 113^{o} 06' 54" West.

The licensed disposal area is a parcel of land consisting of Section 32 of T1S, R11W, in Tooele County, Utah, with the exception of approximately 100 acres used in the Vitro Remedial Action project. The DOE owns the 100 acres used in the Vitro Remedial Action project.

The Class A South/11e.(2) embankment will be located entirely within Section 32.

2.1.1.2 NEARBY FACILITIES

This topic is addressed in the 2005 LRA (Section 2.1.1.2). Since there is no change in the types of waste that will be managed nor are there any new facilities in the area since that submittal, this discussion will be unaffected by the Class A South/11e.(2) embankment.

2.1.2 POPULATION DISTRIBUTION

This topic is addressed in the 2005 LRA (Section 2.1.3). This information is unaffected by the Class A South/11e.(2) embankment.

2.2 METEOROLOGY AND CLIMATOLOGY

Energy*Solutions* has operated a weather station at Clive since April 1992. The station monitors wind speed and direction, 2-m and 9-m temperatures, precipitation, pan evaporation and solar irradiation. A 12-year summary report from July 1, 1992 through June 30, 2004 was provided as Appendix E to the 2005 LRA. Since the Class A South/11e.(2) embankment will be located entirely within Section 32, this information adequately characterizes the site.

2.3 GEOLOGY AND SEISMOLOGY

2.3.1 REGIONAL and SITE GEOLOGY

This topic is addressed in the 2005 LRA (Section 2.4.1). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

2.3.2 SEISMOLOGY

This topic is addressed in the 2005 LRA (Section 2.4.2); and has been independently reviewed and updated by AMEC Earth & Environmental in the course of licensing the Class A Combined embankment in 2005-2006. References for the AMEC update report and interrogatory responses are provided below. Since this information applies to Section 32 as a whole, this discussion will be unaffected by the Class A South/11e.(2) embankment.

- AMEC, "Report: Combined Embankment Study, Envirocare," December 13, 2005
- AMEC, "Round 2 Interrogatories and Response, Class A Embankment Height Study, Energy*Solutions* Facility Near Clive, Utah," April 28, 2006
- AMEC, "Interrogatory Statement and Response, AMEC Interrogatory Response Letter Dated April 28, 2006, Class A Embankment Height Study, Energy*Solutions* Facility Near Clive, Utah," May 22, 2006

The 2005 LRA summarizes work dating back to 1985, during the initial site investigation for the Vitro disposal cell. These investigations developed seismic design values for a Maximum Credible Earthquake of 6.5 with peak acceleration of 0.37g. The original 11e.(2) cell geometry has previously been evaluated against this design value and found to meet acceptable safety factors. See the Application for 11e.(2) Radioactive Material License Renewal, February 17, 2006 (hereafter referred to as the 11e.(2) LRA), sections 2.6 and 4.6; and Appendix H. This original cell geometry is essentially unchanged for the Class A South/11e.(2) embankment.

In reviewing the historical seismic design value work, AMEC found that it was both poorly-documented and conservative by current standards. Therefore, the seismic hazard was updated based on more current knowledge and information. The updated seismic hazard develops a design maximum earthquake of 7.1 with peak acceleration of 0.24g.

2.4 HYDROLOGY

2.4.1 SURFACE WATER HYDROLOGY

This topic is addressed in the 2005 LRA (Section 2.5). Since surface water hydrology was characterized for all of Section 32, this information is applicable to the Class A South/11e.(2) embankment.

2.4.2 GROUNDWATER CHARACTERIZATION

This topic is addressed in the 2005 LRA (Section 2.5). Since groundwater was characterized for all of Section 32, this information is applicable to the Class A South/11e.(2) embankment.

2.5 GEOTECHNICAL CHARACTERISTICS

2.5.1 FIELD INVESTIGATIONS

This topic is addressed in the 2005 LRA (Section 2.8.1). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

2.5.2 FIELD AND LABORATORY TESTING AND ENGINEERING PROPERTIES

This topic is addressed in the 2005 LRA (Section 2.8.2). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

2.5.3 GROUNDWATER CONDITIONS

A significant amount of water quality data and geochemical information has been developed for the subsurface soil and groundwater below Section 32. This information was submitted to DRC on September 1, 2004, as a Comprehensive Groundwater Quality Evaluation Report (CD04-0405). Since groundwater quality was characterized for all of Section 32, this information is applicable to the Class A South/11e.(2) embankment.

2.5.4 BORROW MATERIALS

This topic is addressed in the 2005 LRA (Section 2.8.4). A supplemental evaluation of the change in borrow material volumes associated with the requested design change follows.

Energy*Solutions* estimated the difference in material quantities for the redesigned embankment compared with site wide cover material needs. Table 2.1 summarizes these estimates. The quantity of clay material required for the Class A South/11e.(2) embankment is reduced by approximately 187,000 cubic yards, since the Class A radon barrier is thinner than the 11e.(2) radon barrier. Conversely, the rock materials needed to construct the Class A South cover system will increase by approximately 164,000 cubic yards. The total volume of rock materials needed for remaining cover construction for the entire site is estimated at 1,316,000 cubic yards.

In a letter to DRC dated November 21, 2007 (CD07-0373), Energy*Solutions* provided an independent assessment of the volume and type of rock available at the Grayback Hills gravel pit 24. This is one of several pits in the region; and Energy*Solutions*' contract area alone contains approximately 1.1 million cubic yards of proven rock materials. The adjoining pit areas contain several hundred thousand additional cubic yards of material. In addition, there are other developed and undeveloped rock sources in the Grayback Mountains; the South Grayback Pit currently has at least 600,000 cubic yards of material remaining. The economic cost associated with using pit 24 for cover rock is currently incorporated into the LLRW and 11e.(2) sureties.

Table 2.1: Clay and rock volume estimate

COVER CONSTRUCTION AREAS, SF

	Class A South	11e.(2)	All as 11e.(2)
Top Slope Area	1,869,251	631,119	2,500,370
Side Slope Area*	874,890	139,131	1,014,021
Ditch Outside Slope Area	123,477	17,978	141,455
Completed Cover	NA	729,497	

*Includes inside slope of drainage ditch.

COVER CONSTRUCTION VOLUMES

	Combined Thicknesses of Layers, Ft		Baseline Cover Quantities, CY (all as 11e.(2))	Class A South Cover Quantities, CY	11e.(2) Cover Quantities, CY	Class A South/11e.(2) Cover Materials, CY	Difference, CY
	Class A South	11e.(2)					
Top Slopes							
Radon Barrier (Clay)	2	4	370,425	138,463	93,499	231,962	(138,463)
Erosion Materials (Rock)	3.5	2	185,213	242,310	46,750	289,060	103,847
Side Slopes							
Radon Barrier	2	3.5	131,447	64,807	18,036	82,842	(48,605)
Erosion Materials (Rock)	4.5	2.5	93,891	145,815	12,883	158,697	64,807
Outside Ditch Perimeter							
Erosion Materials (Rock)	1.5	2.5	13,098	6,860	1,665	8,524	(4,573)
						Totals	
						Clay Material	**(187,068)**
						Rock Material	**164,081**

	Class A	Class A North	Mixed Waste	Subtotals Cover Materials CY
Top Slope, SF	2,095,395	795,564	609,560	3,500,519
Radon Barrier (Clay)	2	2	2	259,297.70
Erosion Materials (Rock)	3.5	3.5	3.5	453,770.98
Side Slopes, SF	1,241,195	1,057,703	670,426	2,969,324
Radon Barrier	2	2	2	219,949.93
Erosion Materials (Rock)	3.5	3.5	3.5	384,912.38
Outside Ditch Per., SF	154,230	124,399	98,491	377,121
Erosion Materials (Rock)	1.5	1.5	1.5	20,951.14

Totals	
Clay Material	**479,248**
Rock Material	**859,634**

GRAND TOTALS	
Clay Material	**794,052**
Rock Material	**1,315,916**

2.5.5 STRATIGRAPHY AND DESIGN PARAMETERS

This topic is addressed in the 2005 LRA (Section 2.8.5). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

2.6 GROUNDWATER HYDROLOGY

2.6.1 HYDROGEOLOGY

Site hydrogeology has been characterized in a Revised Hydrogeologic Report submitted to the DRC on September 1, 2004 (CD04-0404), and a Comprehensive Groundwater Quality Evaluation Report, submitted September 1, 2004 (CD04-0405). Since site hydrogeology was characterized for all of Section 32, this information is unaffected by the Class A South/11e.(2) embankment.

2.6.2 GROUNDWATER MODELING

Groundwater modeling was conducted for the Class A South/11e.(2) embankment (Whetstone, December 7, 2007). The purpose of conducting this modeling was to simulate flow in the unsaturated and saturated zones to aid in understanding infiltration and groundwater flow below and adjacent to the Clive site.

- UNSAT-H, a one-dimensional finite difference numerical model, was selected to evaluate the migration of water in the unsaturated soils at the site. Hydrologic Evaluation of Landfill Performance (HELP) was also used to evaluate the migration of water through the cover. PATHRAE was used to evaluate the fate and transport of radionuclides, metals, and organic contaminants through the unsaturated zone and the aquifer. These results support design and performance analyses and are discussed in further detail in section 3.2.1 below.

2.7 GROUNDWATER QUALITY AND GEOCHEMICAL CHARACTERISTICS

A significant amount of water quality data and geochemical information has been developed for the subsurface soil and groundwater below Section 32. This information was submitted to DRC on September 1, 2004, as a Comprehensive Groundwater Quality Evaluation Report (CD04-0405). Since groundwater quality was characterized for all of Section 32, this information is applicable to the Class A South/11e.(2) embankment.

2.8 NATURAL RESOURCES

2.8.1 GEOLOGICAL RESOURCES

This topic is addressed in the 2005 LRA (Section 2.9.1). Since geological resources were characterized for all of Section 32, this information is applicable to the Class A South/11e.(2) embankment.

2.8.2 WATER RESOURCES

This topic is addressed in the 2005 LRA (Section 2.9.2). Since water resources were characterized for all of Section 32, this information is applicable to the Class A South/11e.(2) embankment.

2.9 BIOTIC FEATURES

2.9.1 VEGETATION

Regional vegetation is characterized in the 11-Year Meteorologic Summary Report submitted to the DRC on January 12, 2004 (CD04-0016). This information is applicable to the Class A South/11e.(2) embankment. Further discussion of this topic is addressed in the 2005 LRA (Section 2.10.1). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

2.9.2 TERRESTRIAL LIFE

This topic is addressed in the 2005 LRA (Section 2.10.2). Since terrestrial life was characterized for all of Section 32, this information is applicable to the Class A South/11e.(2) embankment.

2.9.3 AQUATIC BIOTA

Aquatic ecosystems do not occur on or near the South Clive site.

2.9.4 ENDANGERED AND THREATENED SPECIES

This topic is addressed in the 2005 LRA (Section 2.10.4). Since endangered and threatened species were characterized for all of Section 32, this information is applicable to the Class A South/11e.(2) embankment.

2.10 PREOPERATIONAL ENVIRONMENTAL MONITORING

This topic is addressed in the 2005 LRA (Section 2.11). Since preoperational environmental monitoring was characterized for all of Section 32, this information is applicable to the Class A South/11e.(2) embankment.

3.0 FACILITY DESIGN AND CONSTRUCTION

Latitude and Longitude coordinates for the Class A South and 11e.(2) portions of the Class A South/11e.(2) embankment are provided in Table 3.1. Coordinates for the buffer zone around each embankment are provided in Table 3.2. Drawing Set 07021 has been created to define the embankment.

Table 3.1. Embankment Coordinates

Embankment	Corner	Latitude	Longitude
Class A South portion of the Class A South/11e.(2)	NW Corner	40° 41' 12.590"N	113° 07' 24.545"W
	SW Corner	40° 40' 55.055"N	113° 07' 24.761"W
	SE Corner	40° 40' 54.924"N	113° 07' 06.366 "W
	NE Corner	40° 41' 12.458"N	113° 07' 06.148 "W
11e.(2) portion of the Class A South/11e.(2)	NW Corner	40° 41' 12.457 " N	113° 07' 05.993 " W
	SW Corner	40° 40' 54.923 " N	113° 07' 06.210 " W
	SE Corner	40° 40' 54.845 " N	113° 06' 55.564 " W
	NE Corner	40° 41' 12.380" N	113° 06' 55.346 " W

Table 3.2. Buffer Zone Coordinates

Embankment	Corner	Latitude	Longitude
Class A South portion of the Class A South/11e.(2)	NW Corner	40° 41' 13.587"N	113° 07' 25.832"W
	SW Corner	40° 40' 54.077"N	113° 07' 26.070"W
	SE Corner	40° 40' 53.935"N	113° 07' 06.222"W
	NE Corner	40° 41' 13.445"N	113° 07' 05.980"W
11e.(2) portion of the Class A South/11e.(2)	NW Corner	40° 41' 13.446" N	113° 07' 06.136" W
	SW Corner	40° 40' 53.936" N	113° 07' 06.378" W
	SE Corner	40° 40' 53.849" N	113° 06' 54.279" W
	NE Corner	40° 41' 13.359" N	113° 06' 54.037" W

For waste placement, Energy*Solutions* will utilize construction specifications that have already been approved for the Class A and 11e.(2) embankments. No novel engineering designs or construction methods will be implemented for the Class A South/11e.(2) embankment, nor will the waste disposed in the Class A South portion of the embankment differ from waste disposed in the Class A and Class A North embankments in regards to radioactivity or potential hazard.

Energy*Solutions* will construct the Class A South/11e.(2) embankment in accordance with the waste placement, design and construction procedures and specifications found in the current LLRW and 11e.(2) CQA/QC Manual. Therefore, the engineering analyses performed for existing waste disposal practices at the Class A disposal embankments are also valid for the Class A South/11e(2) embankment. Tables 3.3, 3.4, and 3.5, below, summarize the design criteria, pertinent characteristics, and projected performance of the clay barrier wall. Similar information for other embankment features is provided in Tables 3.2, 3.3, and 3.4 of the 2005 LRA. Detailed explanation of waste placement specifications and supporting documentation is located in the 2005 LRA (Section 3).

An important consideration in design of the Class A South/11e(2) embankment is the preservation of existing design basis for the 11e.(2) portion of the embankment. Specifically, radon barrier thickness cannot be compromised at the clay barrier wall. See drawing 07021-V6, details H and I, for side slope and top slope cover transitions. These transitions demonstrate that the full thickness of 11e.(2) radon barrier is maintained over all 11e.(2) waste and into the area over the clay barrier wall. Furthermore, the clay barrier wall has been assigned a permeability specification of no greater than $1x10^{-6}$ cm/sec; which is identical to the lower radon barrier specification. Therefore, the 12-foot wide clay barrier wall will prevent radon migration to the Class A side of the embankment; and the full thickness of radon barrier is maintained over the 11e.(2) side of the embankment.

Specific discussion of the topics identified in NUREG-1199 is provided after Tables 3.3, 3.4, and 3.5.

Table 3.3

Design Criteria of the Principal Design Features

Principal Design Feature	Required Function	Complementary Aspects	Design Criteria	Design Criteria Justification	Conditions	
Barrier Wall	Physical Isolation	Well defined barrier	Minimum wall thickness of 12 feet	Provides adequate downgradient zone (10 feet between monitoring location and edge of 11e.(2) waste) for groundwater remediation, if needed	Normal	Wall is built to design width; in the intended location.
					Abnormal	Wall width or location varies from design.
		Surface water isolation	Top of wall ≥ 1 ft. above adjacent waste.	Establishes well defined freeboard. Assumes waste placed with a slope that falls away from the barrier wall.	Normal	25 yr. 24 hr. event (1.9")
					Abnormal	100 yr. 24 hr. event (2.4")
	Hydraulic Isolation	Prevent lateral migration of fluids during operations	Rework and retest if wall materials become desiccated or frozen.	Re-establishes the design density and permeability.	Normal	Routine conditions require rework of only the uppermost lift.
					Abnormal	Sustained exposure to hot or freezing weather affects density and moisture of wall material to greater than 12 inches deep.
		Provide long-term, post cover isolations of fluids.	Wall permeability ≤ liner permeability	Prevents lateral migration in favor of vertical migration.	Normal	Wall retains design permeability over time.
					Abnormal	Degraded wall permeability.
	Ensure cover	Mitigate differential	Max Allowable Distortion =0.02	AMEC, Oct 4, 2000	Normal	All primary settlement in clay barrier complete prior to cover placement.

	integrity	settlement			Abnormal	Predicted post cover settlement over the barrier wall is greater than the predicted post cover waste settlement.
	Ensure Structural Stability	Settlement	Long term Cover Drainage (No Slope Reversal)	Minimize ponding or concentration of water flow.	Normal	Wall settlement predicted through monitoring, prior to placement of cover.
					Abnormal	Additional secondary settlement of wall after 100-year institutional controls period.
		Maintain Slope Stability	Static Safety Factor $\geq$ 1.5 Seismic Safety factor $\geq$ 1.2	State of Utah Statutes and administrative Rules for Dam Safety, Rule R625-11-6	Normal	Static conditions
					Abnormal	Earthquake and/or saturated conditions in the embankment

Table 3.4

Pertinent Characteristics of the Principal Design Features

Principal Design Feature	Principal Design Element	Pertinent Characteristics	References
Barrier Wall	Clay Wall	Minimum 12 feet thick Permeability $\leq 1x10^{-6}$ cm/sec Compacted to 95% of standard Proctor, moisture between optimum and optimum+5% 85% fines (<0.075mm) 10 < plasticity index <25 30 < liquid limit <50	Drawing series 07021 and LLRW and 11e.(2) CQA/QC Manual, work element "Class A South/11e.(2) Clay Barrier"

Table 3.5

Projected Performance of the Principal Design Features

Principal Design Feature	Required Function	Complementary Aspects	Design Criteria	Projected Performance	Performance Reference	Safety Factor
Barrier Wall	Physical Isolation	Provides short and long term isolation	Minimum thickness ≥12 feet, and wall to be maintained at least one foot above adjacent waste.	Dependent on rigorous implementation of CQA/QC controls.	CQA/QC Manual	Not applicable
	Hydraulic Isolation	Provides short and long term isolation	Permeability ≤ $1x10^{-6}$ cm/sec	Design Permeability ≤ $1x10^{-6}$ cm/sec	CQA/QC Manual	Not applicable
	Ensure Cover Integrity	Mitigate Differential Settlement	Maximum Allowable Distortion in the Cover = 0.02	Settlement ≤ 0.21 feet, for 60 feet high embankment, based on secondary consolidation and no surcharging.	SMN&A 2009	FS ≥2 based on monitoring, and surcharge if needed.
	Ensure Structural Stability	Settlement	Long Term Cover Drainage	Even if the total potential settlement were realized, the drop in elevation from the crest to the shoulder eliminates the potential for slope reversal.	AMEC 2001 AMEC 2002	Not applicable
			Maximum Total Settlement ≤ 15% of Embankment Height	Total Settlement ≤ 1.14' (and secondary settlement ≤0.21') for 60 feet high embankment.	AGRA 2000 AMEC 2000 SMN&A 2009	≥ 7
		Maintain Slope stability	Static FS ≥ 1.5 Seismic FS ≥ 1.2	Static FS ≥ 2.1 Seismic FS ≥ 1.3	AMEC 2005 and SMN&A 2009	Static FS ≥ 2.1 Seismic FS ≥ 1.3

3.1 PRINCIPLE DESIGN FEATURES

3.1.1 PHYSICAL ISOLATION OF WASTE TYPES

The clay barrier wall work element in the Class A South/11e.(2) embankment provides a principal design purpose not called for in prior embankment designs; i.e., to provide physical isolation of different waste types. This topic is not included in NUREG-1199, but merits discussion due to the unique nature of the Class A South/11e.(2) embankment.

Physical isolation is provided by having a well defined barrier and clear standards for surface water isolation during operations. The barrier also provides for monitoring groundwater traveling from beneath the Class A portion of the embankment under the 11e.(2) portion; and creates a "neutral zone" between waste types for groundwater remediation, if needed. See also the discussion of buffer zone in section 3.1.12 below.

The normal condition for this principle design feature is that the wall is built to the minimum design width, and in the design location. The abnormal condition would be if the minimum width is not maintained; or if the location is incorrect. The location and width of the barrier wall will be controlled through construction practices as verified by the LLRW and 11e.(2) CQA/QC Manual. Use of standard survey practices and technology will document and ensure that these criteria are met; minimizing the potential for the abnormal condition to develop. Furthermore, survey results are peer reviewed prior to final lift approval. This ensures that any failure to meet location restrictions for Class A waste, the barrier wall, or 11e.(2) waste will be identified and corrected before final cover is placed.

Physical isolation is provided by a wall of compacted inert silty clay material, with a minimum separation distance of 12 feet. The clay barrier will always be constructed in advance of waste placement and will be a minimum of one foot higher than the adjacent wastes on both sides. The location of the clay barrier will be marked with high visibility cones or other similar markings to ensure that operations personnel are aware of the physical barrier and the waste placement limits. A debris fence will be placed on the clay barrier to minimize the potential for windblown debris to migrate between waste types. The debris fence will be removed and replaced during each phase of barrier construction.

Hydraulic isolation is also provided by the clay barrier due to its geometry and the use of very low permeability material. The clay barrier will be constructed to the same density and permeability specifications as $1x10^{-6}$ cm/sec clay liner and radon barrier. Rain water and surface water runoff will be directed away from both sides of the clay barrier by constructing and maintaining the top of the waste materials at a two percent slope that falls away from the wall alignment. The one foot minimum vertical projection of the wall, along with a minimum two percent falling slope within the first 100 feet of the waste surface, will ensure that no water ponds or flows along the barrier wall between the two waste types. The sloping surface of the waste will be established on the 11e.(2) side of the wall, at the onset, but the 100 foot wide criteria will not be met until the wall is high enough to allow room between the wall and the previously placed waste. Additional details on surface water isolation are discussed in Item No. 8.

Subsurface hydraulic isolation during the operational period will be provided by contrasts in permeability and contrasts in hydraulic gradient. For the general case, wastes will have much higher permeability than the barrier wall, and moisture will follow the more permeable path. Since waste material placed within 100 feet of the wall will also be sloped away from the wall at a minimum of two percent, if infiltration encounters a layer of low permeability waste, then the fluid will migrate laterally away from the barrier wall until it can find another downward path within the cell. As this happens the fluids migrate progressively further from the wall.

The hydraulic gradient within the embankment will be downward due to gravity. Fluids will not migrate across the barrier wall because the hydraulic gradient across the wall will essentially be zero. If there is any lateral component to the gradient, there will be a strong bias for it to be away from the wall due to the falling slope of the placed waste layers. Once any fluids reach the bottom of the cell, during the open cell condition, they will migrate laterally across the liner to an accumulation point where they will be removed.

The exposed portion of the clay barrier wall will be subject to potential degradation due to weathering and erosion, in the same manner as the clay materials that are used for the liner and cover systems. To the extent that moisture or density is degraded at an exposed surface of the clay barrier wall, the material will be reworked to meet the original specification, before additional materials are placed. If material is eroded away, it will be replaced. These potential impacts on the barrier wall will be assessed and rectified in the same manner as currently required for the liner and cover. Please refer to the LLRW and 11e.(2) CQA/QC Manual, work element – Class A South/11e.(2) Clay Barrier, specifications "Clay Barrier Drying Prevention," "Cold Weather Placement of Clay Barrier," and "Spring Start-Up".

3.1.2 WATER INFILTRATION

The Class A South/11e.(2) embankment cover has been designed to direct ambient precipitation away from the disposal unit. Cover design is detailed in drawings 07021-V2 through 07021-V7. As shown on drawing 07021-V2, grade breaks on the surface of the upper 5 x 10^{-8}cm/sec permeability radon barrier clay for the Class A South/11e.(2) embankment have been set to minimize drainage from the LLRW cover system into the 11e.(2) cover system, or vice versa. The eastern peak of the top slope is located directly over the clay barrier wall, so that preferred drainage paths are parallel to the clay barrier wall. See also drawing 07021-V6, details H and I, for side slope and top slope cover transitions.

Flow from offsite precipitation is controlled during disposal operations by run-on berms that completely surround the disposal unit. Construction specifications for run-on berms are provided in the LLRW and 11e.(2) CQA/QC Manual, Work Element – General Requirements, specification "Runon Control During Project". No revision to this specification will be needed for construction of the Class A South/11e.(2) embankment. Groundwater does not need to be directed away from the disposal cell, since the lowest top of liner elevation is 6 feet above the highest recorded elevation for the upper, unconfined aquifer. The lowest top of liner elevation will be at approximately 4261.30 feet above sea level (see the southwest corner of the liner on drawing 07021-V1); the highest recorded elevation for the upper, unconfined aquifer is 4255 feet above sea level.

Hydraulic isolation of waste types is a required function of the barrier wall both during operations and after closure. During operations, the wall will isolate surface water due to its permeability and surface contouring to promote active management of accumulated precipitation. Following closure, the hydraulic gradient within the embankment will be downward due to gravity. Fluids will not migrate across the barrier wall because the hydraulic gradient across the wall will essentially be zero. If there is any lateral component to the gradient, there will be a strong bias for it to be away from the wall due to the falling slope of the placed waste layers.

The post-closure drainage system surrounding the Class A South/11e.(2) embankment has been designed to direct flow from ambient precipitation away from the disposal unit. Drainage system design for the Class A South/11e.(2) embankment is detailed in drawings 07021-V1, 07021-V5, and 07021-V6. Because the overall footprint of the Class A South/11e.(2) embankment is essentially identical to that of the 11e.(2) embankment, existing evaluations of site drainage are directly applicable and need not be re-evaluated.

3.1.3 DISPOSAL UNIT COVER INTEGRITY

The cover system for the Class A portion of the Class A South/11e.(2) embankment consists of the same layers and material specifications as the existing Class A embankment, with the exception of a thicker Type B filter zone on the embankment side slope. Therefore, the cover's ability to perform for the required period of time and to avoid the need for continuing active maintenance has been assessed previously in permitting the Class A embankment.

A comprehensive summary of cover integrity design criteria for the Class A embankment is provided in Sections 3.1.1.2, 3.1.2.1 and 3.1.3.3 of the 2005 LRA; performance assessments against these design criteria are discussed in Sections 3.3.1.2, 3.3.2.1 and 3.3.3.3 of that document. The scope of these assessments include differential settlement, internal erosion, and material stability/external erosion. The cover's ability to resist degradation by biotic activity is addressed in Sections 3.1.3.1.5 and 3.3.3.1.5 of the 2005 LRA.

An evaluation of the clay barrier wall and its' potential impacts on cover integrity is provided in "Class A South/11e.(2) Embankment Barrier Wall Stability Evaluation," Steven M. Newton & Associates, May 20, 2009, included as Attachment 5 to this amendment request. This evaluation concludes that the barrier wall does not have an unacceptable impact on potential differential settlement.

The cover system for the 11e.(2) portion of the Class A South/11e.(2) embankment is unchanged from the current approved design. Please refer to section 6.2 of the 11e.(2) LRA for evaluation of this cover design.

3.1.4 STRUCTURAL STABILITY

Waste placement in the Class A South/11e.(2) embankment will be controlled in accordance with the LLRW and 11e.(2) CQA/QC Manual. No changes to waste placement specifications and controls will be necessary for the Class A South/11e.(2) embankment. Class A and 11e.(2) wastes will be separated by a vertical clay barrier constructed to bulk soil waste lift specifications, so as to perform similarly. Therefore, structural stability has been assessed previously in permitting the Class A embankment. A comprehensive summary of structural stability design criteria for the Class A embankment is provided in Sections 3.1.2.2 and 3.1.3.4 of the 2005 LRA; performance assessments against these design criteria are discussed in Sections 3.3.2.2 and 3.3.3.4 of that document.

An evaluation of the clay barrier wall and its' potential impacts on structural stability is provided in "Class A South/11e.(2) Embankment Barrier Wall Stability Evaluation," Steven M. Newton & Associates, May 20, 2009, included as Attachment 5 to this amendment request. This evaluation concludes that the barrier wall does not have an unacceptable impact on structural stability of the embankment.

3.1.5 CONTACT WITH STANDING WATER

The Class A South embankment will be subject to identical stormwater management requirements during operations as the existing Class A embankment. See Condition I.E.7 of GWQDP UGW450005 as well as design criteria presented in Section 3.1.1.1.1 of the 2005 LRA; performance assessments against these design criteria are discussed in Section 3.3.1.1.1 of that document. Contact with standing water after closure will be controlled using the post-closure drainage ditch system; see Section 3.1.1 above and 3.1.5 below.

3.1.6 SITE DRAINAGE

There are no surface water features within 5 miles of Section 32, as established in Section (x) and Appendix J of "Pre-licensing Plan Approval Application" dated March 15, 2000. Therefore, site drainage is addressed in terms of direct precipitation runoff and sheet flow associated with the Probable Maximum Flood event. The post-closure drainage system surrounding the Class A South/11e.(2) embankment has been designed to direct water from precipitation or sheet flow away from the disposal unit. Drainage system design for the Class A South/11e.(2) embankment is detailed in drawings 07021-V1, 07021-V5, and 07021-V6.

3.1.7 SITE CLOSURE AND STABILIZATION

Long-term isolation of the waste in the Class A South/11e.(2) embankment will be ensured consistent with cover design features and waste placement specifications in place for the existing Class A and 11e.(2) embankments with the exception of change in the Type B Filter thickness. See also section 3.1.1, above, for a discussion of the role of the barrier wall in isolating Class A from 11e.(2) waste. Preventing the need for active maintenance is addressed within the analyses referenced in Sections 3.1.2 and 3.1.3 above. A cover system designed to minimize infiltration without the need for active maintenance is considered a complementary feature that has improved the site's natural characteristics.

3.1.8 LONG-TERM MAINTENANCE

Preventing the need for active maintenance is addressed within the analyses referenced in Sections 3.1.2 and 3.1.3 above. Design criteria for the various elements of the liner, waste placement, and cover systems have been set to incorporate a factor of safety of at least 1.0 against failure under normal, abnormal, and accident conditions. Tables 3.2 and 3.4 of the 2005 LRA provide a comprehensive discussion of embankment design criteria, their basis, conditions evaluated, and projected performance for the Class A embankment. This discussion is applicable to the Class A South/11e.(2) embankment because liner, waste placement, and cover specifications are generally the same for each embankment.

3.1.9 INADVERTENT INTRUDER BARRIER

Both during site operations and after closure, barriers are maintained to prevent inadvertent intrusion to LLRW. The barrier consists of chain link fencing. Post-closure fencing shall be constructed in accordance with the LLRW and 11e.(2) CQA/QC Manual, Work Element – Permanent Chain Link Fences. In addition, the embankment cover system provides a further barrier to inadvertent intrusion, with 3.5 feet of rock layers plus 2 feet of clay above the waste.

3.1.10 OCCUPATIONAL EXPOSURE

Occupational radiation protection is addressed in Section 7 of this document.

3.1.11 SITE MONITORING

Operational environmental monitoring is addressed in Section 4.4 of this document. Post-operational environmental monitoring is addressed in Section 5.3 of this document.

3.1.12 BUFFER ZONE

Buffer zone coordinates for the Class A and 11e.(2) portions of the Class A South/11e.(2) embankment are provided in Table 3.2 above and illustrated on drawing 07021-U1. A discussion of the design criteria and projected performance of the buffer zone is located in the 2005 LRA, Sections 3.1.5 and 3.3.5, respectively. This discussion is applicable to the outer perimeter of the Class A South/11e.(2) embankment because the buffer zone is 100 feet, exceeding the evaluated width of 94 feet.

The 2005 LRA discussion is not applicable to the buffer zone separating the Class A and 11e.(2) portions of the Class A South/11e.(2) embankment. As shown on drawings series 07021, the vertical clay barrier is at least 12 feet wide. A horizontal monitoring well will be located 2 feet from the eastern edge of the Class A waste placement area; providing 10 feet of space for corrective action if needed in the future. Groundwater flow in the region is generally to the northeast.

This is consistent with the current monitoring network and minimum area available for corrective action. In the current network, the groundwater monitoring point of compliance is located 90 feet from the edge of waste, in order to remain close to the source term while providing for a reasonable well spacing network. The Ground Water Quality Discharge Permit, Table 7, defines the buffer zone for each embankment as 100 feet from the edge of waste. Therefore, the effective area available for corrective action around each embankment is a 10-foot wide corridor.

This area is adequate in terms of time because groundwater moves slowly, on the order of one foot per year. Therefore, a 10-foot wide buffer zone allows roughly 10 years of time to design and implement a corrective action before contaminants might cross outside of the buffer zone.

This area is adequate in terms of space because it is feasible to design a groundwater capture and treatment system that fits in a 10-foot wide area. See also Attachment 7, “Responses to Utah DRC Comments 6, 7,9 and 16 relating to the Class A South/11e.(2) Cell Permit Amendment Request,” Environmental Resources Management (ERM), June 5, 2009.

3.2 DESIGN CONSIDERATIONS FOR NORMAL/ABNORMAL ACCIDENT CONDITIONS

Principal design criteria applicable to the Class A South/11e.(2) embankment are located in the 2005 LRA, Section 3.0. Specifically, design criteria of the principal design features are summarized in table 3.2 of that document. Projected performance against these design criteria are summarized in table 3.4 of that document. The 2005 LRA focuses on the Class A embankment; this discussion is generally applicable to the Class A South/11e.(2) embankment because the liner, waste placement, and cover systems are similar for both embankments.

As previously discussed, the only difference is in the Type B filter zone layer thickness on the side slope of the embankment. This dimension increases from 6 inches thick for the Class A embankment to 18 inches thick for the Class A South portion of the Class A South/11e.(2) embankment. For the top slope, the Type B filter thickness remains at 6 inches. The impacts of this increased thickness on the required functions of the cover system, as presented in Table 3.4 of the 2005 LRA, are summarized in Table 3.6 below:

Table 3.6: Summary of Impacts of Thicker Type B Filter

Required Function	**Complementary Aspect**	**Impact of Thicker Type B Filter**
Minimize Infiltration	Minimize infiltration	Required to reduce infiltration through side slopes. See section 3.2.1 below
	Encourage runoff	Not affected.
	Prevent desiccation	Not affected.
	Limit frost penetration	Thicker side slope improves performance slightly.
	Limit biointrusion	Thicker side slope improves performance slightly.
Reduce Exposure	Surface dose rates	Thicker side slope improves performance slightly.
Ensure Cover Integrity	Mitigate differential settlement	Not affected; critical case for differential settlement is in the top slopes.
	Prevent internal erosion	Not affected.
	Material stability/external erosion	Not affected.
Ensure Structural Stability	Settlement	Not affected.
	Maintain slope stability	Not affected.

3.2.1 WATER INFILTRATION

Water infiltration is evaluated through infiltration and transport modeling provided as Attachment 4 to this request. The approach and methodology for this modeling are similar to previous evaluations performed for other embankments at the Clive facility. For the 11e.(2) portion of the Class A South/11e.(2) embankment, the currently approved 11e.(2) Cell Infiltration and Transport Modeling Report, 2001, continues to apply; since there will be no change to that cover design.

The Class A South model indicates that 0.276 cm/yr infiltration would occur through the top slope. With an 18" Type B filter zone, 0.286 cm/yr infiltration would occur through the Class A South side slope. These values compare with modeled infiltration of 0.265 cm/yr for the top slope and 0.364 cm/yr for the side slope of the Class A embankment.

Note that sensitivity analyses at 6” and 12” were performed for the Type B filter zone thickness in both the top and side slopes, as discussed in Section 3.4.3 of the model.

At these modeled average infiltration rates, PATHRAE modeling of the fate and transport of radioactive and hazardous constituents from the waste demonstrates that the Ground Water Protection Levels will not be exceeded for at least 500 years for radiological constituents and at least 200 years for heavy metals and formerly characteristic organic wastes, provided that the concentrations of 5 radionuclides are restricted as presented in Table 3.7 below:

Table 3.7: Class A South Limiting Concentrations

Isotope	**pCi/g**	**Ci/m^3**
Bk-247	0.0000906	1.63E-10
Ca-41	1.322	2.38E-06
Cl-36	0.268	4.83E-07
Re-187	5,556.0	1.00E-02
Tc-99	77,778.0	1.40E-01

These limiting concentrations are captured in the draft Radioactive Material License provided in Attachment 1a, at condition 55.

3.2.2 DISPOSAL UNIT COVER INTEGRITY

Design criteria for protecting the disposal unit cover against internal and external erosion are provided in Sections 3.1.3.3.2 and 3.1.3.3.3 of the 2005 LRA. Projected performance of the cover system against these design criteria is provided in Sections 3.3.3.3.2 and 3.3.3.3.3 of the 2005 LRA. These analyses are applicable to the Class A South/11e.(2) embankment because the cover materials and specifications are essentially identical to that of the Class A embankment. The thicker Type B filter zone in the Class A South/11e.(2) embankment does not affect these calculations, since layer thickness is not an input.

Design criteria for settlement and subsidence are provided in Sections 3.1.1.2, 3.1.2.1 and 3.1.3.3 of the 2005 LRA. Projected performance of the cover system against these design criteria is discussed in Sections 3.3.1.2, 3.3.2.1 and 3.3.3.3 of this document. These analyses are applicable to the Class A South/11e.(2) embankment because the liner, waste placement, and cover materials and specifications are essentially identical to that of the Class A embankment. The thicker Type B filter zone in the Class A South/11e.(2) embankment is limited to the side slopes and does not increase the load for settlement evaluations beyond that already accounted for at the embankment top slopes.

3.2.3 STRUCTURAL STABILITY

Evaluations of structural stability in terms of settlement and differential settlement are discussed in Section 3.2.2, above. Design criteria for ensuring structural stability are provided in Sections 3.1.2.2 and 3.1.3.4 of the 2005 LRA. Projected performance of the cover system against these design criteria is provided in Sections 3.3.2.2 and 3.3.3.4 of the 2005 License Renewal Application. These analyses are applicable to the Class A South embankment because the waste placement and cover materials and material specifications are identical to that of the Class A embankment. See also Section 4.4 and Appendix H to the 11e.(2) LRA; as well as section 2.3.2 above.

Geotechnical stability of the foundation soils were reviewed by comparing the loading condition associated with the barrier wall material to loading from various waste materials. Typical unit weights for various materials are presented below. Properties for the liner and cover systems are not presented because those systems are not affected by the addition of the barrier wall.

Class A Debris	101 PCF
CLSM	120 PCF
Clay Liner & Clay Barrier wall material	123 PCF
Waste soils (24 random samples)	102.4 to 139.5, with an average of 123 PCF

The switch from placing waste to using clay material for the barrier wall location will produce no increase in the loading condition to the foundation soils, because these materials have the same typical unit weights. In fact, the foundation soils are capable of supporting much higher loading conditions, as described in the report[1] that was prepared for the proposed increase in height for the current Class A embankment. That study indicated that the embankment could be raised by at least 18 feet. As documented in various previous license submittals for all the embankments at Clive, and as summarized in reference no. 1, the foundation conditions in the Class A South/11e.(2) footprint are considered equivalent to the conditions analyzed in the AMEC report.

3.2.4 CONTACT WITH STANDING WATER

Design criteria for preventing contact of waste with standing water are provided in Section 3.1.1.1 of the 2005 LRA. Projected performance against these design criteria is provided in Section 3.3.1.1 of the 2005 LRA. These analyses are applicable to the Class A South/11e.(2) embankment because the liner materials and material specifications are identical to that of the Class A embankment.

3.2.5 SITE DRAINAGE

Design criteria for site drainage systems are provided in Section 3.1.4 of the 2005 LRA. Projected performance of the site drainage system against these design criteria is provided in Section 3.3.4 of that document. See also Section 4.2 and Appendix G to the 11e.(2) LRA. These analyses are applicable to the Class A South/11e.(2) embankment because the embankment shape is essentially identical to that of the currently permitted 11e.(2) embankment geometry.

3.2.6 SITE CLOSURE AND STABILIZATION

Closure of the Class A South/11e.(2) embankment will be accomplished by construction of final cover as areas of the embankment reach their design height. This is consistent with the "cut and cover" approach used at the LARW and Class A embankments. Accordingly, all of the principal design criteria discussed herein are applicable to site closure and stabilization, as these criteria affect embankment construction. Each of the performance assessments referenced herein includes analysis of the effects of design-basis abnormal events.

[1] Geotechnical Study, Increase in Height and Footprint, Envirocare LARW Facility, AMEC, May 25, 2005.

3.2.7 LONG-TERM MAINTENANCE

Design criteria for anticipated material durability to prevent the need for long-term maintenance is evaluated for the Class A embankment in Section 3.1.3.3.3 of the 2005 LRA. Projected performance against these design criteria is provided in Section 3.3.3.3.3 of the 2005 LRA. These analyses are applicable to the Class A South/11e.(2) embankment because the erosion barrier materials and specifications are identical to that of the Class A embankment.

Design criteria for anticipated erosion effects to prevent the need for long-term maintenance is evaluated for the Class A embankment in Sections 3.1.3.3.2 and 3.1.3.3.3 of the 2005 LRA. Projected performance against these design criteria is provided in Sections 3.3.3.3.2 and 3.3.3.3.3 of the 2005 LRA. These analyses are applicable to the Class A South/11e.(2) embankment because the erosion barrier materials and material specifications are identical to that of the Class A embankment.

The potential effects of design-basis abnormal events on long-term maintenance requirements are addressed concurrent with projected performance under normal, abnormal, and accident conditions for each design feature. A factor of safety of at least 1.0 against failure is maintained under normal, abnormal, and accident conditions. Tables 3.2 and 3.4 of the 2005 LRA provide a comprehensive discussion of embankment design criteria, their basis, conditions evaluated, and projected performance for the Class A embankment. This discussion is applicable to the Class A South/11e.(2) embankment because liner, waste placement, and cover specifications are essentially the same for each embankment.

3.2.8 INADVERTENT INTRUDER BARRIER

Both during site operations and after closure, a barrier is maintained to prevent inadvertent intrusion to LLRW. During site operations, the barrier consists of chain link fencing. Post-closure fencing shall be constructed in accordance with the LLRW and 11e.(2) CQA/QC Manual, Work Element – Permanent Chain Link Fences. The embankment cover system provides the long-term barrier to inadvertent intrusion, with a minimum of 3.5 feet of rock layers plus 2 feet of clay above the waste. Material stability of cover rock layers is evaluated for the Class A embankment in Section 3.1.3.3.3 of the 2005 LRA. Projected performance against these design criteria is provided in Section 3.3.3.3.3 of the 2005 LRA. These analyses are applicable to the Class A South/11e.(2) embankment because the erosion barrier materials and material specifications are identical to that of the Class A embankment.

3.2.9 OCCUPATIONAL EXPOSURE

ALARA requirements for receiving, inspection, handling, storage, and disposal areas are discussed in Section 7, below. Wastes received at the Class A South portion of the Class A South/11e.(2) embankment will be identical to those approved under the current license for the Class A embankment; therefore, there is no need to evaluate required shielding for higher activity wastes. Energy*Solutions'* procedures for handling the accidental rupture of nonstable waste containers are discussed in Section 4.5, below.

3.2.10 SITE MONITORING

Monitoring systems will be inspected for degradation as a component of each sampling event. Long-term monitoring systems include the groundwater monitoring wells and settlement monitoring plates as discussed in Section 5.3 of this document.

3.2.11 BUFFER ZONE

A discussion of the design criteria and projected performance of the buffer zone is located in the 2005 LRA, Sections 3.1.5 and 3.3.5, respectively. This discussion is applicable to the Class A South/11e.(2) embankment because the buffer zone is 100 feet, exceeding the evaluated width of 94 feet. See also section 3.1.12 above.

3.2.12 STRUCTURAL DESIGN FOR BELOW-GROUND VAULTS AND EARTH MOUNDED CONCRETE BUNKERS

Below ground vaults are defined as warehouse-sized vaults buried beneath grade. Concrete bunkers are defined as concrete lined trenches with compartmental separation for different waste classes. Energy*Solutions* does not perform either of these types of disposal and therefore this topic is not applicable to the Class A South/11e.(2) embankment.

3.3 CONSTRUCTION CONSIDERATIONS

Clay Barrier General Requirements: The clay barrier will be constructed using native clay materials compacted to at least 95% of a Standard Proctor and will have an in-place permeability of no greater than $1x10^{-6}$ cm/sec. The completed clay barrier will be at least 12 ft wide. One and one half to one side slopes (at a maximum) will be constructed when placing lifts. The clay barrier will be constructed such that the top of the clay barrier will be maintained at a minimum of one foot above the surface of the adjacent waste (loose or compacted), and completed waste lifts will slope away, for at least 100 ft on the Class A side, from the wall at a minimum of two percent . Specific construction and quality control specifications have been added to the LLRW & 11e.(2) CQA/QC Manual for the construction of the clay barrier and associated waste placement activities. Please see Attachment 3 to the amendment request.

Storm Water Management General Requirements: Temporary runoff control berms will be constructed around the 11e.(2) and Class A waste placement areas in accordance with the current LLRW and 11e.(2) CQA/QC Manual, Work Element – General Requirements, specification “Runoff Control During Project”. The current 11e.(2) runoff control berm on the west side of the 11e.(2) cell will serve as the runoff control berm on the west side of the 11e.(2) lift area(s) and on the east side of the Class A lift area(s) during the initial construction phase. During subsequent construction of the barrier and surrounding waste lifts, the clay barrier combined with waste lift sloping will prevent runoff from crossing from the Class A waste cell to the 11e.(2) cell. The waste on both sides of the clay barrier will be placed and sloped, at least two percent, to divert storm water runoff away from the clay barrier and to the toe of the cells. This sloped waste area will extend at least 100 ft to the west of the barrier for the Class A side and as much as reasonably possible on the 11e.(2) side of the barrier.

Conceptual Construction Plan: The proposed location of the clay barrier will require the relocation of previously disposed 11e.(2) waste. Drawing 07021-U2 shows the current toe of waste in relation to the proposed location of the clay barrier. In general, the plan is to start on the north side of the embankment and work south. The anticipated sequence of construction includes the following (all work will be performed in accordance with the proposed LLRW and 11e.(2) CQA/QC Manual found in Attachment 3):

Initial Clay Barrier Construction and Waste Placement:

1. All liner for the 11e.(2) cell is already constructed. Liner for the Class A South cell will be constructed to the west as needed to provide capacity to receive Class A wastes.
2. New runoff control berms will be constructed as needed around waste placement areas. The existing runoff control berm west of the current 11e.(2) waste toe will be utilized during the initial construction phase of the clay barrier.
3. Existing placed 11e.(2) material will be excavated to within 12" of the top of clay liner as needed to prepare for the construction of the clay barrier. The excavation wall will be sloped as needed to prevent inadvertent collapse. The removed waste will be stockpiled within the 11e.(2) cell for later replacement.
4. Protective cover will be removed within the footprint of the 12' wide clay barrier wall and stockpiled within the 11e.(2) cell for later replacement as 11e.(2) waste.
5. Once the top surface of the clay liner in established, the liner surface will be roughened to ensure adequate tie-in. The first lift of clay barrier material will then be placed and tested. Subsequent lifts will be constructed per the CQA/QC Plan.
6. When the wall is at least 4 feet higher than the liner elevation, then the first lift of 11e.(2) waste can be placed on the east side of the barrier wall and the first lift of Class A waste can be placed on the west side of the barrier wall. Both Class A and 11e.(2) wastes will be placed with a minimum two percent slope away from the wall. On the Class A side of the wall the 2 percent slope will extend at least 100 ft perpendicular to the wall. On the 11e.(2) side of the wall the waste will slope at two percent until it intercepts existing placed waste

Subsequent Clay Barrier Wall Construction and Waste Placement:

7. Subsequent clay barrier lifts will be placed on top of preceding waste lifts such that the top of the clay barrier wall is always at a height at least 1 ft above the immediately adjacent waste, whether that waste is in a loose or compacted lift.
8. Successive lifts of 11e.(2) wastes will be placed within the cell such that the lowest elevations are maintained as far as possible from the wall alignment, until a minimum of 100 ft from the barrier wall can be achieved. The waste lifts shall be constructed and sloped to maintain drainage away from the barrier wall and into the 10 ft waste offsets between the waste and the runoff control berms
9. During this same time frame Class A wastes can be placed on the Class A South side of the barrier wall. Depending on the amount of 11e.(2) waste being received, Class A waste can either be placed against the barrier wall, or at a separate location to the west (at least 100 ft away from the clay barrier) where it can be placed to elevations higher than the barrier wall. Class A waste placed to higher elevations than the barrier wall will continue to be subject to runoff controls provided in the LLRW and 11e.(2) CQA/QC Manual, Work Element – Class A South/11e.(2) Clay Barrier, specification "Runoff Control". Waste lifts shall be constructed such to maintain drainage away from the barrier wall and into the 10 ft waste offsets between the waste and the runoff control berms.

The rate of waste receipts for both sides of the embankment cannot be reliably predicted more than a few months in advance. The plan dimensions and capacity of the 11e.(2) side will be fixed once the wall is started. Wastes will be placed on that side beginning along the wall. Bulk waste placement capacity in the Class A and Class A North cells will provide buffer for times that Class A waste receipts exceed 11e.(2) waste receipts. After the Class A and Class A North embankments are full, differing relative rates of receipt for each waste type may be managed by having two disposal locations for bulk Class A waste in the Class A South/11e.(2) embankment – one at the barrier wall location and a second location starting at least 100 ft away from the barrier wall. Class A bulk waste receipts consistently exceed 11e.(2) waste receipts; for the rare, short-term case that 11e.(2) waste receipts exceed Class A, this material will be stockpiled until Class A bulk waste receipts permit barrier wall construction. As a last resort, clean fill materials (placed according to waste placement specifications) may be used as a substitute for waste on either side of the clay barrier to balance the construction of the embankment.

3.3.1 CONSTRUCTION METHODS AND FEATURES

Construction methods for the Class A South/11e.(2) embankment are provided in the LLRW and 11e.(2) CQA/QC Manual. The LLRW and 11e.(2) CQA/QC Manual has been revised to incorporate the Class A South/11e.(2) Clay Barrier, and is included as Attachment 3 to this amendment request. Engineering drawings are provided in drawing series 07021, included as Attachment 2 to this amendment request.

3.3.1.1 SITE PREPARATION AND CURRENT CONDITIONS

Site preparation requirements for the Class A South/11e.(2) embankment are provided in the LLRW and 11e.(2) CQA/QC Manual, Work Element – Foundation Preparation. Because these specifications are identical to those of the Class A embankment, no revision to the LLRW and 11e.(2) CQA/QC Manual is needed. The existing surface as of June, 2009 includes areas of approved clay liner, areas excavated to near-foundation elevation; and areas that have not been disturbed. As indicated on drawing 07021-U3, existing groundwater wells GW-36, GW-37, and GW-38R are located within the embankment footprint and will be abandoned prior to liner construction. Furthermore, the 2000 Evaporation Pond is also located within the embankment footprint and will be decommissioned prior to liner construction in that portion of the embankment.

3.3.1.2 CONTROL AND DIVERSION OF WATER

Surface water is controlled by a system of run-on and run-off berms. A comprehensive discussion of berm systems for the Class A embankment is provided in Section 3.4.4 of the 2005 LRA. This discussion is applicable to the Class A South/11e.(2) embankment because berm requirements will be identical for the Class A and the Class A south/11e.(2) embankments. As discussed in section 3.1.2 above, the highest groundwater elevation is 6 feet below the top of liner elevation; therefore, groundwater control will not be necessary.

3.3.1.3 CONSTRUCTION OF DISPOSAL UNITS

The Class A South/11e.(2) embankment will be constructed to the existing liner, waste placement, and to similar cover requirements of the LLRW and 11e.(2) CQA/QC Manual. See also engineering drawing series 07021.

3.3.1.4 CONCRETE AND STEEL CONSTRUCTION

One aspect of disposal at the Class A South/11e.(2) embankment will incorporate concrete as a component of disposal facility construction: Controlled Low-Strength Material (CLSM) used to fill voids in debris placement. CLSM use will be controlled in accordance with existing requirements applicable to disposal in the Class A and 11e.(2) embankments. CLSM requirements are located in the LLRW and 11e.(2) CQA/QC

Manual, Work Element – Waste Placement, specification "CLSM Pours". CLSM is a low-strength void filling material; no reinforcing steel is used.

3.3.1.5 BACKFILLING

Waste placement in the Class A South/11e.(2) embankment will be controlled in accordance with the LLRW CQA/QC Manual, Work Element – Waste Placement. No changes to existing approved waste placement methods are requested.

3.3.1.6 CLOSURE OF INDIVIDUAL DISPOSAL UNITS

The cover over the Class A South/11e.(2) embankment will be constructed in accordance with the LLRW and 11e.(2) CQA/QC Manual, Work Elements – Radon Barrier Borrow Material, Radon Barrier Test Pad, Radon Barrier Placement, Filter Zone, Sacrificial Soil Placement, and Rock Erosion Barrier. See also drawing series 07021.

3.3.1.7 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

Applicable codes and standards are discussed concurrent with establishment of design criteria for each of the principal design features, as referenced above. In addition, ASTM standards applicable to construction of the Class A South/11e.(2) embankment are listed in Appendix B of the LLRW and 11e.(2) CQA/QC Manual and referenced in individual specifications as appropriate.

3.3.1.8 CONSTRUCTION MATERIALS AND QUALITY ASSURANCE

Construction materials for the Class A South/11e.(2) embankment will consist of native soils and rock. Specifications for each component are provided as discussed above. Quality assurance and quality control measures required for construction are provided in the LLRW and 11e.(2) CQA/QC Manual. All construction materials and procedures for the Class A South/11e.(2) embankment will be identical to those currently approved for the Class A embankment.

3.3.1.9 SITE PLANS, ENGINEERING DRAWINGS, AND CONSTRUCTION SPECIFICATIONS

Engineering drawing series 07021 details the Class A South/11e.(2) embankment and is provided as Attachment 2 to this amendment request. In accordance with Condition I.H.6 of the GWQDP, Energy*Solutions* is required to provide an annual as-built report and drawing set documenting embankment construction.

3.3.2 CONSTRUCTION EQUIPMENT

Construction equipment will consist of standard heavy construction and earth-moving equipment. Equipment used to construct the Class A South/11e.(2) embankment will be equal to that used in construction of the Class A embankment.

3.3.3 CONSTRUCTION AND OPERATION CONSIDERATIONS FOR BELOW-GROUND VAULTS AND EARTH MOUNDED CONCRETE BUNKERS

Below ground vaults are defined as warehouse-sized vaults buried beneath grade. Concrete bunkers are defined as concrete lined trenches with compartmental separation for different waste classes. Energy*Solutions* does not perform either of these types of disposal and therefore this topic is not applicable to the Class A South/11e.(2) embankment.

3.4 DESIGN OF AUXILARY SYSTEMS AND FACILITIES

3.4.1 UTILITY SYSTEMS

A discussion of site utility systems is located in the 2005 LRA, Section 3.4.1. This discussion is applicable to the Class A South/11e.(2) embankment because no additional utility systems will be needed for the embankment.

3.4.2 AUXILIARY FACILITIES

A discussion of auxiliary facilities is located in the 2005 LRA, Section 3.4.2. This discussion is applicable to the Class A South/11e.(2) embankment because no additional auxiliary facilities will be needed for the embankment.

3.4.3 FIRE PROTECTION SYSTEM

A discussion of the fire protection system is located in the 2005 License Renewal Application, Section 3.4.3. This discussion is applicable to the Class A South/11e.(2) embankment because no additional fire protection system will be needed for the embankment.

3.4.4 EROSION AND FLOOD CONTROL SYSTEM

For information regarding site drainage and flood protection following closure, please refer to Sections 3.1.6 and 3.2.5, above. A discussion of operational erosion and flood control is located in the 2005 LRA, Section 3.4.4. This discussion is applicable to the Class A South/11e.(2) embankment because Energy*Solutions* will implement similar run-on and run-off control berms around the Class A South/11e.(2) embankment.

4.0 FACILITY OPERATIONS

4.1 RECEIPT AND INSPECTION OF WASTE

Incoming shipments of Class A wastes will be inspected and received in accordance with the currently approved LLRW Waste Characterization Plan (RML condition 58, currently approved revision date March 10, 2008). Incoming shipments of 11e.(2) wastes will be inspected and received in accordance with operating procedures CL-SR-PR-041, *Incoming Radioactive Waste Shipment Acceptance*. There will be no changes to these requirements for purposes of constructing the Class A South/11e.(2) embankment.

4.1.1 PROCEDURE FOR VISUAL EXAMINATION OF SHIPPING DOCUMENTS

This topic is addressed in the current LLRW Waste Characterization Plan, Step 3. Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

4.1.2 PROCEDURE FOR VISUAL EXAMINATION OF WASTE PACKAGES

This topic is addressed in the current Waste Characterization Plan, Step 3. Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

4.1.3 PROCEDURE FOR VERIFICATION SURVEYS

This topic is addressed in the 2005 LRA (Section 4.1). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

4.1.4 PROCEDURE ON VERIFYING WASTE CLASS

This topic is addressed in the current Waste Characterization Plan, Step 2. Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

4.1.5 PROCEDURE FOR ANALYTICALLY VERIFYING WASTE CHARACTERISTICS AND FORM

This topic is addressed in the current Waste Characterization Plan, Step 2. Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

4.1.6 OTHER PROCEDURES TO ENSURE WASTE ACCEPTANCE CRITERIA ARE MET

This topic is addressed in the current Waste Characterization Plan. Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

4.2 WASTE HANDLING AND INTERIM STORAGE

Waste handling and interim storage will be managed in accordance with existing controls and at existing facilities provided by the RML and the GWQDP, according to the waste type being managed. There will be no changes to these requirements for purposes of constructing the Class A South/11e.(2) embankment.

All wastes received at the Clive facility are entered into and tracked with the Electronic Waste Information System (EWIS). EWIS is an electronic record-keeping system used to track waste type, volume, activity, and placement location within the disposal embankments. EWIS also contains waste profile information and provides automated compliance checks of the waste shipments against license limits, sampling frequency, etc. Furthermore, all waste containers received are labeled as to waste type, generator, receipt date, and disposal cell. This prevents inadvertent cross-contamination of waste types.

4.3 WASTE DISPOSAL OPERATIONS

Waste disposal operations will be controlled in accordance with the LLRW and 11e.(2) CQA/QC Manual. As bulk waste placement in the existing Class A and Class A North embankments is completed, bulk Class A waste disposal operations will move to the Class A South portion of the Class A South/11e.(2) embankment. There will be no changes to waste placement, testing, and documentation requirements for purposes of constructing the Class A South/11e.(2) embankment.

Class A and 11e.(2) waste will be placed in the Class A South/11e.(2) embankment using shared equipment, facilities, and personnel. This approach continues long-standing practice and controls at the Clive facility. Specifically, controls to minimize cross-contamination of Class A and 11e.(2) wastes are provided at RML #UT 2300249, condition 51. These controls are implemented via site operating procedure CL-LM-PR-001, *Equipment and Facility Labeling Requirements*, provided in Attachment 6 to this request.

4.3.1 WASTE EMPLACEMENT

Waste placement will be controlled in accordance with the LLRW and 11e.(2) CQA/QC Manual. It is anticipated that bulk Class A waste placement in the Class A South portion of the embankment will begin at the northern boundary and progress generally south and west. The exact sequence will necessarily depend on timing and volumes of 11e.(2) waste receipts, so that 11e.(2), clay barrier, and bulk Class A waste lifts all come up roughly together. See also section 3.3 above for a discussion of waste emplacement concurrent with barrier wall construction.

4.3.2 FILLING OF VOID SPACES

The LLRW and 11e.(2) CQA/QC Manual provides controls for filling void spaces. Since there is no change in waste placement procedures for the Class A South/11e.(2) embankment, these controls are unaffected..

4.3.3 WASTE COVERING

Waste covering operations will be controlled in accordance with the LLRW and 11e.(2) CQA/QC Manual. As discussed in Section 3 above, cover system specifications and construction procedures will be essentially identical to that approved for the existing Class A embankment; with the exception being Type B filter zone thickness.

4.3.4 LOCATION DISPOSAL UNITS AND BOUNDARY MARKERS

This topic is addressed in the 2005 LRA (Section 4.3.5). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

4.3.5 DISPOSAL UNIT CLOSURE AND STABILIZATION

This topic is addressed in the 2005 LRA (Section 4.3.4). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

4.3.6 BUFFER ZONE

This topic is addressed in the 2005 LRA (Section 4.3.6). The Class A South/11e.(2) embankment is designed with a 100 foot buffer zone, consistent with the minimum dimension of 94 feet. See also section 3.1.12 above.

4.4 OPERATIONAL ENVIRONMENTAL MONITORING AND SURVEILLANCE

4.4.1 REVIEW AND AUDIT OF FACILITY OPERATIONS

Energy*Solutions*' program for facility review and audit is provided in the 2005 LRA, Appendix V, Quality Assurance Manual. Since there is no change to the types of waste that will be managed, this plan will be unaffected by the Class A South/11e.(2) embankment.

4.4.2 FACILITY ADMINISTRATION AND OPERATING PROCEDURES

This topic is addressed in the 2005 LRA (Section 4.8). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

4.4.3 ENVIRONMENTAL MONITORING AND SURVEILLANCES

Groundwater monitoring system design and feasibility is addressed in "Responses to Utah DRC Comments 6, 7, 9 and 16 relating to the Class A South/11e.(2) Cell Permit

Amendment Request," Environmental Resources Management (ERM), June 5, 2009. This report is provided as Attachment 7 to this amendment request. This approach provides reasonable assurance that releases from the Class A portion can and will be detected beneath the clay barrier before they have migrated under the 11e.(2) portion of the embankment.

Environmental monitoring will be performed in accordance with the current approved Environmental Monitoring Plan per Radioactive Material License #UT 2300249, condition 26. This plan was recently revised and re-issued to incorporate LLRW and 11e.(2) environmental monitoring into a single program. The current approved version is revision 0, dated November 24, 2008. The Environmental Monitoring Plan does not require separate and distinct air, radon, or direct gamma monitoring for any particular embankment or waste type; rather, the dose and contamination limits apply at facility boundaries accessible to members of the public regardless of source. Therefore, no further revision to the environmental monitoring program is needed.

4.5 EMERGENCY AND CONTINGENCY PLAN

Energy*Solutions*' currently approved Emergency Response and Contingency Plan, operating procedure CL-SH-PR-500, is applicable to the Class A South/11e.(2) embankment. The plan addresses general types of emergency, and does not specify different responses for the Class A, Class A North, and 11e.(2) disposal cells. Haul routes to the cell location already exist, and waste management practices at receipt and unloading facilities will be unchanged in relation to this request. Since there is no change to the types of waste that will be managed, this plan will be unaffected by the Class A South/11e.(2) embankment.

5.0 SITE CLOSURE PLAN AND INSTITUTIONAL CONTROLS

The embankment is designed to eliminate to the extent practicable the need for active maintenance after closure. Once the proposed Class A South/11e.(2) embankment is closed, no further maintenance to the embankment is anticipated. Embankment closure is executed on a continuing basis, with cover construction generally completed within a relatively short time after a section of the embankment reaches its design limit of waste placement. As required by Class A RML condition 74, Energy*Solutions* will submit a detailed site decontamination and decommissioning plan at least one year prior to the anticipated closure of the site. This plan will address site closure in the context of site conditions at that time.

5.1 SITE STABILIZATION

This topic is addressed in the 2005 LRA (Section 5.1). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

5.1.1 SURFACE DRAINAGE AND EROSION PROTECTION

This topic is addressed in the 2005 LRA (Section 5.1.1). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

5.1.2 GEOTECHNICAL STABILITY

This topic is addressed in the 2005 LRA (Section 5.1.2). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

5.1A SITE CLOSURE AND STABILIZATION CONSIDERATIONS FOR BELOW-GROUND VAULTS AND EARTH MOUNDED CONCRETE BUNKERS

Below ground vaults are defined as warehouse-sized vaults buried beneath grade. Concrete bunkers are defined as concrete-lined trenches with compartmental separation for different waste classes. Energy*Solutions* does not perform either of these types of disposal and therefore this topic is not applicable to the Class A South/11e.(2) embankment.

5.2 DECONTAMINATION AND DECOMISSIONING

This topic is addressed in the 2005 LRA (Section 5.2). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

5.3 POST-OPERATIONAL ENVIRONMENTAL MONITORING

This topic is addressed in the 2005 LRA (Section 5.3). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

6.0 SAFETY ASSESSMENT

This topic is addressed in the 2005 LRA, section 6. Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment. Furthermore, the dose assessments are confirmed by monitoring data reported to DRC. Personnel monitoring information is provided to DRC by April 30 of each year in the annual report required by 10 CFR 20.2206. Monitoring of dose to the general public is reported to DRC with the quarterly environmental monitoring reports required by RML condition 29.A. Both of these regular reports confirm Energy*Solutions*' ongoing compliance with the applicable dose limits.

6.1 RELEASE OF RADIOACTIVITY

Anticipated sources and radioactivity of wastes will be no different than radioactive wastes currently being placed in the Class A and Class A North embankments, i.e., Class A LLRW. Radioactive Material License Condition 9.B prohibits receipt of Class B and C LLRW.

6.1.1 DETERMINATION OF TYPES, KINDS, AND QUANTITIES OF WASTE

This topic is addressed in the 2005 LRA (Section 6.1-6.2). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

6.1.2 INFILTRATION

This topic is addressed in the 2005 LRA (Section 6.3.1.4). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A

South/11e.(2) embankment. Section 3.2.1 of this amendment request discusses infiltration modeling results for the Class A South/11e.(2) embankment.

6.1.3 RADIONUCLIDE RELEASE – NORMAL CONDITIONS

This topic is addressed in the 2005 LRA (Section 6.3.1). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

6.1.4 RADIONUCLIDE RELEASE – ACCIDENTAL OR UNUSUAL OPERATIONAL CONDITIONS

This topic is addressed in the 2005 LRA (Section 6.3.2). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

6.1.5 RADIONUCLIDE TRANSFER TO HUMAN ACCESS LOCATION

This topic is addressed for groundwater, air, surface water, and other transfer mechanisms in the 2005 LRA (Sections 6.4.1 – 6.4.3). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment. See section 3.2.1 of this amendment request for a discussion of groundwater modeling specific to the Class A South/11e.(2) embankment.

6.1.6 ASSESSMENT OF IMPACTS AND REGULATORY COMPLIANCE

The analyses provided and referenced above demonstrate that Energy*Solutions*' exiting operations have impacts that are maintained within the applicable regulatory limits. Furthermore, personnel and environmental monitoring data confirm that the applicable limits are met on a continuing basis. Since there is no change in the types of waste that will be managed, this issue will be unaffected by the Class A South/11e.(2) embankment.

6.2 INTRUDER PROTECTION

6.2.1 NORMAL RELEASES

The waste to be disposed in the Class A South portion of the Class A South/11e.(2) embankment is identical to that approved for the existing Class A and Class A North embankments. Therefore, there is no difference in potential radiological release with the proposed embankment. Ongoing confirmation that releases meet all applicable regulatory requirements is provided in the quarterly environmental monitoring reports referenced in Section 6.0 above.

6.2.1.1 CONTROL OF WINDBORNE DISPERSION

Engineering and operational controls to prevent the resuspension and dispersion of particulate radioactivity are provided at RML condition 53 and in the LLRW and 11e(2) CQA/QC Manual. Those controls will be implemented without revision in construction of the Class A South/11e.(2) embankment.

6.2.1.2 CONTROL OF SURFACE CONTAMINATION

All equipment, vehicles, and personnel are screened for both alpha and beta contamination before being released from the site. There will be no revision to these requirements associated with the Class A South/11e.(2) embankment.

6.2.2 POTENTIAL ACCIDENTAL RELEASES

Construction of the proposed Class A South/11e.(2) embankment will not change the nature of possible potential accidental releases that have been addressed in Energy*Solutions'* previous licensing actions. No new emergency response or contingency plans will be generated, as the nature of the waste that will be disposed of in the proposed Class A South portion of the Class A South/11e.(2) embankment is identical to the waste currently being disposed of in the Class A and Class A North embankment.

6.2.3 POTENTIAL RELEASES FOLLOWING OPERATIONS

6.2.3.1 RADIONUCLIDE TRANSFER TO HUMAN ACCESS LOCATIONS

The construction of the proposed Class A South/11e.(2) embankment will not change the nature of possible transfer to human access locations discussed in previous licensing actions.

6.2.3.2 PROJECTED DOSES TO MEMBERS OF THE GENERAL PUBLIC

Since there will be no change to the waste handled or to the operating and disposal procedures, previous dose assessment work remains applicable to the Class A South/11e.(2) embankment. Furthermore, the dose assessments are confirmed to be conservative by monitoring data reported to DRC. Monitoring of dose to the general public is reported to DRC with the quarterly environmental monitoring reports required by RML condition 29.A.

6.3 LONG-TERM STABILITY

6.3.1 SURFACE DRAINAGE AND EROSION PROTECTION

This topic is addressed in sections 3.1.6, 3.2.5, and 3.4.4 above.

6.3.2 SLOPE STABILITY

This topic is addressed in the 2005 LRA (Section 6.4.3.3). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment. See also "Class A South/11e.(2) Embankment Barrier Wall Stability Evaluation," Steven M. Newton & Associates, May 20, 2009, included as Attachment 5 to this amendment request.

6.3.2.1 SITE AND SLOPE AREA CHARACTERIZATION

This topic is addressed in the 2005 LRA (Section 6.4.3). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment. See also "Class A South/11e.(2) Embankment Barrier Wall Stability Evaluation," Steven M. Newton & Associates, May 20, 2009, included as Attachment 5 to this amendment request.

6.3.3 SETTLEMENT AND SUBSIDENCE

Design criteria for settlement and subsidence are provided in Sections 3.1.1.2, 3.1.2.1 and 3.1.3.3 of the 2005 LRA. Projected performance of the cover system against these design criteria are discussed in Sections 3.3.1.2, 3.3.2.1 and 3.3.3.3 of that document. These analyses are applicable to the Class A South/11e.(2) embankment because the liner, waste placement, and cover materials and material specifications are essentially identical to that of the Class A and Class A North embankments. See also Sections 3.1.1 and 3.2.2 above and "Class A South/11e.(2) Embankment Barrier Wall Stability Evaluation," Steven M. Newton & Associates, May 20, 2009, included as Attachment 5 to this amendment request..

7.0 OCCUPATIONAL RADIATION PROTECTION

7.1 OCCUPATIONAL RADIATION EXPOSURES

7.1.1 POLICY CONSIDERATIONS

The objective of the Clive Radiation Protection Program is to ensure that all reasonable actions are taken to reduce radiation exposures and effluent concentrations to levels that are considered As Low As Reasonably Achievable (ALARA).

Energy*Solutions*' ALARA management policy is detailed in Section 5 of the ALARA Program document. Section 4 of the ALARA Program describes the organizational structure of the ALARA program and the responsibilities of those involved in managing and implementing the ALARA program. The ALARA Program is located in the 2005 LRA (, Appendix H).

The waste type and classification that will be disposed of in the Class A South portion of the Class A South/11e.(2) embankment will be no different than waste currently being disposed of in the Class A and Class A North embankments. Therefore, the ALARA Program will not require revision for the Class A South/11e.(2) embankment.

The Class A South/11e.(2) embankment was presented to and discussed by the Clive Radiation Safety Committee in accordance with the ALARA program. The committee's review and ALARA evaluation is provided as Attachment 8 to this amendment request.

7.1.2 DESIGN CONSIDERATIONS

This topic is addressed in the 2005 LRA (Section 7.1.2). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

7.1.3 OPERATIONAL CONSIDERATIONS

This topic is addressed in the 2005 LRA (Section 7.1.3). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

7.2 RADIATION SOURCES

The types and quantities of materials received for disposal in the Class A South portion of the Class A South/11e.(2) embankment will be no different than materials disposed of in the Class A and Class A North embankments. Therefore, radiation protection, access control to restricted areas, and personnel protective equipment policies will not change from what is currently being performed.

7.3 RADIATION PROTECTION DESIGN FEATURES

7.3.1 FACILITY DESIGN FEATURES

This topic is addressed in the 2005 LRA (Section 7.3.1). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

7.3.2 SHIELDING

This topic is addressed in the 2005 LRA (Section 7.3.2). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

7.3.3 VENTILATION

This topic is addressed in the 2005 LRA (Section 7.3.3). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e(2) embankment.

7.3.4 AREA RADIATION AND AIRBORNE RADIOACTIVITY MONITORING INSTRUMENTATION

This topic is addressed in the 2005 LRA (Section 7.3.4). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

7.3.5 EQUIPMENT, INSTRUMENTATION, AND FACILITIES

This topic is addressed in the 2005 LRA (Section 7.3.5). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

7.4 RADIATION PROTECTION PROGRAM

This topic is addressed in the 2005 LRA (Section 7.4). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

7.4.1 ORGANIZATION

The specific organization of the radiation protection program is defined by the Class A RML, condition 32.A. These requirements will be unaffected by the Class A South/11e.(2) embankment.

8.0 CONDUCT OF OPERATIONS

Operations at the Clive facility will not change with respect to the Class A South/11e.(2) embankment. The type of waste, method of disposal and engineering design of the proposed embankment are no different than what is currently performed in the Class A and Class A North embankments.

8.1 ORGANIZATIONAL STRUCTURE

Detailed requirements and qualifications for significant organizational positions are described in the Class A RML, Condition 32, Appendix I (currently approved revision is Rev. 21, February 9, 2009).

8.2 QUALIFICATIONS OF APPLICANT

A discussion of applicant qualifications is provided in Section 1.1.2 of this amendment request.

8.3 TRAINING PROGRAM

This topic is addressed in the 2005 LRA (Section 7.4.3). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

8.4 EMERGENCY PLANNING

This topic is addressed in the 2005 LRA (Section 4.5). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

8.5 REVIEW AND AUDIT

This topic is addressed in the 2005 LRA (Section 4.6). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

8.6 FACILITY ADMINISTRATIVE AND OPERATING PROCEDURES

This topic is addressed in the 2005 LRA (Section 4). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A South/11e.(2) embankment.

8.7 PHYSICAL SECURITY

The Site Radiological Security Plan is incorporated in the Class A RML at condition 54 (currently approved as revision 3, May 5, 2008). Since there is no change to the types of waste that will be managed, this plan will be unaffected by the Class A South/11e.(2) embankment.

9.0 QUALITY ASSURANCE

Energy*Solutions’* Quality Assurance Program is described in the 2005 LRA (Section 9). Since there is no change to the types of waste that will be managed, this program will be unaffected by the Class A South/11e.(2) embankment.

10.0 FINANCIAL ASSURANCE

In order to protect the State of Utah from financial damage arising from having to close and decommission the facility, the LLRW financial surety will be revised to include cost estimates for the closure of the LLRW portion of the Class A South/11e.(2) embankment. Financial surety for the 11e.(2) portion of the Class A South/11e.(2) embankment is covered under the currently approved 11e.(2) surety.

The annual surety review is submitted annually on or before December 1st. A revised surety estimate is not included with this amendment request. Energy*Solutions* anticipates that the surety will need to be revised to include new groundwater monitoring points; and may require an adjustment for fencing and construction of haul roads around the Class A portion of the embankment. Adjustments will be made to the surety revision approved at the time this license amendment is approved, then funded prior to initiating any Class A waste placement in the Class A South/11e.(2) embankment.

Any proportional decrease within the 11e.(2) portion of the embankment will be captured within an annual update to the 11e.(2) Surety after approval of the proposed amendment. Current open cell limitations for the 11e.(2) portion of the Class A South/11e.(2) Cell will not change as a direct result of this amendment request.

10.1 FINANCIAL QUALIFICATIONS OF APPLICANT

Energy*Solutions'* financial qualifications are discussed in Section 1.1.1.2 above.

10.2 FUNDING ASSURANCES

10.2.1 SPECIFIC ACCEPTABLE FINANCIAL ASSURANCES

10.2.1.1 SURETIES OR PERFORMANCE BONDS

Sureties are a type of financial mechanism provided to help protect the State of Utah from financial damage as a result of closing and decommissioning the facility. Performance bonds are another type of financial mechanism. Energy*Solutions* has chosen an alternative financial mechanism approved by the State.

10.2.1.2 LETTERS OF CREDIT

Energy*Solutions* has chosen as its financial mechanism an irrevocable letter of credit. This irrevocable letter of credit has been entered into by Energy*Solutions* and Zions First National Bank for the benefit of the Executive Secretary of the Utah Radiation Control Board.

Upon DRC approval of the Class A South/11e.(2) embankment and associated financial surety calculations, and prior to placing waste within the embankment, Energy*Solutions* will amend the letters of credit as necessary to ensure funding for closure and post-closure monitoring of the Class A South portion of the Class A South/11e.(2) embankment. The 11e.(2) portion of the Class A South/11e.(2) embankment is covered under a separate irrevocable letter of credit in accordance with Radioactive Material License UT2300478.

10.3 FINANCIAL ASSURANCE FOR INSTITUTIONAL CONTROLS

In addition to the estimated costs for decommissioning the facility, the financial surety also covers estimated costs of long-term surveillance of the site. This includes sampling of groundwater monitoring wells, site inspections and repairs and other miscellaneous costs. See also the discussion in Section 10.0 above.

11.0 REFERENCES

10 CFR 20.3(a)(14), definition of a restricted (or controlled) area.

AMEC, "Report: Combined Embankment Study, Envirocare," December 13, 2005

AMEC, "Round 2 Interrogatories and Response, Class A Embankment Height Study, Energy*Solutions* Facility Near Clive, Utah," April 28, 2006.

AMEC, “Interrogatory Statement and Response, AMEC Interrogatory Response Letter Dated April 28, 2006, Class A Embankment Height Study, Energy*Solutions* Facility Near Clive, Utah,” May 22, 2006.

Envirocare of Utah, Inc., “Pre-licensing Plan Approval Application,” Appendix J, March 15, 2000.

Envirocare of Utah, Inc., “Application for License Amendment: Containerized Class A, B, and C LLRW Disposal,” December 13, 2000.

Envirocare of Utah, Inc., “Comprehensive Groundwater Quality Evaluation Report”, September 1, 2004.

Envirocare of Utah, Inc., “Revised Hydrogeologic Report”, September 1, 2004.

Envirocare of Utah, Inc., Radioactive Material License Renewal Application, June 20, 2005.

Envirocare of Utah, Inc., Application for 11e.(2) Radioactive Material License Renewal, February 17, 2006.

Energy*Solutions* LLC, “Ground Water Quality Discharge Permit (GWQDP) UGW450005”.

Energy*Solutions* LLC, “LLRW and 11e.(2) CQA/QC Manual”, currently approved as Rev. 23d, November 10, 2008 (listed within application as LLRW and 11e.(2) CQA/QC Manual).

Energy*Solutions* LLC, “Organization”, currently approved as Rev. 21, February 9, 2009.

Energy*Solutions* LLC, “Radioactive Material License (RML) UT 2300249”.

Energy*Solutions* LLC, “Site Radiological Security Plan”, currently approved revision date May 5, 2008.

Energy*Solutions* LLC, “Waste Characterization Plan”, currently approved revision date March 10, 2008.

USNRC, NUREG-1199 Rev. 02, "Standard Format and Content of a license application for a Low-Level Radioactive Waste Disposal Facility", January 1991.

Whetstone Associates, “Energy*Solutions* Class A South Cell Infiltration and Transport Modeling”, December 7, 2007.

1A

ENERGYSOLUTIONS' LICENSE AMENDMENT #4XX

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LICENSE AMENDMENT

UTAH DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF RADIATION CONTROL
RADIOACTIVE MATERIAL LICENSE

Pursuant to Utah Code Annotated, Title 19, Chapter 3 and the Radiation Control Rules, Utah Administrative Code (UAC) R313, and in reliance on statements and representations heretofore made by the Licensee designated below, a license is hereby issued authorizing the Licensee to transfer, receive, possess, and use the radioactive material designated below; and to use radioactive material for the purpose(s) and at the place(s) designated below. The license is subject to all applicable rules, and orders now or hereafter in effect and to all conditions specified below.

****

LICENSEE	) 3. License Number UT 2300249
	) Amendment # 4XX
1. Name EnergySolutions, LLC (EnergySolutions)	)
	)**********************************
2. Address 423 West 300 South Suite 200 Salt Lake City, UT 84101	) 4. Expiration Date) January 25, 2013)**********************************
	) 5. License Category 4-a

****

6. Radioactive Material (element and mass number)		7. Chemical and/or physical form		8. Maximum Radioactivity and/or quantity of material the Licensee may possess at any one time.
A.	Any Radioactive Material including Special Nuclear Material specified in License Condition 13 A through J.	A. and B. Notwithstanding Conditions 9 (Authorized Use), 16 (Prohibitions and Waste Requirements), and 56 (containerized waste), typically large volume, bulky or containerized, soil or debris. Debris can include both decommissioning (cleanup) and routinely generated operational waste including but not limited to radiologically contaminated paper, piping, rocks, glass, metal, concrete, wood, bricks, resins, sludge, tailings, slag, residues, personal protective equipment (PPE) that conforms to the size limitations in currently approved QA/QC Manual.	A.	20,000 Curies***
B	Special Nuclear Material		B.	As specified in License Condition 13.A through J.

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6. Radioactive Material (element and mass number)		7. Chemical and/or physical form		8. Maximum Radioactivity and/or quantity of material the Licensee may possess at any one time.
C.	Cesium-137	Sealed Source(s) registered pursuant to R313-22-210 or an equivalent U.S. Nuclear Regulatory Commission or Agreement State regulation	C.	Not to exceed 11 millicuries per source
D.	Americium-241	Sealed Neutron Source(s) registered pursuant to R313-22-210 or an equivalent U.S. Nuclear Regulatory Commission or Agreement State regulation	D.	Not to exceed 51 millicuries per source
E.	Americium-241 Americium-243 Neptunium-237 Plutonium-239 Plutonium-242 Thorium-229 Thorium-230 Uranium-232 Uranium-238	Liquid	E.	Not to exceed 5 microcuries total activity per source
F.	Strontium-90/Yttrium-90	Liquid	F.	Not to exceed 5 microcuries total activity
G.	Americium-241	Sealed Source(s) registered pursuant to R313-22-210 or an equivalent U.S. Nuclear Regulatory Commission or Agreement State regulation	G.	Not to exceed 5 microcuries total activity
H.	Thorium-230	Sealed Source(s) registered pursuant to R313-22-210 or an equivalent U.S. Nuclear Regulatory Commission or Agreement State regulation	H.	Not to exceed 48.6 microcuries total activity
I.	Plutonium-239	Sealed Source(s) registered pursuant to R313-22-210 or an equivalent U.S. Nuclear Regulatory Commission or Agreement State regulation	I.	Not to exceed 21.9 microcuries total activity

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6. Radioactive Material (element and mass number)		7. Chemical and/or physical form		8. Maximum Radioactivity and/or quantity of material the Licensee may possess at any one time.
J.	Strontium-90/Yttrium-90 and Americium-241	Sealed Source(s) registered pursuant to R313-22-210 or an equivalent U.S. Nuclear Regulatory Commission or Agreement State regulation	J.	Not to exceed 8.1 millicuries per source
K.	Am-241, Cd-109, Co-57, Te-123m, Cr-51, Sn-113, Sr-85m, Cs-137, Co-60, and Y-88	Calibration or Referenced Combined Source(s)	K.	Not to exceed 5 microcuries per source
L.	Uranium-234, Uranium-235, Uranium-238, Americium-241, and Plutonium-239	Calibration or Reference Combined Source(s)	L.	Not to exceed 5 nanocuries per source
M.	Cobalt-60 and Cesium-137	Calibration or Reference Combined Source(s)	M.	Not to exceed 0.4 microcuries per source
N.	Reserved	Reserved	N.	Reserved
O.	Americium-241 and Europium-152	Calibration or Reference Combined Sources	O.	Not to exceed 2 microcuries per source
P.	Cesium-137	Sealed Source(s) registered pursuant to R313-22-210 or an equivalent U.S. Nuclear Regulatory Commission or Agreement State regulation	P.	Not to exceed 12 millicuries per source

***Applies to undisposed maximum quantity at the Class A disposal cell and the Mixed Waste landfill cell.
****

9. AUTHORIZED USE

A. Licensee may receive, store, and dispose by land burial, radioactive material as naturally occurring and accelerator produced material (NARM) and low-level radioactive waste. Prior to receiving an initial, low-level radioactive waste shipment for disposal from a generator, the Licensee shall obtain documentation which demonstrates that the low-level radioactive wastes have been approved for export to the Licensee. Approval is required from the low-level radioactive waste compact of origin (including the Northwest Compact), or for states unaffiliated with a low-level radioactive waste compact, the state of origin, to the extent a state can exercise such approval.

B. In accordance with Utah Code Annotated 19-3-105, the Licensee may not receive Class B or Class C low-level radioactive waste without first receiving approval from the Executive

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Secretary of the Utah Radiation Control Board and also receiving approval from the Governor and the Legislature.

C. The Licensee shall fulfill and maintain compliance with all conditions and shall meet all compliance schedules stipulated in the Ground Water Quality Discharge Permit, number UGW 450005 (hereafter GWQ Permit), issued by the Executive Secretary of the Utah Water Quality Board.

D. The Licensee may receive and store up to twenty (20) empty radioactive waste transportation casks under the following conditions:

- The casks are dedicated to the transportation of low level radioactive wastes.
- Storage of the casks is confined to the Restricted Area within the area specified in License Condition 10, except when staged for return to commerce within 7 days.
- Internal contamination is kept minimal as practical but will not exceed the contamination limits specified for Department of Transportation, Class 7 Hazardous Material, Radioactive Material, Excepted Package-Empty Packaging, UN2908.
- During storage, casks are to be secured in accordance with their Department of Transportation or Nuclear Regulatory Commission approved design specifications.

E. The Licensee may dispose of Class A Low-Level Radioactive Waste (LLRW) and NARM in both the Class A, and Class A North, and Class a South disposal cells described in License Condition 40, and in the Mixed Waste Landfill Cell. Class A waste is defined in Utah Radiation Control Rule R313-15-1008 and NARM at R313-12-3.

F. Effective January 1, 2002, the Licensee shall not accept, possess, store or dispose of any radioactive waste delivered to the disposal site by any conveyance, unless the associated Shipping Documents have a valid Generator Site Access Permit number, issued by the Utah Division of Radiation Control, affixed.

G. The Licensee may receive, treat, and dispose radioactively contaminated aqueous liquids and liquid mercury as characterized in the waste profile at the mixed waste facilities only, the waste must be Class A LLRW at receipt.

H. Reserved

I. Licensed material in Items 6.C and 6.D, Sealed source(s) contained in compatible portable gauging devices (registered pursuant to R313-22-210 or an equivalent U.S. Nuclear Regulatory Commission or Agreement State regulation) for measuring properties of materials.

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J. Licensed material in Items 6.E through 6.L, for operational checks and efficiency determinations of radiation detection instrumentation.

K. Licensed material in Items 6.M through 6.O, calibration or reference combined source(s) for use in conjunction with the Licensee's whole body counter.

L. Licensed material in Item 6.P, sealed source(s) contained in MGP Instruments, Inc. Model IRD-2000 dosimeter calibrators/irradiators for tests and source checks of electronic dosimeters.

SITE LOCATION

10. A. The Licensee may receive, store and dispose of licensed material at the Licensee's facility located in Section 32 of Township 1 South and Range 11 West, Tooele County, Utah.

B. Section 32, Township 1 South and Range 11 West, Tooele County, Utah, is defined by the following points of reference:

Southwest Section Corner:	Latitude 40° 40' 51.894060" N Longitude 113° 7' 28.579640" W
Elevation	4269.76 feet above mean sea level (amsl)
Southeast Section Corner	Latitude 40° 40' 50.906471" N Longitude 113° 6' 20.023247" W
Elevation	4277.27 feet-amsl
Northwest Section Corner	Latitude 40° 41' 44.093832" N Longitude 113° 7' 27.371551" W
Elevation	4273.06 feet-amsl
Northeast Section Corner	Latitude 40° 41' 43.107203" N Longitude 113° 6' 18.839771" W
Elevation	4280.83 feet-amsl

C. The Southwest Section Corner marker of Section 32 shall be the Point of Beginning (POB).

D. The Licensee shall cause a survey to be conducted by a Utah licensed land surveyor to identify the section corners of Section 32, Township 1 South, and Range 11 West, Tooele County, Utah (as defined in Condition 10.B). Licensee shall place monuments with brass caps at the identified section corner locations. Monuments shall be permanent and constructed in a manner that will protect them from being disturbed.

E. Licensed material in Items 6.C through 6.P shall be used only at the Licensee's facilities

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referenced in Condition 10.B.

11. The open cell area within the Class A, and Class A North, and Class A South disposal embankments where waste disposal/placement has or may occur, but the cover system has not been completed shall be limited to 3,650,000 square feet. Uncovered radioactive waste shall be limited to a surface area of 1,020,000 square feet.

12. Pursuant to UAC R313-12-55(1), the Licensee is granted an exemption to UAC R313-25-9, as it relates to land ownership and assumption of ownership.

SPECIAL NUCLEAR MATERIAL

13. In accordance with the Order issued by the U.S. Nuclear Regulatory Commission dated January 14, 2003, Docket No. 040-8989, License No. SMC-1559, the EnergySolutions may possess Special Nuclear Material (SNM) within the restricted area of the EnergySolutions facility as described in Condition 10 provided that:

A. Concentrations of SNM in individual waste containers must not exceed the values listed in Table 13-A at time of receipt:

Table 13-A

Column 1 Radionuclide	Column 2 Maximum Concentration (pCi/g)	Column 3 Measurement Uncertainty (pCi/g)
U-235[a]	1,900	285
U-235[b]	1,190	179
U-235[c]	26	10
U-235[d]	680	102
U-233	75,000	11,250
Pu-236	500	75
Pu-238	10,000	1,500
Pu-239	10,000	1,500
Pu-240	10,000	1,500
Pu-241	350,000	50,000
Pu-242	10,000	1,500

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Column 1 Radionuclide	Column 2 Maximum Concentration (pCi/g)	Column 3 Measurement Uncertainty (pCi/g)
Pu-243	500	75
Pu-244	500	75

a - for uranium below 10 percent enrichment and a maximum of 20 percent of the weight of the waste of materials listed in License Condition 13.B
b - for uranium at or above 10 percent enrichment and a maximum of 20 percent of the weight of the waste of materials listed in License Condition 13.B
c - for uranium at any enrichment with unlimited quantities of materials listed in License Condition 13.B and License Condition 13.C
d - for uranium at any enrichment with sum of materials listed in License Condition 13.B and License Condition 13.C not exceeding 45 percent of the weight of the waste

*The measurement uncertainty values in Column 3 above represent the maximum one-sigma uncertainty associated with the measurement of the concentration of the particular radionuclide.
The SNM must be homogeneously distributed throughout the waste. If the SNM is not homogeneously distributed, then the limiting concentrations must not be exceeded on average in any contiguous mass of 600 kilograms.

B. Except as allowed by notes a, b, c, and d in Condition 13.A, waste must not contain “pure forms” of chemicals containing carbon, fluorine, magnesium, or bismuth in bulk quantities (e.g., a pallet of drums, a B-25 box). By “pure forms,” it is meant that mixtures of the above elements such as magnesium oxide, magnesium carbonate, magnesium fluoride, bismuth oxide, etc. do not contain other elements. These chemicals would be added to the waste stream during processing, such as at fuel facilities or treatment such as at mixed waste treatment facilities. The presence of the above materials will be determined by the generator, based on process knowledge or testing.

C. Except as allowed by notes c and d in Condition 13.A, waste accepted must not contain total quantities of beryllium, hydrogenous material enriched in deuterium, or graphite above one percent of the total weight of the waste. The presence of the above materials will be determined by the generator, based on process knowledge, physical observations, or testing.

D. Waste packages must not contain highly water soluble forms of uranium greater than 350 grams of uranium-235 or 200 grams of uranium-233. The sum of the fractions rule will apply for mixtures of U-233 and U-235. Highly soluble forms of uranium include, but are not limited to: uranium sulfate, uranyl acetate, uranyl chloride, uranyl formate, uranyl fluoride, uranyl nitrate, uranyl potassium carbonate, and uranyl sulfate. The presence of the above materials will be determined by the generator, based on process knowledge or testing.

E. Mixed waste processing of waste containing SNM will be limited to stabilization (mixing waste with reagents), micro-encapsulation, macro-encapsulation using low-density and high density polyethylene, macroencapsulation using cementatious mix (Macro Mix), and thermal desorption.

When waste is processed using the thermal desorption process, EnergySolutions shall confirm the SNM concentration following processing and prior to returning the waste to temporary storage.

Liquid waste may be stabilized provided the SNM concentration does not exceed the SNM concentration limits in License Condition 13.A. For containers of liquid waste with more than 600 kilograms of waste, the total activity (pCi) of SNM shall not exceed the SNM concentration in License Condition 13.A times 600 kilograms of waste. Waste containing free liquids and the solids shall be mixed prior to treatment. Any solids shall be maintained in a suspended state during transfer and treatment.

F. EnergySolutions shall require generators to provide the following information for each waste stream:

Before Receipt

1. Waste Description. The description must detail how the waste was generated, list the physical forms in the waste, and identify uranium chemical composition.
2. Waste Characterization Summary. The data must include a general description of how the waste was characterized (including the volumetric extent of the waste, and the number, location, type, and results of any analytical testing), the range of SNM concentration ranges, and the analytical results with error values used to develop the concentration ranges.
3. Uniformity Description. A description of the process by which the waste was generated showing that the spatial distribution of SNM must be uniform, or other information supporting spatial distribution.
4. Manifest Concentration. The generator must describe the methods to be used to determine the concentrations on the manifests. These methods could include direct measurement and the use of scaling factors. The generator must describe the uncertainty associated with sampling and testing used to obtain the manifest concentrations.

   EnergySolutions shall review the above information and, if adequate, approve in writing this pre-shipment waste characterization and assurance plan before permitting the shipment of a waste stream. This will include statements that EnergySolutions has a written copy of all the information required above, that the characterization information is adequate and consistent with the waste description, and that the information is sufficient to demonstrate compliance with Conditions 13.F.1 through 13.F.4. Where generator process knowledge is used to demonstrate compliance with Conditions 13.A, 13.B, 13.C, or 13.D, EnergySolutions shall review this information and determine when testing is required to provide additional information in assuring compliance with the conditions. EnergySolutions shall retain this information as required by the State of Utah to permit independent review.

At Receipt

EnergySolutions shall require generators of SNM waste to provide a written certification with each waste manifest that states the SNM concentrations reported on the manifest do not exceed the limits in Condition 13.A, that the measurement uncertainty does not exceed the uncertainty value in Condition 13.A, and that the waste meets Conditions 13.B through 13.D.

G. Sampling and radiological testing of waste containing SNM must be performed in accordance with the following: One sample for each of the first ten shipments of a waste stream; or one sample for each of the first 100 cubic yards of waste up to 1,000 cubic yards of a waste stream; and one sample for each additional 500 cubic yards of waste following the first ten shipments or following the first 1,000 cubic yards of a waste stream. Sampling and radiological testing of debris waste containing SNM can be waived if the SNM concentration is lower than one tenth of the applicable limit in License Condition 13.A.

H. EnergySolutions shall notify the NRC, Region IV office within 24 hours if any of the above conditions are violated, including if a batch during a treatment process exceeds the SNM concentration in License Condition 13.A. A written notification of the event must be provided within 7 days.

I. EnergySolutions shall obtain NRC approval prior to changing any activities associated with the above conditions.

J. Notwithstanding License Condition13.A through 13.I, for the Containerized Waste Facility described in License Condition 10.F, the following limits for possession of SNM apply to the total combined quantities of SNM at the Containerized Waste Facility:

Consistent with the definition of special nuclear material given in UAC R313-12-3, the maximum quantity of special nuclear material which the EnergySolutions may possess at any one time, shall not exceed: 350 grams of U-235, 200 grams of U-233, and 200 grams Pu, or any combination of them in accordance with the following formula:

$$\frac{\text{(Grams U-235)}}{350} + \frac{\text{(Grams U-233)}}{200} + \frac{\text{(Grams Pu)}}{200} \leq 1$$

“Possession” and “Disposal” are defined in License Conditions 63 and 64 respectively.

MIXED WASTE

14. A. The Licensee may receive for treatment, storage, and disposal any radioactive waste as authorized by this license that is also determined to be hazardous (commonly referred to as mixed waste) as permitted by the “Hazardous Waste Plan Approvals” issued and modified by the Executive Secretary, Utah Solid and Hazardous Waste Control Board and “HSWA Permit”

issued by the U.S. Environmental Protection Agency.

B. The Licensee shall dispose of these wastes in the "mixed waste" disposal embankment only. Characteristic or listed hazardous waste treated at the Licensee's facility shall not be disposed of in the Class A North, ~~the~~ Class A, Class A South, or the 11.e(2) disposal cell.

WASTE TREATMENT AND PROCESSING

15. A. Prior to receipt of any low level radioactive or mixed wastes requiring treatment before disposal, the Licensee shall, based on knowledge of the technology to be used for treatment/processing of each particular radioactive or mixed waste, calculate and document that the resultant processed waste is neither Class B nor Class C waste.

B Reserved

C. Following treatment at the Mixed Waste facility the Licensee shall classify the resultant processed waste in accordance with UAC R313-15-1008.

D. The Licensee shall manifest treated waste from the Mixed Waste facility for disposal in accordance with UAC R313-15-1006.

PROHIBITIONS AND WASTE ACCEPTANCE REQUIREMENTS

16. A. Sealed sources as defined in Utah Administrative Code (UAC) R313-12 shall not be accepted for disposal.

B. In accordance with UAC R313-15-1008(2)(a)(v), waste shall not be readily capable of detonation or of explosive decomposition or reaction at normal pressures and temperatures, or of explosive reaction with water.

C. In accordance with UAC R313-15-1008(2)(a)(vi), waste shall not contain, or be capable of generating, quantities of toxic gases, vapors, or fumes harmful to persons transporting, handling, or disposing of the waste.

D. In accordance with UAC R313-15-1008(2)(a)(vii), waste shall not be pyrophoric.

E. Waste containing untreated biological, pathogenic, or infectious material including radiologically contaminated laboratory research animals is prohibited

F. Liquid Waste Restrictions

i. Except for liquid mercury, receipt of nonaqueous liquid waste is prohibited unless specifically approved by the Executive Secretary.

ii. Treated liquid radioactive waste shall be disposed in the Mixed Waste Landfill Cell in accordance with LLRW and 11e.(2) Construction QA/QC Manual.

iii. Only Utah Division of Radiation Control approved solidification or absorption agents as listed in the State-issued Part B Permit are authorized for liquid waste treatment.

iv. Liquid radioactive waste shall be solidified or absorbed in a manner such that no liquid component is disposed.

v. Only containers authorized by the U. S. Department of Transportation as specified in the regulations (49 CFR parts 100 thru 180) for transporting liquid radioactive materials shall be accepted for all liquid radioactive wastes, regardless of radioactivity concentrations.

G. In accordance with UAC R313-15-1008(2)(a)(viii), gaseous waste received for disposal in the Containerized Waste Facility shall be packaged at an absolute pressure that does not exceed 1.5 atmospheres at a temperature of 20 degrees Celsius and the total activity of any container shall not exceed 100 curies (3.7×10^{12} Bequerels).

H. In accordance with UAC R313-15-1008(2)(a)(ii), waste received for disposal in the Containerized Waste Facility shall not be packaged in cardboard or fiberboard containers.

I. The Licensee shall not accept for disposal any neutron source (e.g., polonium-210, americium-241, radium-226 in combination with beryllium or other target).

J. Incinerator ash shall be treated, in preparation for disposal, in a manner that renders it non-dispersible in air.

K. Radioactive waste containing chelating agents greater than 0.1 percent by weight shall be disposed of in the Mixed Waste Landfill Cell.

L. The Licensee shall not accept containerized radioactive waste unless each waste package has been:

i. Classified in accordance with R313-15-1008, "Classification and Characteristics of Low-Level Radioactive Waste." In addition, the Licensee shall require that all radioactive waste received for disposal meet the requirements specified in the Nuclear Regulatory Commission, "Branch Technical Position on Concentration Averaging and Encapsulation", as amended.

ii. Marked as either Class A Stable or Class A Unstable as defined in the most recent version of the "Low-Level Waste Licensing Branch Technical Position on Radioactive Waste Classification." originally issued May, 1983 by the U.S. Nuclear Regulatory Commission.

iii. Marked with a unique package identification number, clearly visible on the package, that can be correlated with the manifest for the waste shipment in which the package arrives at the facility.

M. The Licensee may accept containerized Class A LLRW in the following waste packages for disposal in the Containerized Waste Facility of the Class A or Class A North disposal cell:

i. DOT "strong, tight" containers in accordance with 49 CFR 173 and meeting the following void space criteria: void spaces within the waste and between the waste and its packaging shall be reduced to the extent practicable, but in no case shall less than 85 percent of the capacity of the container be filled

ii. High-Integrity Containers (HICs) exceeding the void space criteria provided in License Condition 16.M.i, shall be approved by the Executive Secretary.

iii. DOT “strong, tight” containers in accordance with 49 CFR 173 exceeding the void space criteria provided in License Condition 16.M.i and large components shall be placed as approved by the Executive Secretary.

iv. Oversized DOT containers (larger than 215 cubic feet) meeting the void space criteria provided in License Condition 16.M.i shall be placed in accordance with the currently approved LLRW Construction QA/QC Manual.

MANAGEMENT OF FREE LIQUIDS

17. In accordance with UAC R313-15-1008(2)(a)(iv), solid waste received for disposal shall contain as little free standing and non-corrosive liquid as reasonably achievable, but shall contain no more free liquids than one percent of the volume of the waste. Solid waste received and containing free liquid in excess of 1% by volume shall have the liquid removed and placed in the evaporation ponds or the liquid solidified prior to management. In addition, the Licensee shall notify the Division of Radiation Control within 24 hours that the shipment(s) failed the requirements for acceptance and manage in accordance with the Waste Characterization Plan.

RADIATION SAFETY

18. The Licensee shall comply with the provisions of UAC R313-18, “Notices, Instructions and Reports to Workers by Licensees or Registrants--Inspections”; and UAC R313-15, “Standards for Protection Against Radiation.”

19. The Licensee may transport licensed material or deliver licensed material to a carrier for transport in accordance with the provisions of UAC R313-19-100, Transportation.”

20. Written procedures incorporating operating instructions and appropriate safety precautions for licensed activities shall be maintained and available at the location specified in License Condition 10.A. The written procedures established shall include the activities of the radiation safety and environmental monitoring programs, the employee training program, operational procedures, analytical procedures, and instrument calibration. At least annually, the Licensee shall review all procedures to determine their continued applicability.

21. The Licensee’s Director of Health Physics shall review and approve written procedures as stated in License Condition 20 and subsequent changes to the procedures related to waste disposal operations.

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ROUTINE MONITORING AND CONTAMINATION SURVEYS

22. The Licensee shall conduct contamination surveys in accordance with Table 22-A:

TABLE 22-A

Type	Location	Frequency
A. Gamma Radiation Levels	1. Perimeter of Restricted Area(s)	1. Weekly
	2. Office Area (s)	2. Weekly
	3. Lunch/Change Area(s)	3. Weekly
	4. Transport Vehicles	4. Upon vehicle arrival at site and before departure.
	5. Mixed Waste Facility	5. Weekly
	6. Decontamination facilities	6. Weekly
B. Contamination Wipes	1. Eating Area(s) 2. Change Area(s)	1. Weekly 2. Weekly
	3. Office Areas(s)	3. Weekly
	4. Railcar rollover and control shack	4. Weekly
	5. Equipment/Vehicles	5. Once before release
	6. Decontamination facilities	6. Weekly
	7. Mixed Waste Facility	7. Weekly
	8. Shredder Facility and control room	8. Weekly
	9. Rotary Dump and control room	9. Weekly
C. Employee/Personnel	1. Skin & Personal clothing	1. Prior to exiting restricted area
D. Gamma Exposure	1. Administration Bldg.(s)	1. Quarterly
E. Radon Concentration	1. Administration Bldg.(s)	1. Quarterly

23. The Licensee shall determine internal exposure of employees under its bioassay program, in accordance with UAC R313-15-204.

24. The Licensee shall implement a respiratory protection program that is in accordance with UAC R313-15-703.

25. The Licensee shall calibrate air sampling equipment at intervals not to exceed six months.

26. The operational environmental monitoring program shall be conducted in accordance with the Environmental Monitoring Plan (Rev 0. dated: November 24, 2008)

27. Vehicles, containers, facilities, materials, equipment or other items for unrestricted use shall not be released from the Licensee's control if contamination exceeds the limits found in Table 27-A. Except as provided in 49 CFR 173.443(d), conveyances used for commercial transport of radioactive waste or materials, may not be returned to service until the radiation dose rate at each accessible surface is 0.005 mSv per hour (0.5mrem per hour) or less, and there is no surface removable (non-fixed) radioactive surface contamination as specified in paragraph (a) of 49 CFR 173.443.

TABLE 27-A

Nuclide[a]	Column 1 Average [b,c,f]	Column 2 Maximum [b,d,f]	Column 3 Removable [b,e,f]
U-nat, U-235, U-238, and associated decay products	5,000 dpm alpha/ $100cm^2$	15,000 dpm alpha/ $100cm^2$	1,000 dpm alpha/ $100cm^2$
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	100 dpm/$100cm^2$	300 dpm/$100cm^2$	20 dpm/$100cm^2$
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1,000 dpm/$100cm^2$	3,000 dpm/$100cm^2$	200 dpm/$100cm^2$
Beta-gamma emitters (nuclides with decay modes other than alpha emissions or spontaneous fission) except Sr-90 and other noted above.	5,000 dpm beta, gamma/$100cm^2$	15,000 dpm beta-gamma/$100cm^2$	1,000 dpm beta-gamma/$100cm^2$

a. Where surface contamination on both alpha-and beta-gamma emitting nuclides exists, the limits established for alpha-and beta-gamma emitting nuclides should apply independently.

b. As used in this table, dpm (disintegration's per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

c. Measurements of average contamination should not be averaged over more than one square meter. For objects of less surface area, the average should be derived for each such object.

d. The maximum contamination level applies to an area of not more than 100 cm^2.

e. The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping the area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

f. The average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters shall not exceed 0.2 mrad/hr at 1 cm and 1.0 mrad/hr at 1 cm, respectively, measured through not more than 7 milligrams per square centimeter of total absorber.

28. The Licensee shall submit the following to the Executive Secretary for review and approval pending

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resolution of all issues as judged by the Executive Secretary:

A. The Licensee shall submit a corrective action plan for the Cover Test Cell for Executive Secretary approval by no later than July 23, 2008. The corrective action plan shall identify all means necessary to collect valid data to verify actual performance of the cover system. Said plan shall include Cover Test Cell design, construction, instrumentation, monitoring, reporting, and comparison of actual performance to projected performance. The Cover Test Cell corrective action plan shall include:
   i. Performance goals to meet the objective of verifying modeled cover system performance.
   ii. Methodologies and plans that provide quantitative and qualitative results capable of satisfying the objective.
   iii. Design, construction, and operational plans to implement the methodologies and plans.
   iv. Quality control and quality assurance requirements of work to be performed. Quality control and quality assurance specifications and procedures shall state specific actions and processes the Licensee will use to ensure compliance with designs and specifications, monitoring, reporting, ensure data validity, timely detect data deficiencies, enhance accuracy of data interpretation, and ensure correctness of results prior to being submitted to the Division.
   v. In the event that the plan results in new instrumentation or construction, the Licensee shall complete all such activities within 30-days of Executive Secretary approval. Within 30-days of completion of said construction, the Licensee shall submit an As-Built report for Executive Secretary approval.

B. The Licensee shall submit an annual report for Executive Secretary approval by March 1 of each calendar year. This annual report shall detail the Licensee's progress in implementing the corrective action plan, provide the data collected in the past year, analyze the data, and interpret the meaning of the data relative to the overall objective of the corrective action plan.

REPORTING

29. The Licensee shall submit the following reports to the Executive Secretary:

A. Quarterly results from the Environmental Monitoring Program (Env. Monitoring Plan, as amended). The report(s) shall be submitted within 90 days after the expiration of each calendar quarter. Calendar Quarter shall mean:

First Quarter	January, February, and March
Second Quarter	April, May, and June
Third Quarter	July, August, and September
Fourth Quarter	October, November, and December

B. A quarterly summary report detailing the radioisotopes, activities, weighted average concentrations, volume, and tonnage for waste disposed of during the calendar quarter. The report of volume (cubic feet and cubic yards) and tonnage (tons) shall be partitioned according to waste type: Low Level Radioactive Waste (LLRW), LLRW with PCBs, Mixed Waste (MW),

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MW with PCBs, MW Treatment, NORM, Containerized Class A, uranium/thorium mill tailings (i.e. 11e.(2) wastes), and waste generated prior to congress passing the Uranium Mill Tailings Radiation Control Act in 1978. The report(s) shall be submitted within 30 days after the expiration of each calendar quarter. Calendar Quarter shall mean:

First Quarter	January, February, and March
Second Quarter	April, May, and June
Third Quarter	July, August, and September
Fourth Quarter	October, November, and December

C. Reserved

D. For the Mixed Waste Landfill Cell, the Licensee shall ensure that the maximum acceptable activities, used as source terms in the groundwater performance modeling are not exceeded after facility closure. Therefore, the Licensee shall notify the Executive Secretary, at the earliest knowledge, that the following nuclides are scheduled for disposal: berkelium-247 and chlorine-36.

E. For the Class A, and Class A North, and Class A South portion of the Class A South/11e.(2) disposal cells, the Licensee shall ensure that the maximum acceptable activities used as source terms in the groundwater performance modeling are not exceeded after facility closure. Therefore, the Licensee shall notify the Executive Secretary, at the earliest knowledge, that the following nuclides are scheduled for disposal: aluminum-26, berkelium-247, calcium-41, californium 250, chlorine-36, rhenium-187, terbium-157, and terbium-158.

F. An annual report shall be submitted by March 31st and shall report the cumulative void space (expressed as a percent of waste volume) disposed of in the Containerized Waste Facility for the previous year.

30. Except as provided by this condition, the Licensee shall maintain the results of sampling, analyses, surveys, and instrument calibration, reports on inspections, and audits, employee training records as well as any related review, investigations and corrective actions, for five (5) years. The Licensee shall maintain personnel exposure records in accordance with UAC R313-15-201.

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STAFFING/QUALIFICATIONS

31. Radiation Safety operations for bulk, containerized and mixed waste, portable gauging device(s), radioactive source(s), and dosimeter calibrator(s)/irradiator(s) shall be conducted by or under the supervision of Rick Chalk, Director of Health Physics.

32. A. The Licensee's staff shall meet the qualifications as described in Appendix I (February 9, 2009, rev 21).

B. Licensed material in License Conditions 6.C and 6.D. shall be used by, or under the supervision and in the physical presence of, the Director of Health Physics or individuals who have been trained in the Licensee's standard operating and emergency procedures and have satisfactorily completed at least one of the following:

i. The device manufacturer's training course for safe use and handling of portable gauging devices containing licensed material; or

ii. A portable gauge training program conducted in accordance with the provisions of a specific license issued by the Executive Secretary, an Agreement State or the U.S. Nuclear Regulatory Commission.

C. Licensed material in License Conditions 6.E through 6.P shall be used by, or under the supervision of, the Director of Health Physics, or individuals designated in writing by the Director of Health Physics.

D. The Licensee shall maintain the organizational independence of the programs that monitor and enforce employee safety, environmental protection, and public safety from programs responsible for production and profitability and other influences or priorities that might compromise quality and radiation safety.

E. The Licensee shall establish a method for any employee or contractor to anonymously submit questions, concerns, ideas, or other comments regarding employee safety, environmental protection, and public safety to the Director of Health Physics. The method shall include documentation of all comments submitted, the Applicant’s response to each comment, and a method for communicating the Licensee’s response to employees and contractors.

CONSTRUCTION ACTIVITIES

33. The Licensee shall obtain prior written approval from the Executive Secretary prior to construction of significant facilities. Significant facilities shall include, but are not limited to waste, stormwater, and wastewater related handling, storage, and transfer projects.

34. The Licensee shall address and resolve all concerns the Division has identified regarding clay mining activities in areas adjacent to Section 32, as provided in a February 16, 2007 Division letter to the

Licensee, including a February 9, 2007 Round 1 Interrogatory by the URS Corporation (URS 39400018.3090). The Licensee shall deliver detailed analyses, explanations, descriptions, and appropriate justification to the Division no later than July 1, 2008. If the Executive Secretary determines that unacceptable adverse conditions exist or might develop or evolve, the Licensee shall submit for approval a remedial action plan within 30 days of written notice of the determination by the Executive Secretary. The remedial action plan will address, among other topics, description of proposed activities, justification that the proposed activities will be adequate to protect the facilities in Section 32 from possible impacts of clay mining, and engineering design, specifications, and construction of proposed remedial actions.

35. Reserved.

36. A. The West Rail Spur and Unloading facility shall be operated as a transfer station for Surface Contaminated Objects (SCO) and large components, (waste storage is prohibited). These objects may be set on the gravel pad for 24 hours to facilitate unloading and transferring to the Class A disposal cell.

B. The West Rail Spur and Unloading facility shall be operated as a transfer station for conveyances to be unloaded at the Containerized Waste Facility (unloading of waste packages is prohibited).

37. All ion exchange resins shall be disposed of as follows:

A. Solidified using solidification agents approved by the Executive Secretary and disposed of in the Containerized Waste Facility; or

B. Packaged in High-Integrity Containers (HIC) approved by the Executive Secretary, carbon-steel liners, unapproved HICs, or poly HICs meeting the void space criteria described in License Condition 16.M.i and disposed of in the Containerized Waste Facility; or

C. Packaged in High-Integrity Containers (HIC) approved by the Executive Secretary, carbon-steel liners, unapproved HICs, or poly HICs not meeting the void space criteria described in License Condition 16.M.i and disposed of as approved by the Division under License Condition 16.M.ii or 16.M.iii in the Containerized Waste Facility; or

D. Disposed of in accordance with the requirements of the LLRW and 11e.(2) Construction ~~Quality~~ QA/QC ~~Assurance/Quality Control~~ Manual.

38. The Licensee shall construct the Class A disposal Cell identified in the Ground Water Quality Discharge Permit No. UGW450005 and in accordance with approved engineering design drawings "Series 9821".

39 Waste placement and backfilling within the Containerized Waste Facility shall be conducted in accordance with the following:

A. The Containerized Waste Facility shall conform to the characteristics defined, analyzed, and described in the Engineering Justification Report “Class A Disposal Cell Containerized Waste

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Facility" (dated April 12, 2001); Engineering Justification Report, Addendum "Fifteen Percent Void Space Criteria" (Revision 1 dated October 10, 2001); and the AMEC letter to Envirocare of Utah, Inc. "Placement of Drums and B-25 Containers with 15 Percent Voids; Envirocare Class A - Containerized Waste Facility Near Clive, Utah" (dated October 2, 2001). Waste containers that have void space in excess of 15 percent shall be filled to the top of the container opening using Controlled Low Strength Material (CLSM) in accordance with the LLRW and 11e.(2) Construction QA/QC manual. The Licensee is exempt from the CLSM cold weather requirements and the 48 hour notification for void remediation only at the CWF Facility.

B. Waste container placement configurations and associated waste placement procedures, backfill materials and procedures, and backfill cover materials shall be those approved by the Executive Secretary following testing according to Work Element: Containerized Waste Facility-Waste Placement Test Pad of the currently approved LLRW and 11e.(2) Construction Q~~uality~~ A~~ssurance~~/Q~~uality~~ C~~ontrol~~ Manual.

C. Waste delivered in a shielded transportation cask shall remain in the cask until the waste is approved for disposal and the disposal location is prepared for the shipment. Waste received for disposal in the Containerized Waste Facility shall not be handled, stored or transferred within the contaminated portion of the Restricted Area without the approval of the Director of Health Physics.

D. The Containerized Waste Facility shall be operated as a contamination-free portion of the Restricted Area until containerized waste disposal operations are completed. Bulk waste may then be used to complete the filling of the cell.

E Interim storage is applicable only to the Containerized Waste Facility. Packages containing radioactive material shall not be stored for a period of longer than 30 days from the date of receipt. Retention of waste materials above ground pending disposal up to 3 working days does not constitute storage. All packages in storage shall be shielded so that the package or shielding shall not exceed 40 mR/hour at one meter from the surface.

F. Disposal of non-containerized decomposable or compressible waste at the Containerized Waste Facility is prohibited. Such waste shall be disposed of as debris in bulk waste portions of the Class A or Class A North disposal embankments, in accordance with debris placement requirements of the currently approved LLRW and 11e.(2) CQA/QC Manual.

40. The LARW and Class A Disposal Cells, shall be defined by the areas enclosed by the points of reference in the Ground Water Quality Discharge Permit No. UGW450005. The Containerized Waste Facility within the Class A disposal cell shall be separated from the non-containerized area by a 6-foot chain link fence on the berm around the Containerized Waste Facility perimeter area.

41. Reserved.

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42. Reserved.

43. The Licensee shall construct the Class A North disposal cell identified in the Ground Water Quality Discharge Permit No. UGW450005 and in accordance with approved engineering design drawings "Series 04080".

44. The Licensee shall fulfill all requirements and maintain compliance with all conditions in the LLRW and 11e.(2) CQA/QC Manual and engineering drawings currently approved by the Executive Secretary.

45. All engineering related soil tests conducted by the Licensee to demonstrate compliance with Condition 44 shall be performed by a laboratory certified and accredited by the AASHTO Materials Reference Laboratory (AMRL). Said certification / accreditation shall apply to clay liner, clay radon barrier, soil filter layers, sacrificial soils, and riprap materials, or other soil or man-made materials as directed by the Executive Secretary. Said certification shall include all engineering test methods required by License Condition 44, or as directed by the Executive Secretary.

46. Reserved

47. The Licensee shall not initiate disposal operations in newly excavated areas until the Division has inspected and the Executive Secretary has approved the cell/embankment liner.

CONSTRUCTION DRAWINGS.

48. A. The Licensee shall provide a comprehensive set of drawings for the entire Clive site. The drawings shall correctly: (1) locate all structures, utilities, fences, ponds, drainage features railroad tracks, roads, storage facilities, loading and off-loading facilities, disposal embankments, all environmental monitoring locations including instruments/devices, and any other appurtenances related to the operation, maintenance and closure of the disposal facility; and (2) provide survey control including elevations in sufficient detail to fully describe the site. The drawings shall be developed in accordance with the standards of professional care. A drawing index shall be included that identifies drawings by discrete number. Each drawing shall include a revision block that documents the latest changes or modifications by date and includes the initials of the responsible reviewer for QA/QC tracking purposes.

B. Drawings showing approved future designs shall be marked as "Final Drawings." Final drawings or drawings developed for construction shall be sealed by a Utah registered professional engineer. The drawings shall be developed in accordance with the standards of professional care.

C. Within 30 days of completion of any project that requires approval by the Executive Secretary, a set of "As-Built" drawings shall be submitted for review. The drawings shall indicate as-built

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conditions as they existed no earlier than 30 days prior to the submittal. Drawings of finished construction shall be marked as "As-Built" in the final entry in the revision block.

SITE OPERATING PROCEDURES

49. Shipments containing free liquid in excess of 1% shall be absorbed, evaporated, or the liquids removed only at facilities with approved secondary containment or the rail rollover facility.

50. A. On-site generated waste shall be managed according to its radiological, physical and chemical characteristics. Solid phase material shall be disposed in either the Class A Cell, Class A North Cell, , , Class A South/11e.(2) Cell, or Mixed Waste Cell, or the 11e.(2) Cell. Waste water from decontamination facilities will be put in the evaporation ponds or sprayed on disposal cells for purposes of dust and engineering controls.

B. Site equipment that has reached the end of its useful life, is not operational and does not meet the removable contamination limits of License Condition 27, Table 27-A, shall be disposed in the LLRW Class A Cell, or Class A North Cell, or Class A South portion of the Class A South/11e.(2) Cell within 90 days as debris in accordance with requirements of the LLRW and 11e.(2) Construction Quality Assurance/Quality Control Manual or stored on approved facilities for storage, transfer, and sampling of bulk waste.

C. Facility vehicles transferring or unloading waste shall not be left unattended.

51. The following shall be implemented for LLRW and 11e.(2) Waste segregation purposes:

A. LLRW and 11e.(2) waste shall not be managed simultaneously at the Rail rollover facility, Shredder Facility, Rotary Dump Facility, or Rail Digging facility;

B. Any vehicle or facility used to manage waste for disposal within the 11e.(2) disposal embankment, must be clearly labeled to designate 11e.(2) management. The labels shall be visible from both sides of a vehicle/facility designated for 11e.(2) waste management.

C. Equipment, vehicles and facilities, which are used for management of LLRW will be cleaned of any material before being used for 11e.(2) waste management activities. Equipment, vehicles and facilities shall be cleaned of all waste material to a limit of 500 grams per square foot prior to being used for other waste types.

52. Waste shipments or transportation packages received shall meet the following contamination control requirements for removable contamination

*Less then 220 dpm/100cm^2 alpha
*Less then 2200 dpm/100cm^2 Beta-gamma

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If a shipment or transportation package does not meet the above contamination requirements, the Licensee shall take actions to reduce the risk for spread of contamination.

53. A. Quarterly, the Licensee shall clean the facility roads, or more frequently when needed. The material collected from cleaning the roads shall be disposed within an approved disposal embankment for Class A waste.

B. On a biweekly basis (once every two weeks) between the first day of May and the last day of September, the Licensee shall spray a polymer solution on all exposed contaminated cell areas and areas of waste within the Class A Cell, ~~and~~ Class A North Cell, and Class A South portion of the Class A South/11e.(2) Cell which have been disturbed in the previous two weeks. The Licensee will apply a polymer-based stabilizer in accordance with the manufacturer's instructions.

C. The Licensee shall minimize the dust created during the process of placing and moving waste, through the use of water. Water or other engineering controls shall be placed on roads and in areas which work is being performed.

D. The Licensee shall cease loading, hauling, and dumping of un-containerized waste whenever the 5-minute average wind velocities exceed 35 miles per hour. When both the 5-minute average and 5-minute maximum wind velocities are less than 35 mph as observed on the meteorological station, management of un-containerized waste may resume.

54. The Licensee shall fulfill and maintain compliance with all conditions and requirements in the Site Radiological Security Plan (Revision 3, May 5, 2008).

55. A. For the Class A and Class A North disposal cells, the Licensee shall ensure that the actual cumulative activity of chlorine-36 does not exceed 0.2828 picocuries per gram in accordance with the following formula:

$$\frac{\text{Total Activity of chlorine-36 Received (picocuries)}}{\text{Total Mass of Active Cell (grams) + Completed Cell (grams)}} \leq 0.2828 \text{ picocuries per gram}$$

B. For the Class A and Class A North disposal cells, the Licensee shall ensure that the actual cumulative activity of berkelium-247 does not exceed 0.0001 picocuries per gram in accordance with the following formula:

$$\frac{\text{Total Activity of berkelium-247 Received (picocuries)}}{\text{Total Mass of Active Cell (grams) + Completed Cell (grams)}} \leq 0.0001 \text{ picocuries per gram}$$

C. For the Mixed Waste disposal cell, the Licensee shall ensure that the actual cumulative activity of chlorine-36 does not exceed 8.75 picocuries per gram in accordance with the following formula:

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Total Activity of chlorine-36 Received (picocuries) *≤ 8.75 picocuries per gram*
Total Mass of Active Cell (grams) + Completed Cell (grams)

D. For the Mixed Waste disposal cell, the Licensee shall ensure that the actual cumulative activity of berkelium-247 does not exceed 0.00314 picocuries per gram in accordance with the following formula:

Total Activity of berkelium-247 Received (picocuries) *< 0.00314 picocuries per gram*
Total Mass of Active Cell (grams) + Completed Cell (grams)

E. For the Class A portion of the Class A South/11e.(2) disposal cell, the Licensee shall ensure that the actual cumulative activity of berkelium-247 does not exceed 0.00009 picocuries per gram in accordance with the following formula:

Total Activity of berkelium-247 Received (picocuries) *< 0.00009 picocuries per gram*
Total Mass of Active Cell (grams) + Completed Cell (grams)

F. For the Class A portion of the Class A South/11e.(2) disposal cell, the Licensee shall ensure that the actual cumulative activity of calcium-41 does not exceed 1.322 picocuries per gram in accordance with the following formula:

Total Activity of calcium-41 Received (picocuries)< 1.322 picocuries per gram
Total Mass of Active Cell (grams) + Completed Cell (grams)

G. For the Class A portion of the Class A South/11e.(2) disposal cell, the Licensee shall ensure that the actual cumulative activity of chlorine-36 does not exceed 0.268 picocuries per gram in accordance with the following formula:

Total Activity of chlorine-36 Received (picocuries) *< 0.268 picocuries per gram*
Total Mass of Active Cell (grams) + Completed Cell (grams)

H. For the Class A portion of the Class A South/11e.(2) disposal cell, the Licensee shall ensure that the actual cumulative activity of rhenium-187 does not exceed 5,556.0 picocuries per gram in accordance with the following formula:

Total Activity of rhenium-187 Received (picocuries) < 5,556.0 picocuries per gram
Total Mass of Active Cell (grams) + Completed Cell (grams)

I. For the Class A portion of the Class A South/11e.(2) disposal cell, the Licensee shall ensure that the actual cumulative activity of technicium-99 does not exceed 77,778.0 picocuries per gram in accordance with the following formula:

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Total Activity of technicium-99 Received (picocuries) *< 77,778.0 picocuries per gram*
Total Mass of Active Cell (grams) + Completed Cell (grams)

~~*Total Activity of berkelium-247 Received (picocuries)* *≤ 0.00314 picocuries per gram*~~
~~*Total Mass of Active Cell (grams) + Completed Cell (grams)*~~

56. Containerized Class A waste shall be certified by the generator to meet the Waste Acceptance Criteria in accordance with the Waste Characterization Plan described in License Condition 58.

57. A. The Licensee shall move rail shipments into the Restricted Area within seven (7) days of arrival. The shipments may be return to the carrier when management of the waste is not possible within the seven (7) day period, unless additional time is approved by the Executive Secretary of the Utah Radiation Control Board.
B. Empty outbound railcars shall be picked up by the local rail service within seven (7) days of release from the Restricted Area, unless additional time is approved by the Executive Secretary of the Utah Radiation Control Board.
C. Railcars that have been decontaminated and surveyed both internally and externally and found to meet criteria of non-fixed radioactive surface contamination less than 220 dpm/100 cm^2 Alpha, 2,200 dpm/100 cm^2 Beta and a dose rate less than 0.5 mrem/hr or that meet` the limits found in Table 27-A do not have to picked up by local rail service within seven (7) days.
D. The Licensee may perform the following activities on incoming shipments on rail lines outside of Section 32, not including the main line adjacent to Section 32:

1. Visual Inspection
2. Radiation level surveys
3. Affix labels

58. The Licensee shall fulfill and maintain compliance with all conditions and requirements in the LLRW Waste Characterization Plan (dated March, 10, 2008).

59. Reserved.

60. All wind dispersed litter located outside of the disposal cell/embankments, shall be retrieved by the Licensee and returned to the Licensee's control within 24 hours.

61. Truck, railcar, and other equipment washdown (decontamination) facilities, including evaporation ponds, shall be controlled with fences or other approved barriers to prevent intrusion.

62. All burial embankments and waste storage areas, including immediately adjacent drainage structures, shall be controlled areas, surrounded by a six-foot chain link fence. Upon site closure, all permanent fences shall be six-feet high chain link topped with three strand barbed wire, tip tension wire, and twisted selvedge.

63. Radioactive and mixed wastes within Section 32 and all rail spurs controlled by the Licensee around

the Licensee's Disposal Facility are possessed by the Licensee. Waste conveyed to the facility by truck is in transport as long as the commercial carrier driver and vehicle remain at the Clive disposal facility. The Licensee does not possess such waste for purposes of determining compliance with surety requirements and SNM quantity limits, except that the Licensee does, however, possess any waste containing SNM that is not disposed of on the day it is delivered to the facility.

64. "Disposal" is the locating of radioactive waste into a lift of the disposal embankment. Disposal does not include the storage of waste in containers on a lift when the container will ultimately be emptied, the staging of containerized waste in the disposal embankment; or waste as "In Cell Bulk Disposal".

MANIFEST/SHIPPING REQUIREMENTS

65. The Licensee shall comply with UAC R313-15-1006 and UAC R313-25-33(8), Requirements for Low-Level Waste Transfer for Disposal at Land Disposal Facilities and Manifests.

66. The Licensee shall not accept radioactive waste for storage and disposal unless the Licensee has received from the shipper a completed manifest that complies with UAC R313-15-1006 and UAC R313-25-33(8).

67. The Licensee shall maintain copies of complete manifests or equivalent documentation required under Conditions 65 and 66 until the Executive Secretary authorizes their disposition.

68. The Licensee shall immediately notify the Executive Secretary or the Division's on-site representative of any waste shipment where there may be a possible violation of applicable rules or license conditions.

69. The Licensee shall require anyone who transfers radioactive waste to the facility to comply with the requirements in UAC R313-15-1006.

70. The Licensee shall acknowledge receipt of the waste within one (1) week of waste receipt by returning a signed copy of the manifest or equivalent document to the shipper. The shipper to be notified is the Licensee who last possessed the waste and transferred the waste to the Licensee. The returned copy of the manifest or equivalent documentation shall indicate any discrepancies between materials listed on the manifest and materials received.

71. The Licensee shall notify the shipper (e.g., the generator, the collector, or processor) and the Division when any shipment or part of a shipment has not arrived within 60 days after receiving the advance manifest.

72. The Licensee shall maintain a record for each shipment of waste disposed of at the site. At a minimum, the record shall include:

    A. The date of disposal of the waste;

    B. The location of the waste in the disposal site;

    C. The condition of the waste packages received;

    D. Any discrepancy between the waste listed on the shipment manifest or shipping papers and the waste received in the shipment;

E. A description of any evidence of leaking or damaged packages or radiation or contamination in excess of applicable regulatory limits; and

F. A description of any repackaging of wastes in any shipment.

FINANCIAL ASSURANCE/CLOSURE

73. The Licensee shall at all times maintain a Surety that satisfies the requirements of UAC R313-25-31 in an amount adequate to fund the decommissioning and reclamation of Licensees' grounds, equipment and facilities by an independent contractor. The Licensee shall annually review the amount and basis of the surety and submit a written report of its findings by December 1 each year for Executive Secretary approval. At a minimum, this annual report shall meet the following requirements:

A. Summary of Changes – the annual report shall include a written summary of any change in the cost estimate previously approved by the Executive Secretary, including, but not limited to:

i. A description of any modification, addition, or deletion of any direct cost or post-closure monitoring and maintenance (PCMM) cost line item, including supporting justification, calculations and basis;

ii. Any change to the unique reference number (cost line item) assigned approved by the Executive Secretary for any direct or PCMM cost line item.

B. Indirect Costs shall be based on the sum of all direct costs in accordance with the following values:

Surety Reference No.	Description	Percentage
300	Working Conditions	5.5%
301	Mobilization / Demobilization	4.0%
302	Contingency	11.0%
303	Engineering and Redesign	2.25%
304	Overhead and Profit	19.0%
305	Management Fee and Legal Expenses	4.0%
306	DEQ Oversight	4.0%

C. RS Means Guide estimates of direct construction costs provided in the annual report shall be derived from or based on the most recent edition of the RS Means Guide for Construction.

D. Report Certification – the annual report shall be prepared under the direct supervision of and certified by a Professional Engineer or Professional Geologist currently licensed by the State of Utah with at least five (5) years of construction cost estimation experience. The annual report shall be developed in accordance with the standards of professional care.

E. Electronic Format – the Licensee shall provide the report in both paper and electronic formats, as directed by the Executive Secretary.

F. Within 60-days of Executive Secretary approval of said annual report, the Licensee shall submit written evidence that the surety has been adequately funded.

G. The Licensee shall prepare and maintain current a gravel resource evaluation report on-site that quantifies the gravel reserves remaining in the Grayback Hills Gravel Pit located in Section 24 of T. 1 N., R. 12 W (SLBM). Such report shall be prepared and certified on or before August 31 of each year by a professional engineer or professional geologist currently registered in the State of Utah.

74. One (1) year prior to the anticipated closure of the site, the Licensee shall submit for review and approval by the Executive Secretary a site decontamination and decommissioning plan. As part of this plan, the Licensee shall demonstrate by measurements and/or modeling that concentrations of radioactive materials which may be released to the general environment, after site closure, will not result in an annual dose exceeding 25 millirems to the whole body, 75 millirems to the thyroid, and 25 millirems to any other organ of any member of the public.

75. In accordance with UAC R313-25-33(6), the Licensee shall submit a financial statement annually by March 31st of each year for the previous year.

76. Reserved.

SPECIAL HANDLING

77. Except while waste packages are being handled in the active areas of the Containerized Waste Facility, external gamma radiation levels shall not exceed 40 mR/hr at one meter from the surface of any emplaced waste package or from shielding placed around disposed waste containers.

78. The Licensee shall observe the following controls on waste handling at the Containerized Waste Facility:

A. Before unloading any waste container whose external gamma radiation at the surface exceeds 10 R/hr, an ALARA review shall be performed and documented and a pre-job briefing shall be conducted.

B. As part of the ALARA review, the Licensee shall determine and record (1) estimates of the radiation dose rates for the waste container, disposal unit working face, and any other potentially significant radiation sources; (2) expected durations of exposures to and distances from each radiation source; and (3) expected doses to each person involved in the actual disposal operation.

C. Before unloading any waste container whose external gamma radiation at the surface exceeds 200 R/hr, a practice run shall be conducted. The practice run shall involve shielding, container(s) filled with non-radioactive material, and handling equipment that are similar to those involved with the actual shipment. Similarity includes similar rigging and physical characteristics (e.g., weight, dimensions, and attachments). Those personnel who will participate in receiving, processing, handling, and disposing of the actual waste will participate in the practice run, using actual procedures. The Licensee shall notify the Division 24 hours in advance of conducting the practice runs.

D. On a case-by-case basis, the Executive Secretary may exempt the Licensee from conducting the required practice run, considering the results of earlier practice runs and actual experience handling waste containers with high radiation levels.

79. Reserved.

80. The Licensee shall notify in writing the Executive Secretary at the earliest possible date, but no later than 10 days before scheduled receipt of each shipment with contact radiation levels in excess of 200 R/hr. The notification shall include the anticipated dates of receipt and plan for disposal in the Containerized Waste Facility.

81. The Director of Health Physics or other qualified person designated by the Director of Health Physics shall be present for and shall observe the receipt, processing, handling, and disposal of each waste package with contact radiation levels in excess of 200 R/hr.

82. The Licensee shall dispose of only closed containers in the Containerized Waste Facility. The Licensee shall not dispose of any breached waste container in the Containerized Waste Facility without first repairing the breached container or overpacking it in an undamaged container. The Licensee is authorized to open packages at its facility only to:

A. Repair or repackage breached containers.

B. Inspect for compliance with conditions of this license.

C. Confirm package contents and fill voids in packages/containers that have greater than 15% void space.

D. Accomplish other purposes as approved by the Executive Secretary.

83. The Licensee shall handle and emplace LLRW packages in the Containerized Waste Facility such that packaging integrity is maintained during handling, emplacement, and subsequent backfilling. Waste packages deposited in the Containerized Waste Facility shall be protected from any adverse effects of operations which may damage them.

SEALED SOURCES AND/OR DEVICES

84. A. i. Sealed sources shall be tested for leakage and/or contamination at intervals not to exceed the intervals specified in the certificate of registration issued by the U.S. Nuclear Regulatory Commission under 10 CFR 32.210 or by equivalent regulations of an Agreement State.

ii. In the absence of a certificate from a transferor indicating that a leak test has been made within the intervals specified in the certificate of registration issued by the U.S. Nuclear Regulatory Commission under 10 CFR 32.210 or by equivalent regulations of an

Agreement State prior to the transfer, a sealed source received from another person shall not be put into use until tested.

iii. Sealed sources need not be tested if they are in storage and are not being used. However, when they are removed from storage for use or transferred to another person, and have not been tested within the required leak test interval, they shall be tested before use or transfer. No sealed source shall be stored for a period of more than 3 years without being tested for leakage and/or contamination.

iv. The leak test shall be capable of detecting the presence of 185 becquerels (0.005 µCi) of radioactive material on the test sample. If the test reveals the presence of 185 becquerels (0.005 µCi) or more of removable contamination, a report shall be filed with the Executive Secretary in accordance with R313-15-1208, and the source shall be removed immediately from service and decontaminated, repaired, or disposed of in accordance with Utah Radiation Control Rules. The report shall be filed within 5 days of the date the leak test result is known with the Division of Radiation Control, P.O. Box 144850, Salt Lake City, Utah 84114-4850. The report shall specify the source involved, the test results, and corrective action taken.

v. (a) The Licensee is authorized to collect leak test samples in accordance with Condition 85.D of this license, the Licensee's renewal application (dated March 1, 2001), and the Licensee's Memo (dated March 11, 2002).

(b) The analysis of leak test samples shall only be performed by individuals who meet the qualifications of a Health Physics Technician I or II, as defined by this license. The analysis of leak test samples shall be performed in accordance with the Licensee's renewal application (dated March 1, 2001), and the Licensee's Memo (dated arch 11, 2002). Alternatively, tests for leakage and/or contamination, including sample collection and analysis, may be performed by other persons specifically licensed by the Executive Secretary, the U.S. Nuclear Regulatory Commission, or an Agreement State to perform such services.

vi. Records of leak test results shall be kept in units of Becquerels or microcuries and shall be maintained for inspection by representatives of the Executive Secretary.

B. Sealed sources or source rods, containing licensed material shall not be opened or sources removed from source holders, devices, or detached from source rods by the Licensee, except as specifically licensed by the Executive Secretary, an Agreement State, or the U.S. Nuclear Regulatory Commission to perform such services.

C. The Licensee shall conduct a physical inventory every six months to account for all sealed sources and/or devices received and possessed under this license. The records of inventories shall be maintained for three years from the date of the inventory for inspection by the Division, and shall include the quantities and kinds of radioactive material, manufacturer's name and model numbers, location of the sources and/or devices, and the date of the inventory.

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PORTABLE GAUGING DEVICES:

85. A. Each portable gauging device shall have a lock or outer locked container designed to prevent unauthorized or accidental removal of the sealed source from its shielded position. The gauge or its container must be locked when in transport, storage or when not under the direct surveillance of an authorized user.

B. Each portable gauging device shall be kept under the constant surveillance (direct surveillance) of individuals trained in accordance with Condition 32.B of this license, when the device is not in secured storage, as required by Condition C of this license condition.

C. When a portable gauging device is not in transit or under constant surveillance (direct surveillance) as required by Condition B of this license condition:

i The Licensee shall secure the device in accordance with R313-15-801(1) and (2).

ii. The Licensee shall not:

(a) leave the device unattended or unsecured;

(b) chain the device to a post, chain the device in the back of an open bed truck; or secure the device in any similar manner.

D. Any cleaning and/or maintenance of portable gauging device(s) or the collection of leak test samples, performed by the Licensee, shall only be performed with the radioactive source/source rod in the safe shielded position.

E. All cleaning and/or maintenance of portable gauging device(s), performed by the Licensee shall only be performed in accordance with Condition D of this license condition, and the manufacturer's instructions and recommendations.

F. Any cleaning, maintenance, or repair of portable gauging device(s) that requires removal of the sources/source rod shall be performed only by the manufacturer or by other persons specifically licensed by the Executive Secretary, an Agreement State, or the U.S. Nuclear Regulatory Commission to perform such services.

DOSIMETER CALIBRATOR(S)/IRRADIATOR(S):

86. A. The LDM-2000 reader shall only be connected to a maximum of two IRD-2000 irradiator modules.

B. Devices(s) shall only be:

i. installed in areas where device(s) can be secured and limited to individuals authorized to use device(s) pursuant to Condition A of this license condition and Condition 32.C of this license.

ii. used by individuals who meet the qualifications of a Health Physics Technician I or II, as defined by this license.

iii. used in accordance with the manufacturer's operating manual and certificate of registration issued by the U.S. Nuclear Regulatory Commission under 10 CFR 32.210 or by equivalent regulations of an Agreement State. The Licensee shall follow the manufacturer's recommendations for preventative maintenance and operational testing.

C. Maintenance and servicing of device(s) shall only be performed by the manufacturer or persons specifically licensed by the Executive Secretary, the U.S. Nuclear Regulatory Commission, or an Agreement State to perform such services.

D. The Licensee shall not perform calibration(s) for non-MGP Instrument dosimeters.

INCREASED CONTROL CONDITIONS

87. The Licensee shall comply with the requirements described in the Division's letter dated November 14, 2005 and attached document to the Division's letter entitled "Increased Controls for Licensees that Possess Sources Containing Radioactive Material Quantities of Concern." The Licensee shall complete implementation of said requirements before May 15, 2006 or the first day that radionuclides in quantities of concern are possessed at or above the limits specified in Table 1, provided as an attachment to the Division's letter dated November 14, 2005, whichever is later. Within 25 days after the implementation of the requirements of this License Condition, the Licensee shall notify the Executive Secretary in writing that it has completed the requirements of this License Condition.

88. The licensee shall comply with requirements described in the Executive Secretary's letter dated May 16, 2008, Attachment 1, "Fingerprinting and Criminal History Records Check Requirements for Unescorted Access to Certain Radioactive Material" and Attachment 2, "Specific Requirements Pertaining to Fingerprinting and Criminal History Records Checks." The requirements of this license condition shall be implemented as part of the trustworthiness and reliability program of the Increased Controls requirements.

A. On or before August 14, 2008, the licensee shall provide under oath or affirmation, a certification that the Trustworthiness and Reliability Official is deemed trustworthy and reliable by the licensee as required in paragraph 2.B of Attachment 1, "Fingerprinting and Criminal History Records Check Requirements for Unescorted Access to Certain Radioactive Material."

B. All fingerprints obtained by the licensee pursuant to this requirement must be submitted to the U.S. Nuclear Regulatory Commission for transmission to the U.S. Federal Bureau of Investigation (FBI). Additionally, the licensee's submission of fingerprints shall also be accompanied by a certification, under oath and affirmation, of the trustworthiness and reliability of the Trustworthiness and Reliability Official as required by paragraph 2.B of Attachment 1, "Fingerprinting and Criminal History Records Check Requirements for Unescorted Access to Certain Radioactive Material."

C. The licensee shall complete implementation of the fingerprinting requirements on or before November 12, 2008. The licensee shall notify the Executive Secretary when full compliance with the requirements described in the Executive Secretary's letter dated May 16, 2008, Attachment 1, "Fingerprinting and Criminal History Records Check Requirements for

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Unescorted Access to Certain Radioactive Material" and Attachment 2, "Specific Requirements Pertaining to Fingerprinting and Criminal History Records Checks" have been achieved. Notification to the Executive Secretary shall be made within twenty-five (25) days after full compliance has been achieved.

D. The licensee shall notify both the Executive Secretary and the U.S. Nuclear Regulatory Commission within 24 hours if the results from a criminal history records check indicate that an individual is identified on the FBI's Terrorist Screening Data Base.

CLOSEOUT CONDITIONS

89. Except as specifically provided otherwise in this license, the Licensee shall conduct its program in accordance with the statements, representations, and procedures contained in the documents, including any enclosures, listed below. The Utah Radiation Control Rules, Utah Administrative Code R313 shall govern unless the statements, representations, and procedures in the Licensee's application and correspondence are more restrictive than the rules.

A. License renewal application, Revision 2, dated June 20, 2005.

B. The following documents refer to revisions made in Amendment 22:

(1) Letter CD04-0481, dated October 27, 2004, Amendment and Modification Request – Class A North Embankment.

(2) Letter CD04-0548, dated December 23, 2004, Revised Class A North Disposal Embankment License Amendment Request.

(3) URS Review of Revised Class A North Embankment Amendment Request, dated December 29, 2004.

(4) Letter CD05-0024, dated January 17, 2005, Class A North Disposal Embankment License Amendment Request Revision 2.

(5) Letter CD05-0265, dated May 20, 2005, Revision of Appendix R, Environmental Monitoring and Surveillance Plan.

(6) Letter CD05-0266, dated May 25, 2005, Surety Calculations for the Class A North Disposal Cell.

(7) Memo: Treesa Parker to John Hultquist, dated May 25, 2005, Proposed revisions to RML for Amendment 22

(8) Email: Treesa Parker to Christine Hiaring, dated June 1, 2005, License Amendment 22 Minor Changes for Consistency.

C. The following documents refer to revisions made in Amendment 22A:

(1) Division letter dated November 14, 2005.

D. The following documents refer to revisions made in Amendment 22B:

(1) Letter CD05-0333, dated June 30, 2005, RML no. UT 2300249 Request for approval of revisions to Appendix I, Organization, and amendment of License Condition 32 A.

(2) Memorandum dated August 2, 2005, Subject; Review of Appendix I

(3) Letter CD05-0398, dated August 16, 2005, Request for approval of revisions to Appendix I, Organization and amendment of license condition 31.A,B,C, and 32A.

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(4) Letter CD05-0507, October 26, 2005, Additional information regarding proposed revisions to Appendix I, Organization and amendment of license condition 31.A,B,C, and 32A.
(5) Letter CD05-0453, dated September 19, 2005 Request for amendment of License Condition 9.10 RML UT2300478; Organization.
(6) Letter dated November 22, 2005, Request for information regarding request to revise Appendix I of the 11e(2) License Application and Amendment of L.C. 9.10.
(7) Letter dated October 11, 2005, Re: Request for Information: Revision to Appendix I and amendment 31A. B. C. and 32A. dated August 16, 2005 (CD05-0398).
(8) Memorandum, dated October 3, 2005, Subject; Appendix I, revisions to RML UT2300249 conditions 31 A, B, C, and 32 A.
(9) Letter CD05-0411, dated August 23, 2005, Payment of administrative cost for Appendix I amendment request dated August 16, 2005.
(10) Letter CD05-0472, dated September 30, 2005, License condition 39.E amendment
(11) Email dated August 10, 2005, Subject: Draft amendment for LC 39.E and attached august 10, 2005, License Condition 39 E. amendment “draft”.
(12) Email dated September 16, 2005, Subject: RE: FW: Draft amendment for LC 39.E.
(13) Letter CD05-0285, dated June 1, 2005, Envirocare containerized waste facility concrete overpacks corrective action plan.
(14) Letter dated June 2, 2005, filling waste package voids at the containerized waste facility using controlled low strength material (CLSM)
(15) Letter CD05-0326, dated June 27, 2005, Re: Letter to Mr. Dane Finerfrock, dated April 13, 2005, CD05-0181.
(16) Letter CD05-0366, dated July 26, 2005, Re: Letter to Dane Finerfrock, dated June 27, 2005, CD05-0326.
(17) Letter CD06-0011, dated January 12, 2006, Request to amend License Condition No. 2, Address.
(18) Letter CD06-0043, dated February 3, 2006, Request to amend License Condition No. 1, Company Name.
(19) Letter dated February 6, 2006, evidence of name change with the Utah Department of Commerce.
(20) Email dated October 6, 2005, Subject: License condition 39.E.
(21) Memorandum from Woodrow W. Campbell through Loren Morton and Dane Finerfrock to Envirocare File, dated January 13, 2006 regarding AMRL Soils Lab Certification for the Envirocare Soils Lab.
(22) Email dated February 15, 2006 from Loren Morton to Dan Shrum, Subject: License Amendment for Condition 73.
(23) Email dated December 23, 2005 from Loren Morton to Dane Finerfrock, Subject: Proposed Changes to License Condition 73 - Annual Surety Evaluation Report.
(24) Letter dated February 22, 2006, Subject: Revise void remediation procedure OPC-6.0.

E. The following documents refer to revisions made in Amendment 22C:
(1) Letter CD05-0435, dated September 8, 2005, Request to amend RML UT 2300249:

Condition 58, Waste Characterization Plan.

(2) Letter CD05-0557, dated December 5, 2005, RML UT 2300249; Condition 58 Waste Characterization Plan –Revised License Amendment Request.

(3) Letter CD06-0072, dated February 27, 2006, Radioactive Material License UT 2300249: Condition 58 Waste Characterization Plan – Revised License Amendment Request.

(4) Email dated February 24, 2006 from Boyd Imai to Sean McCandless Re: Waste Characterization Plan.

(5) Letter CD06-0059, dated February 15, 2006, Radioactive Material License UT 2300249 – Self Identified Noncompliance.

(6) Letter dated March 17, 2006, from the DRC regarding the February 15, 2006 letter of noncompliance.

(7) Letter CD06-0055) dated February 9, 2006, Request to Amend RML UT 2300249 to show addition of Liquid Radioactive Sources to License Condition 6.E.

(8) Letter (CD06-0092) dated March 8, 2006, RML UT 2300249; Request for administrative amendment. Conditions 21A and B and Condition 81.

F. The following documents refer to revisions made in Amendment 22E:

(1) CD06-0389, "Request to amend Radioactive Materials License No. UT 23000249 and 11e.(2) Radioactive Materials License No. UT 23000478 – Request for approval revised Appendix I, *Organization*," October 6, 2006.

(2) Shredder Facility

a. CD05-0448, "Radioactive Materials License No. UT 2300249 (RML) and Groundwater Quality Discharge Permit UGW450005 (GWQDP). Request to Construct Shredding Facility," September 15, 2005.

b. CD05-0532, "Request to Construct Shredding Facility – Revised Design and Interrogatory Response," November 14, 2005.

c. CD05-0556, "Request to Construct Shredding Facility – Additional Information," December 2, 2005.

d. CD06-0036, "Request to Construct Shredding Facility – Response to Round 2 Interrogatories", February 1, 2006.

e. CD06-0098, "Request to Construct Shredding Facility – Response to Round 3 Interrogatory," March 10, 2006.

f. ASTM F-1417, "ASTM Method F 1417-92," March 29, 2006.

g. CD06-0188, "Request to Construct Shredder Facility – Response to Round 4 Interrogatory," May 9, 2006.

h. CD06-0211, "Request to Construct Shredder Facility – Response to Round 4B Interrogatory," May 25, 2006.

i. CD06-0234, "Requests to Construct Shredder and Rotary Dump Facilities – Revised Wastewater Management Process," June 19, 2006.

j. "EnergySolutions LLC Low-Level Radioactive Waste Closure & Post-Closure Trust License UT 2300249 Trust #16673400," June 29, 2006.

k. CD-0346, "Interim Wastewater Management Plan for the Shredder Facility – Response to August 18, 2006 Request for Additional Information," August 31, 2006.

l. CD06-0388, "Radioactive Material License UT 2300429 and Groundwater Quality Discharge Permit (GWDP) No UGW450005 Shredder Facility – Request to Operate," October 5, 2006.
m. CD06-0407, "Comment on Proposed Amendment of Radioactive Material License UT 2300249 and Groundwater Quality Discharge Permit (GWDP) No UGW450005, October 18, 2006.
n. CD06-0414, "Radioactive Material License UT 2300249 and Groundwater Quality Discharge Permit No UGW450005 Shredder Facility – Submittal of Revised Drawings" October 25, 2006.
o. CD06-0425, "Groundwater Quality Discharge Permit No UGW450005 (GWQDP) Submittal of Revised Appendix J and K," November 7, 2006.

(3) Rotary Dump Facility

a. CD05-0564, "Request to Construct – Rotary Dump," December 12, 2005.
b. CD05-0570, "Request to Construct Rotary Dump 00 Submittal of Dose Assessment," December 16, 2005.
c. CD06-0086, "Request to Construct Rotary Dump Facility – Response to Round 1 Interrogatory", March 2, 2006.
d. ASTM F-1417, "ASTM Method F 1417-92," March 29, 2006.
e. CD06-0147, "Request to Construct Rotary Dump Facility – Revised Drawings," April 10, 2006.
f. CD06-0210, "Request to Construct Rotary Dump Facility – Response to Round 2 Interrogatory," May 25, 2006.
g. CD06-0211, "Request to Construct Rotary Dump Facility – Response to Round 4B Interrogatory", May 25, 2006.
h. CD06-0226, "Request to Construct Rotary Dump Facility – Response to Round 2B Interrogatories," June 8, 2006.
i. CD06-0234, "Requests to Construct Shredder and Rotary Dump Facilities – Revised Wastewater Management Process," June 19, 2006.

(4) Intermodal Container Wash Building

a. CD05-0291a, "Radioactive Materials License No. UT 2300249 (RML) and Groundwater Quality Discharge Permit UGW450005 (GWQDP). Request to Construct Intermodal Container Wash Building and Access Control Building," June 9, 2005.
b. CD05-0388, "Request to Construct Intermodal Container Wash Building – Revised Design and Supplemental Information," August 8, 2005.
c. CD05-0432, "Request to Construct Intermodal Container Wash Building – Revised Design and Interrogatory Response," September 1, 2005.
d. CD06-0110, "MARSSIM Release for New Intermodal Container Wash Facility," March 22, 2006.
e. CD06-0206, "Radioactive Material License UT 2300249 and Groundwater Quality Discharge Permit No UGW450005 Intermodal Container Wash Building – Request to Operate," May 22, 2006.

f. "EnergySolutions LLC Low-Level Radioactive Waste Closure & Post-Closure Trust License UT 2300249 Trust #16673400," June 29, 2006.
g. CD06-0259, "Groundwater Quality Discharge Permit (GWDP) No UGW450005 Intermodal Container Wash Building – Revised Appendix J and K," July 10, 2006.

(5) Decontamination Access Control Building
a. CD05-0291b, "Radioactive Materials License No. UT 2300249 (RML) and Groundwater Quality Discharge Permit UGW450005 (GWQDP). Request to Construct Intermodal Container Wash Building and Access Control Building," June 9, 2005.
b. CD05-0367, "MARSSIM Release of New Boxwash Access Control", July 26, 2005.
c. CD06-0139, "Radioactive Material License UT 2300249 and Groundwater Discharge Quality Permit (GWDP) No UGW450005 Decontamination Access Control Building – Request to Operate", April 6, 2006.
d. "EnergySolutions LLC Low-Level Radioactive Waste Closure & Post-Closure Trust License UT 2300249 Trust #16673400," June 29, 2006.
e. CD06-0245, "Groundwater Discharge Quality Permit (GWDP) No UGW450005 Decontamination Access Control Building – Revised Appendix J and K and Drawing No 05015-S100," June 30, 2006.

(6) East Side Drainage Project
a. CD06-0175, "Request to Construct East Side Drainage and Gray Water System Modifications," May 1, 2005.
b. CD06-0244, "East Side Drainage and Gray Water System Modifications – Response to DRC Review," June 30, 2006.
c. CD06-0293, "Groundwater Discharge Quality Permit No UGW450005 East Side Drainage and Gray Water System – Revised Design and BAT Plans," August 4, 2006.
d. CD06-0327, "Groundwater Discharge Quality Permit No UGW450005 East Side Drainage and Gray Water System – Revised Appendix J BAT Performance Monitoring Plan and Appendix K BAT Contingency Plan," August 23, 2006.
e. CD06-0328, "Groundwater Discharge Quality Permit No UGW450005 East Side Drainage and Gray Water System – Revised Drawings," August 24, 2006.

G. The following documents refer to revisions made in Revision 0 of the License Renewal Application:

(1) AGRA Earth & Environmental, Inc. 1999. Summary Seismic Stability and Deformation Analysis: Envirocare LARW Disposal Facility, Clive, Tooele County, Utah. September 1, 1999. (1998 LRA Appendix J)
(2) AGRA Earth & Environmental, Inc. 2000a. Evaluation of Settlement of Compressible Debris Lifts: LARW Embankments, Clive, Tooele County, Utah. June 1, 2000.
(3) AGRA Earth & Environmental, Inc. 2000b. Evaluation of Settlement of Incompressible Debris Lifts: LARW Embankments, Clive, Tooele County, Utah. June 1, 2000.
(4) AMEC Earth & Environmental, Inc. 2000a. Letter Report: Allowable Differential Settlement and Distortion of Liner and Cover Materials. October 4, 2000.

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(5) AMEC Earth & Environmental, Inc. 2000b. Letter Report Stability Considerations: Proposed LLRW Embankment. October 25, 2000.

(6) AMEC Earth & Environmental, Inc. 2000c. Letter Report Stability Considerations - Addendum: Proposed LLRW Embankment. November 8, 2000.

(7) AMEC Earth & Environmental, Inc. 2001. Response to Interrogatory Number 2: Placement if HICs in Caissons. October 1, 2001.

(8) AMEC Earth & Environmental, Inc. 2002. Placement of Large Liners in Caissons. June 19, 2002.

(9) Bingham Environmental. 1996. Project Memorandum HEC-1 and HEC-2 Analysis, LARW Application for License Renewal, Envirocare Disposal Facility, Clive Utah. November 26, 1996. (1998 LRA Appendix KK)

(10) EnergySolutions (Rebeccah McCloud) to Utah Division of Radiation Control (Dane Finerfrock). 2006. Correspondence concerning corporate ownership and name changes. February 6, 2006.

(11) EnergySolutions (Tye Rogers) to Utah Division of Radiation Control (Dane Finerfrock). 2006. Correspondence concerning corporate ownership and name changes. February 3, 2006.

(12) EnergySolutions LLC. 2007. “2006 Annual 083106 Rev 052107.xls” [annual surety review], Revision 22, May 21, 2007

(13) EnergySolutions to Utah Division of Radiation Control. 2006. Letter number CD06-0348, Radioactive Materials License No. UT2300249 – Revision to License Condition 26, Appendix R request submitted to DRC on March 17, 2006. September 1, 2006.

(14) Envirocare of Utah, Inc. to URS Corporation. 2005. Personal communication via electronic mail (Sean McCandless and Robert D. Baird, PE). January 27, 2005.

(15) Envirocare of Utah, Inc. to Utah Division of Radiation Control. 2004. Letter number CD04-0287, Updated Specific Gravity Report and Request for Eliminating Specific Gravity Monitoring. June 9, 2004.

(16) Envirocare of Utah, Inc. to Utah Division of Radiation Control. 2005. Letter number CD05-0487, Cover Test Cell Evaporative Zone Depth (EZD) Report. October 13, 2005 June 9, 2004.

(17) Envirocare of Utah, Inc. 2000a. Pre-Licensing Plan Approval Application for a License Amendment Allowing Disposal of Class B & C Low-Level Radioactive Waste. (revision of January 5, 2000 plan) March 15, 2000.

(18) Envirocare of Utah, Inc. 2000b. Rock Cover Design. July 26, 2000.

(19) Envirocare of Utah, Inc. 2001. "Clive Facility Total Ditch Flow Calculations." October 30, 2001.

(20) Envirocare of Utah, Inc. 2003c. Application for Renewal: Radioactive License Materials License Number UT-2300249. July 2, 2003.

(21) Envirocare of Utah, Inc. 2005d. Application for Renewal: Radioactive License Materials License Number UT-2300249, Revision 2 (including all Appendices). June 20, 2005.

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(22) Montgomery-Watson (John Pellicer and Patrick Corser) to Envirocare of Utah, Inc. (Tim Orton). 2000. Letter Report LLRW Cover Frost Penetration. March 1, 2000.

(23) Rogers and Associates Engineering for the Utah Division of Radiation Control. 2000. Siting Evaluation Report for Proposed Disposal Under URCR R-313-25-3 of Class B & C Low Level Radioactive Waste. May 2, 2000.

(24) Shrum, Dan to Robert D. Baird, PE, CCE (URS Corporation). 2005. Via electronic mail. February 28, 2005.

(25) SWCA Environmental Consultants, Inc. 2000. Assessment of Vegetative Impacts on LLRW.

(26) Tooele County Recorder. 1993. Entry No. 5489, Book 348, Page 104. March 16, 1993.

(27) Utah Bureau of Radiation Control (Larry F. Anderson) letter to Envirocare of Utah, Inc. (Khosrow B. Semnani, President). 1987. "Radioactive Material License No. UT 2300249." November 18, 1991.

(28) Utah Department of Environmental Quality (Diane R. Nielson, Executive Director) and Envirocare of Utah, Inc. (Khosrow B. Semnani, President). 1993. "Agreement Establishing Covenants and Restrictions." March 16, 1993.

(29) Utah Division of Radiation Control (Dane Finerfrock) to Envirocare of Utah, Inc. (Daniel Shrum). 2007. "EnergySolutions 2006 Annual Surety Submittal, May 21, 2007 Update." June 1, 2007.

(30) Utah Division of Radiation Control (Dane Finerfrock) to Envirocare of Utah, Inc. (Tye Rogers). 2004. "Restoration of Site Drainage." November 12, 2004.

(31) Utah Division of Radiation Control (Dane Finerfrock) to Envirocare of Utah, Inc. (Tye Rogers). 2005a. "Response to December 4, 2004 Report - Restoration of Site Drainage: Request for Additional Information." February 23, 2005.

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(33) Utah Division of Radiation Control (Dane Finerfrock) to Envirocare of Utah, Inc. (Tye Rogers). 2007. "Restoration of Grade - Round 1 Interrogatories: Notice of Upcoming Requirements and Request for Schedule." February 16, 2007.

(34) Utah Division of Radiation Control (Loren Morton) to EnergySolutions (Tye Rogers) . 2006. Correspondence regarding "DRC Response to Eight Submittals by EnergySolutions Regarding Proposed Class A Combined (CAC) Disposal Cell: Request for Additional Information, Round 3 Interrogatory." March 3, 2006.

(35) Utah Division of Radiation Control to EnergySolutions, LLC. 2006. Letter of approval of Revision 20 of the CQA/QC Manual. September 21, 2006.

(36) Utah Division of Radiation Control (William Sinclair) to Envirocare of Utah, Inc. 2000. Correspondence concerning expectations in addressing the land ownership issue. March 6, 2000.

(37) Utah Division of Radiation Control. 2006a. Memorandum: Analysis of the December 20, 2005 Envirocare Submittal of Settlement Monitoring Plan Update. February 2, 2006. (Johnathan P. Cook to Loren Morton)

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(38) Whetstone Associates, Inc. memorandum to Envirocare of Utah, Inc. 2000. Technical Memorandum 41010 Infiltration Through Lower Radon Barrier, Class A, B, & C Cell Cover. November 7, 2000.

(39) Whetstone Associates, Inc. 2000a. Revised Envirocare of Utah Western LARW [Class A] Cell Infiltration and Transport Modeling. July 19, 2000.

(40) Whetstone Associates, Inc. 2001a. "Travel Time Through Class A Cell Cover." June 22, 2001.

(41) Whetstone Associates, Inc. 2003b. Memorandum to Dan Shrum, Envirocare of Utah, "Open Cell Modeling Results for Years 7 – 12," Technical Memorandum 4101T, August 28, 2003.

(42) Whetstone Associates, Inc. 2004. Revised Western LARW Cell Infiltration and Transport Modeling. July 19, 2004.

(43) Zion's Bank and Energy Solutions, LLC, 2007. Surety Details. March 27, 2007.

(44) "Envirocare's Cover Test Cell Evaporative Zone Depth (EZD) Report", Daniel B. Shrum of Envirocare of Utah, LLC to Dane L. Finerfrock of Utah Division of Radiation Control, CD05-0487, October 13, 2005.

(45) "Cover Test Cell Data Report Addendum: Justification to Change EZD from 18-inches to 24-inches", Envirocare of Utah, LLC, October 5, 2005.

(46) "October 13, 2005 Envirocare Submittal Regarding Cover Test Cell Evaporative Zone Depth (EZD) Report: CAC Cell Round 2 Interrogatory", Loren B. Morton of Utah Division of Radiation Control to Daniel B. Shrum of Envirocare of Utah, LLC, November 1, 2005.

(47) "Class A Combined Embankment Interrogatories: Clarification of Envirocare October 13, 2005 Evaporative Zone Depth Report", Daniel B. Shrum of Envirocare of Utah, LLC to Dane L. Finerfrock of Utah Division of Radiation Control, CD05-0518, November 2, 2005.

(48) "Response to DRC Letter dated November 1, 2005 in Regards to Envirocare's October 13, 2005 Evaporative Zone Depth Report", Daniel B. Shrum of Envirocare of Utah, LLC to Dane L. Finerfrock of Utah Division of Radiation Control, CD05-0520, November 3, 2005.

(49) "Cover Test Cell As-Built Report", Envirocare of Utah, LLC, January 24, 2002.

(50) Appendix N, "Cover Test Cell Monitoring Report" dated June 20, 2003, Envirocare of Utah, LLC, License Renewal Application, Revision 2, dated June 20, 2005

(51) Appendix G, "Drawings" variously dated, Envirocare of Utah, LLC, License Renewal Application, Revision 2, dated June 20, 2005.

(52) "Attachment 4: EZD Cover Test Cell Data" CD-ROM attached to "Radioactive Material License #UT2300249 and Groundwater Quality discharge Permit No. UGW450005. Class A Combined Disposal Embankment – Response to September 19, 2005 Interrogatories", Tye Rogers of Envirocare of Utah, LLC to Dane L. Finerfrock of Utah Division of Radiation Control, CD05-0574, December 16, 2005.

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(53) "HDU Data", Mike LeBaron of Envirocare of Utah, LLC to Loren Morton of Utah Division of Radiation Control and Robert Baird of URS Corporation, e-mail dated December 19, 2005.
(54) "Cover Test Cell WCR Data", Mike LeBaron of Envirocare of Utah, LLC to Loren Morton of Utah Division of Radiation Control and Robert Baird of URS Corporation, e-mail dated December 20, 2005.
(55) "Matric Potential Conversion Factor", Mike LeBaron of Envirocare of Utah, LLC to Loren Morton of Utah Division of Radiation Control and Robert Baird of URS Corporation, e-mail dated December 21, 2005.
(56) "RE: Evaporative Pan Data (39400085.10300 OUT)", Mike LeBaron of Envirocare of Utah, LLC to Loren Morton of Utah Division of Radiation Control and Robert Baird of URS Corporation, e-mail dated December 22, 2005.
(57) "Report Combined Embankment Study: Envirocare", AMEC Earth and Environmental, Inc., December 13, 2005.
(58) "Geotechnical Study Increase in Height and Footprint: Envirocare LARW Facility Near Clive, Utah", AMEC Earth and Environmental, Inc., May 27, 2005.
(59) "Class A Disposal Cell: Containerized Waste Facility: Engineering Justification Report", Envirocare of Utah, April 12, 2001.
(60) "Class A Disposal Cell: Containerized Waste Facility: Engineering Justification Report: Addendum 15 Percent Void Space Criteria", Envirocare of Utah, October 2, 2001.
(61) "Mixed Waste Embankment Engineering Justification Report" Revision 2, Envirocare of Utah, October 20, 2001
(62) "Minimum Temperature Return Rates", personal communication from Jim Ashby, November 1, 2000.
(63) "Review of Cover Design for LARW Cell", TerraMatrix/Montgomery Watson to Envirocare of Utah, February 5, 1998.
(64) "Cover Test Cell As-Built Report", Envirocare of Utah, January 24, 2002.
(65) Letter CD02-0097, "Revised CQA/QC Manual - Containerized Waste Facility: Placement of Large Liners/HICs", Envirocare of Utah to Utah Division of Radiation Control, March 18, 2002.
(66) Letter CD02-0269, "Revised CQA/QC Manual - Containerized Waste Facility: Placement of Large Liners/HICs - Response to Interrogatories", Envirocare of Utah to Utah Division of Radiation Control, July 3, 2002.
(67) Letter CD02-0315, "Revised CQA/QC Manual - Containerized Waste Facility: Placement of Large Liners/HICs - Revised Settlement Analysis and CQA/QC Language", Envirocare of Utah to Utah Division of Radiation Control, August 7, 2002.
(68) Letter CD02-0339, "Revised CQA/QC Manual - Containerized Waste Facility: Placement of Large Liners/HICs - Proposed Revision 15 of the LLRW CQA/QC Manual", Envirocare of Utah to Utah Division of Radiation Control, August 26, 2002.
(69) Letter CD01-0212, "Engineering Justification Report - Waste Placement with CLSM", Envirocare of Utah to Utah Division of Radiation Control, May 16, 2001.

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(70) Letter CD01-0296, "Containerized Waste Facility - Placement of Class A Ion-Exchange Resins in Polyethylene HICs and Steel Liners", Envirocare of Utah to Utah Division of Radiation Control, July 5, 2001.

H. The following documents refer to revisions made in Amendment 1:
(1) Letter CD07-0420, "RML UT2300249, Condition 58 –Request for Amendment to the Waste Characterization Plan, dated July 23, 2007.
(2) Letter CD08-0078, "RML UT2300249, Condition 58 –Request for Amendment to the Waste Characterization Plan."
(3) Letter CD08-0004, "RML UT2300249 Amendment for Calibration Sources" dated January 2, 2008.
(4) Letter CD08-0066, "RML UT2300249; Request to amend License Condition 32" dated February 28, 2008.
(5) Email dated February 29, 2008 from Boyd Imai to Mark Ledoux Re: Amendment Request (CD08-004).
(6) Email dated November 23, 2007 from John Hultquist to Sean McCandless, Request for Information regarding WCP:
(7) Letter dated March 7, 2008, Utah Division of Radiation Control (Dane Finerfrock) to EnergySolutions, LLC. (Sean McCandless). "Appendix I Organization dated February 28, 2008".
(8) Memorandum from John Hultquist to File; dated March 11, 2008 Review of WCP revised November 9, 2007 and March 10, 2008.

I. The following documents refer to revisions made in Amendment 2:
(1) Executive Secretary's letter dated May 16, 2008 [LA# 116-2008]

J. The following documents refer to revisions made in Amendment 3:
(1) Letter CD08-0218, “Clive Transportation Hub” dated July 9, 2008.
(2) Email dated July 28, 2008 from Mark Ledoux to Boyd Imai, “Clive cask hub.”
(3) Letter CD08-0339, Request to Amend License Conditions 10, 38, 43, and Table 40.A., dated October 21, 2008.
(4) Letter CD08-0137, Request for Amendment to Condition 54, Site Radiological Security Plan, dated May 5, 2008.
(5) Email dated May 6, 2008 from Mark Ledoux to John Hultquist, License condition 57 proposed changes.
(6) Letter CD08-0111, RML UT2300249 License Condition 26, and RML UT2300478 License Condition 13.1.D. Environmental Monitoring Plan, dated April 4, 2008
(7) Letter CD08-0115, RML UT2300249 License Condition 26, and RML UT2300478 License Condition 13.1.D. Environmental Monitoring Plan, dated April 9, 2008
(8) Email dated November 13, 2008 from John Hultquist to Sean McCandless, Summary of meeting regarding the Env. Monitoring Plan.
(9) Email dated December 11, 2008, from Sean McCandless to John Hultquist, Procedure

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CL-RS PR-120 Rev 2. Access Control Points, DRC Comment Rev.

(10) Letter CD08-0376, RML UT2300249 License Condition 26, and RML UT2300478 License Condition 13.1.D. Environmental Monitoring Plan, dated November 24, 2008

(11) Email dated December 15, 2008 from Sean McCandless to John Hultquist, Procedure CL-RS PR-120 Rev 2. Access Control Points, Form update.

K. The following documents refer to revisions made in Amendment 4:

(1) Letter dated January 26, 2009 (CD09-0020) from Daniel Shrum to Dane Finerfrock; Radioactive Material License No: UT230029 and UT2300478; Revision of Appendix I, *Organization*.

(2) Letter dated January 28, 2009 John Hultquist to Dan Shrum, Request for Information, Revision to Appendix I *Organization* submitted January 26, 2009.

(3) Letter dated February 9, 2009 (CD09-0038) from Dan Shrum to Dane Finerfrock, Revision to Appendix I *Organization*. Response to Request for Information.

UTAH RADIATION CONTROL BOARD

___________________________________ ____________________

Dane L. Finerfrock, Executive Secretary Date

1B

ENERGYSOLUTIONS' GROUNDWATER QUALITY DISCHARGE PERMIT

STATE OF UTAH

DIVISION OF WATER QUALITY

UTAH WATER QUALITY BOARD

P.O. BOX 16690

SALT LAKE CITY, UTAH 84116-0690

Ground Water Quality Discharge Permit

In compliance with the provisions of the
Utah Water Quality Act, Title 19, Chapter 5, Utah Code Annotated 1953, as amended,

EnergySolutions, LLC
423 West 300 South, Suite 200
Salt Lake City, Utah 84101

hereafter referred to as the "Permittee", is granted a Ground Water Quality Discharge Permit for a Low-Level Radioactive Waste and 11e.(2) Waste Disposal Facility in accordance with conditions set forth herein. This facility currently consists of four separate operable units: a Low-Activity Radioactive Waste (LARW) cell, an 11e.(2) Cell, a Mixed Waste cell, and ~~a~~ Class A cells, which are located at approximately latitude 40° 41' 18" North, longitude 113° 06' 54" West.

This modified Ground Water Quality Discharge Permit amends and supersedes all other Ground Water Discharge permits for this facility issued previously.

This modified permit shall become effective on June 9, 2008

This permit and the authorization to operate shall expire at midnight, **June 8, 2013.**

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Co-Executive Secretary
Water Quality Board

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SPECIFIC CONDITIONS

A. Ground Water Classification

Based on ground water quality data submitted by the permit applicant, ground water in the vicinity of the site is defined as Class IV, saline ground water.

B. Background Ground Water Quality

1. Background Quality from Existing Monitoring Wells

   Based on ground water quality samples collected through June 2006, the upper boundary of background ground water quality is defined as the mean concentration plus the second standard deviation for any contaminant in any individual well as determined by the Executive Secretary.

   Based on prior waste disposal practices, the background ground water quality level for PCBs shall be below the Practical Quantitation Limit (PQL) identified in the currently approved Appendix I.

2. Determination and Revision of Background Ground Water Quality

   After submittal of additional ground water quality data, background ground water quality values may be revised by the Executive Secretary.

C. Ground Water Protection Levels

~~i.~~1. Ground Water Protection Levels, LARW Cell, Class A Cell, ~~and~~ Class A North Cell, and Class A South portion of the Class A South/11e.(2) Cell

Based on the types of wastes to be received for disposal in the low-activity radioactive waste (LARW) facility, which include naturally occurring radioactive materials (NORM) and Class A low-level radioactive waste (LLRW), an evaluation of indicator isotopes and their mobility, and the Ground Water Quality Standards (GWQS); ground water protection levels (GWPL) are defined as either the GWQS or the Background Concentration, whichever is greater, as listed in Tables 1A and 1B of this Permit. In all cases, ground water quality in any compliance monitoring well at the LARW cell, Class A cell, ~~and~~ Class A North cell, and Class A South portion of the Class A South/11e.(2) cell shall comply with the GWPLs found in Table 1A, unless other GWPLs have been cited on a well and contaminant-specific basis in Table 1B, below.

~~a.~~2 Ground Water Protection Levels, 11e.(2) portion of the Class A South/11e.(2) Cell

Based on the types of waste to be disposed of in the 11e.(2) portion of the Class A South/11e.(2) cell~~s~~, an evaluation of the Ground Water Quality Standards; GWPLs for inorganic, dissolved metals, and organic parameters are defined as either the GWQS or the Background Concentration, whichever is greater, as listed in Tables 1C and 1D of this Permit. In all cases, ground water quality in any compliance monitoring well at the 11e.(2) portion of the Class A South/11e.(2) Disposal cell~~s~~ shall comply with the GWPLs found in Table 1C, unless other

GWPLs have been cited on a well and contaminant-specific basis in Table 1D, below.

3. Revision of Ground Water Protection Levels

After submittal of additional ground water quality data, the ground water protection levels may be revised by the Executive Secretary.

Table 1A: Ground Water Protection Levels (GWPL) – Universal to All LARW, Class A, ~~and~~ Class A North, and Class A South Wells

Parameter	GWPL [1]	Parameter	GWPL [1]
Field and Inorganic Parameters (mg/l)		*Radiologic Parameters – Alpha Emitters [9] (pCi/l)*	
Cyanide	0.2	Adjusted Gross Alpha [10]	15
Fluoride	4.0	Neptunium-237 [11]	7
Total Nitrate/Nitrite (as N)	10.0	Strontium-90	42
pH (units)	6.5 – 8.5	Thorium-230	83
Dissolved Metals (mg/l)		Thorium-232	92
Arsenic	NA [2]	Uranium-233	26
Barium	2.0	Uranium-234	26
Beryllium [3]	0.004	Uranium-235	27
Cadmium	0.005	Uranium-236	27
Chromium	0.1	Uranium-238	26
Copper	1.3	*Radiologic Parameters – Beta/Gamma Emitters [12] (pCi/l)*	
Lead	0.015	Carbon-14	3,200
Mercury	0.002	Iodine-129 [13]	21
Molybdenum	NA [2]	Technetium-99	3,790
Nickel [3]	0.10	Tritium	60,900
Selenium	0.05		
Silver	0.1	*Combined Radiologic Parameters (pCi/l)*	
Uranium – total [4]	0.03	Radium-226 + Radium-228 [14]	5
Zinc	5.0		
Organic Parameters (mg/l)			
Acetone [5]	0.7	1,2-Dichloroethane	0.005
2-Butanone [15]	4.0	Methylene Chloride [7]	0.005
Carbon Disulfide [5]	0.7	1,1,2-Trichloroethane [8]	0.005
Chloroform [6]	0.08	Vinyl Chloride	0.002

1. All ground water protection levels (GWPLs) derived from Ground Water Quality Standards (GWQS, see UAC R317-6-2), except as noted.
2. Due to naturally elevated concentrations of arsenic and molybdenum in the Class IV saline aquifer at Clive, Utah, these constituents are poor indicators of cell leakage and therefore will not be used as compliance parameters with ground water protection levels. However, the Permittee will continue to sample, analyze, and report arsenic and

molybdenum data in all compliance monitoring wells at Permit and License renewal as a best management practice.

3. Beryllium and Nickel GWQS derived from EPA drinking water Maximum Contaminant Levels (MCL), as published in the July 17, 1992 Federal Register, Vol. 57, No. 138, pp. 31776 – 31849, Table 1.
4. Total uranium GWQS of 0.03 mg/l from EPA final MCL in National Primary Drinking Water Regulations Final Rule for Radionuclides (December 7, 2000 Federal Register, Vol. 65, No. 236, p. 76708).
5. GWQS for acetone, and carbon disulfide determined by DWQ staff from reference doses available in the technical literature, see August 8, 1994 DWQ Staff Report: Ground Water Quality Conditions and Proposed Revision to Ground Water Protection Levels, Envirocare of Utah Inc., Low-Level Radioactive Waste and 11e.(2) Waste Disposal Facility, near Clive, Tooele County, Utah, p. 3.
6. GWQS for chloroform derived from a 1998 EPA final drinking water MCL for total trihalomethane compounds in “Drinking Water Standards and Health Advisories”, EPA 822-B-00-001, Summer 2000.
7. GWQS for methylene chloride derived from EPA drinking water MCL (ibid.).
8. GWQS for 1,1, 2-Trichloroethane from final EPA MCL in “Drinking Water Regulations and Health Advisories”, EPA 822-B-96-002, October 1996.
9. All GWPL values for alpha-emitting radionuclides based on 1E-4 lifetime cancer mortality risk concentration levels provided in 1991 EPA draft MCL values for drinking water (July 18, 1991 Federal Register, Vol. 56, No. 138, pp. 33078-9, 33100-3, and Appendix C).
10. Adjusted Gross alpha activity excludes radon, radium-226, and uranium alpha particle activity. Gross alpha activity to be determined by co-precipitation, EPA Method 00-02.
11. Neptunium-237, as determined by Total Radioactive Neptunium, EPA Method 907.0.
12. All GWPL values for beta/gamma emitting radionuclide parameters based on a 4 millirem/year equivalent dosage, as per 1991 EPA draft MCL values for drinking water (July 18, 1991 Federal Register, Vol. 56, No. 138, pp. 33078, 33103, and Appendix B).
13. Iodine-129, as determined by Total Radioactive Iodine, EPA Method 902.0.
14. GWQS of 5 pCi/l for combined radium-226 + radium-228 from final EPA MCL in National Primary Drinking Water Regulations Final Rule for Radionuclides (December 7, 2000 Federal Register, Vol. 65, No. 236, p. 76708).
15. GWQS for 2-Butanone (methyl ethyl ketone) derived from Life-time health advisory value in “2006 Edition of the Drinking Water Standards and Health Advisories”, EPA 822-R-06-013, August 2006

Table 1B: Ground Water Protection Level Exceptions[1] – LARW, Class A, ~~and~~ Class A North, and Class A South Wells

Well ID	Parameter	GWPL [2]	Well ID	Parameter	GWPL [2]
Inorganic/Metal Parameters (mg/l)					
			GW-95	Uranium – total	0.0320
			GW-100	Uranium – total	0.117
			P3-95 SWC	Uranium – total	0.180
GW-94	Uranium – total	0.035			
Radiologic Parameters (pCi/l)					
GW-16R	Gross Alpha [3]	44.5	GW-89	Gross Alpha [3]	25.7
				Ra-226+Ra-228	5.04
GW-20	Gross Alpha [3]	27.0	GW-90	Gross Alpha [3]	22.8
	Ra-226+Ra-228	5.49		Ra-226+Ra-228	5.85
GW-22	Gross Alpha [3]	52.5	GW-91	Gross Alpha [3]	23.2
				Ra-226+Ra-228	5.92
			GW-92	Gross Alpha [3]	17.8
GW-23	Gross Alpha [3]	27.2	GW-93	Gross Alpha [3]	52.4
GW-24	Gross Alpha [3]	37.0		Ra-226+Ra-228	5.54
	Ra-226+Ra-228	5.81	GW-94	Gross Alpha [3]	65.5
GW-29	Gross Alpha [3]	58.1			
	Ra-226+Ra-228	5.59	GW-95	Gross Alpha [3]	36.4
GW-56R	Gross Alpha [3]	52.8	GW-99	Gross Alpha [3]	27.3
	Ra-226+Ra-228	5.31			
GW-64	Gross Alpha [3]	26.3			
	Ra-226+Ra-228	5.63	GW-100	Gross Alpha [3]	110
GW-77	Gross Alpha [3]	36.4		Uranium-234	68.6
	Ra-226+Ra-228	5.46		Uranium-238	43.0
			GW-103	Gross Alpha [3]	35.5
			GW-104	Gross Alpha [3]	36.8
			GW-105	Gross Alpha [3]	51.0
				Ra-226+Ra-228	6.03
GW-84	Gross Alpha [3]	20.6			
	Ra-226+Ra-228	6.01	P3-95 SWC	Gross Alpha [3]	87
GW-85	Gross Alpha [3]	22.3		Uranium-234	48
	Ra-226+Ra-228	7.77		Uranium-238	79
GW-86	Gross Alpha [3]	17.2		Ra-226+Ra-228	7.63
	Ra-226+Ra-228	6.19	P3-97 NEC	Gross Alpha [3]	26.3
GW-88	Gross Alpha [3]	19.6	GW-128	Gross Alpha	19
	Ra-226+Ra-228	5.04			

1. Table 1B exceptions constitute specific wells and parameters determined to have natural background ground water quality concentrations above GWQS, or as otherwise specified below. Background concentration is defined as the mean concentration plus the second standard deviation for any contaminant in any individual well.
2. The number of significant figures used for all GWPLs determined by laboratory results previously reported by the Permittee.
3. Adjusted Gross alpha activity excludes radon, radium-226, and uranium alpha particle activity. Gross alpha activity to be determined by co-precipitation, EPA Method 00-02.
4. Iodine-129, as determined by Total Radioactive Iodine, EPA Method 902.0.

Table 1C: Ground Water Protection Levels – Universal for all 11e.(2) Wells

Parameter	GWPL [(1)]	Parameter	GWPL [(1)]
Field and Inorganic Parameters [(2)] *(mg/l)*		*Organic Parameters – Specific to 11e.(2) (mg/l)*	
Cyanide	0.2	Acetone [(5)]	0.7
Fluoride	4.0	2-Butanone [(11)]	4.0
Total Nitrate/Nitrite (as N)	10.0	Carbon Disulfide [(5)]	0.7
pH (units)	6.5 – 8.5	Chloroform [(6)]	0.08
Dissolved Metals [(2)] *(mg/l)*		1,2-Dichloroethane	0.005
Arsenic	NA [(3)]	Methylene Chloride [(7)]	0.005
Barium	2.0	Naphthalene [(8)]	0.02
Beryllium [(4)]	0.004	Diethyl Phthalate [(9)]	5.0
Cadmium	0.005	2-Methylnaphthalene [(10)]	0.004
Chromium	0.1		
Copper	1.3		
Lead	0.015		
Mercury	0.002		
Molybdenum	NA [(3)]		
Nickel [(4)]	0.10		
Selenium	0.05		
Silver	0.1		
Uranium – total	0.03		
Zinc	5.0		

1. All field, inorganic, dissolved metals, and organic indicator organic parameters and corresponding GWPLs for the 11e.(2) wells are equivalent to those for the LARW wells in Table 1A, above.
2. All ground water protection levels (GWPL) derived from Ground Water Quality Standards (GWQS, see UAC R317-6-2), except as noted.
3. Due to naturally elevated concentrations of arsenic and molybdenum in the Class IV saline aquifer at Clive, Utah, these constituents are poor indicators of cell leakage and therefore will not be used as compliance parameters with ground water protection levels. However, the Permittee will continue to sample, analyze, and report arsenic and molybdenum data in all compliance monitoring wells at Permit and License renewal as a best management practice.
4. Beryllium and Nickel GWQS derived from EPA drinking water Maximum Contaminant Levels (MCL), as published in the July 17, 1992 Federal Register, Vol. 57, No. 138, pp. 31776 – 31849, Table 1.
5. GWQS for acetone, and carbon disulfide determined by DWQ staff from reference doses available in the technical literature, see August 8, 1994 DWQ Staff Report: Ground Water Quality Conditions and Proposed Revision to Ground Water Protection Levels, Envirocare of Utah Inc., Low-Level Radioactive Waste and 11e.(2) Waste Disposal Facility, near Clive, Tooele County, Utah, p. 3.
6. GWQS for chloroform derived from a 1998 EPA final drinking water MCL for total trihalomethane compounds in "Drinking Water Standards and Health Advisories", EPA 822-B-00-001, Summer 2000.
7. GWQS for methylene chloride derived from EPA drinking water MCL (ibid.).
8. Naphthalene GWQS derived from final EPA drinking water LHA (ibid.).
9. GWQS for diethyl phthalate based on draft EPA drinking water LHA (ibid.).
10. GWQS for 2-methylnaphthalene could not be located or determined, thanks to a lack of reference dosage information in the technical literature. Consequently, a detection monitoring approach has been taken and the GWPL set equal to the minimum achievable detection limit for the compound as a result of matrix interferences from high TDS content of Clive ground water. As health-based risk or other reference dosage information becomes available, the Executive Secretary may modify the Permit and set a GWQS for 2-methlynaphthalene.

~~1.~~11. GWQS for 2-Butanone (methyl ethyl ketone) derived from Life-time health advisory value in "2006 Edition of the Drinking Water Standards and Health Advisories", EPA 822-R-06-013, August 2006

Table 1D: Ground Water Protection Level Exceptions (1) – 11e.(2) Wells

Well ID	Parameter	GWPL (2)	Well ID	Parameter	GWPL (2)
Inorganic/Metal Parameters (mg/l)					
			GW-27		
				Uranium – total	0.039
GW-25					
	Uranium – total	0.146			
GW-26			GW-36	Uranium – total	0.058
	Uranium – total	0.037	GW-58	Uranium – total	0.046

~~I~~1. Table 1D exceptions constitute specific wells and parameters determined to have natural background ground water quality concentrations above GWQS, or as otherwise specified below. Background concentration is defined as the mean concentration plus the second standard deviation for any contaminant in any individual well.

~~II~~2. The number of significant figures used for all GWPLs determined by laboratory results previously reported by the Permittee.

Table 1E: Ground Water Protection Levels Universal to All Mixed Waste Wells

Parameter	GWPL	Parameter	GWPL
Dissolved Metals (mg/l)			
Uranium – total (1)	0.03		
Radiologic Parameters (pCi/l)			
Alpha Emitters (2)		*Beta/Gamma Emitters (5)*	
Adjusted Gross Alpha (3)	15	Carbon-14	3,200
Neptunium-237 (4)	7	Iodine-129 (7)	21
Strontium-90	42	Technetium-99	3,790
Thorium-230	83	Tritium	60,900
Thorium-232	92		
Uranium-233	26		
Uranium-234	26	*Combined Radiologic Parameters (pCi/l)*	
Uranium-235	27	Radium-226 + Radium-228 (8)	5
Uranium-236	27		
Uranium-238	26		

~~i.~~1. Total uranium GWQS of 0.03 mg/l from EPA final MCL in National Primary Drinking Water Regulations Final Rule for Radionuclides (December 7, 2000 Federal Register, Vol. 65, No. 236, p. 76708).

~~ii.~~2. All GWPL values for alpha-emitting radionuclides based on 1E-4 lifetime cancer mortality risk concentration levels provided in 1991 EPA draft MCL values for drinking water (July 18, 1991 Federal Register, Vol. 56, No. 138, pp. 33078-9, 33100-3, and Appendix C).

~~iii.~~3. Adjusted Gross alpha activity excludes radon, radium-226, and uranium alpha particle activity. Gross alpha activity to be determined by co-precipitation, EPA Method 00-02.

~~iv.~~4. Neptunium-237, as determined by Total Radioactive Neptunium, EPA Method 907.0.

~~v.~~5. All GWPL values for beta/gamma emitting radionuclide parameters based on a 4 millirem/year equivalent dosage, as per 1991 EPA draft MCL values for drinking water (July 18, 1991 Federal Register, Vol. 56, No. 138, pp. 33078, 33103, and Appendix B).

~~vi.~~6. Iodine-129, as determined by Total Radioactive Iodine, EPA Method 902.0.

~~vii.~~7. GWQS of 5 pCi/l for combined radium-226 + radium-228 from final EPA MCL in National Primary Drinking Water Regulations Final Rule for Radionuclides (December 7, 2000 Federal Register, Vol. 65, No.236,p.76708).

Table 1F: Ground Water Protection Level Exceptions [(1)] – Mixed Waste Wells

Well ID	Parameter	GWPL [(2)]	Well ID	Parameter	GWPL [(2)]
Radiologic Parameters (pCi/l)					
GW-41	Gross alpha [(3)]	34.2			
GW-42	Gross alpha [(3)]	19.4			
GW-68	Gross alpha [(3)]	26.4			
			GW-123R	Gross alpha [(3)]	19.2
GW-69	Gross alpha [(3)]	20.6			
	Ra-226+Ra-228	5.08			
			GW-124	Gross alpha [(3)]	18.9
			GW-128	Gross alpha [(3)]	19
GW-118	Gross alpha [(3)]	16.1			

1. Table 1F exceptions constitute specific wells and parameters determined to have natural background ground water quality concentrations above GWQS, or as otherwise specified below. Background concentration is defined as the mean concentration plus the second standard deviation for any contaminant in any individual well.
2. The number of significant figures used for all GWPLs determined by laboratory results previously reported by the Permittee.
3. Adjusted gross alpha activity excludes radon, radium-226, and uranium alpha particle activity. Gross alpha activity to be determined by co-precipitation, EPA Method 00-02.

D. Best Available Technology (BAT) Design Standard

1. Discharge Technology Performance Criteria

Best available technology for the facility will incorporate discharge technology based on the use of earthen materials in both the bottom liner and final cover. However, under no circumstances shall the facility cause ground water at the compliance monitoring wells (Part I.F.1) to exceed the ground water protection levels in Part I.C for the following minimum periods of time:

Disposal Cell	Contaminant Group	Performance Standard*
LARW, Class A, ~~and~~ Class A North, and Class A South portion of Class A South/11e.(2)	Heavy metals Inorganics Organics Mobile and non-mobile Radionuclides	200 years 200 years 200 years 500 years
11e.(2) portion of Class A South/11e.(2)	Heavy metals Inorganics Organics	200 years 200 years 200 years
Mixed Waste	Mobile and non-mobile	500 years

* Said performance standards shall be measured from the following initial startup dates: 1988 [LARW Cell], 1992 [Mixed Waste Cell], 1994 [11e.(2) Cells], 2000 [Class A Cell]

If after review of any environmental monitoring data collected at the facility, the Executive Secretary determines that the ground water protection levels in Part I.C of the Permit may be exceeded at the compliance monitoring wells before completion of the above-minimum time periods, said potential shall constitute a violation of the Best Available Technology requirements of this Permit.

2. Final Authorized LARW Cell Engineering Design and Specifications

The best available technology design standard shall be defined by, and construction of the LARW facilities shall conform to the engineering plans summarized in Table 2A, below, and the specifications listed in the approved ~~LARW~~ LLRW and 11e.(2) Construction Quality Assurance/Quality Control (CQA/QC) ~~Plan~~ Manual (Radioactive Materials License No. 2300249 (the License), Condition 44):

For the LARW cell, this engineering design includes, but is not limited to, the following elements:

a) Cover System – shall include the following materials or as specified by the approved LLRW and 11e.(2) CQA/QC ~~Plan~~ Manual (Radioactive Materials License, Condition 44), from the top down:

1) An 18-inch thick erosion barrier consisting of a 1.25-inch, or greater, average diameter rock material over the top-slope area, and a 4.5-inch, or greater average diameter rock material over the side-slope area, as specified on the approved engineering drawing number 9407-4, Revision S2, dated and submitted on October 15, 1999,

2) A 6-inch thick upper filter zone consisting of sandy gravel material,

3) A 12-inch compacted thickness of sacrificial soil with a minimum Residual Moisture Content of 3.5% (by weight). Such Residual Moisture Content shall be the asymptotic value measured by ASTM Methods D-3152 and D-2325 at soil tensions above 15 bars,

4) A 6-inch lower filter zone consisting of sandy gravel material with a minimum permeability of 3.5 cm/sec,

Particle Size Distribution	Particle Size		
	Upper (Type A) Filter	**Sacrificial Soil**	**Lower (Type B) Filter**
D_{100}	≤ 6.0 inch	≤ 0.75 inch	≤ 1.5 inch
D_{70}	≤ 3.0 inch	n/a	n/a
D_{60}	n/a	≥ 0.375 inch	n/a
D_{50}	≤ 1.57 inch (40 mm)	n/a	n/a
D_{40}	n/a	n/a	≥ 0.375 inch
D_{35}	n/a	≥ No. 4 sieve (4.75 mm)	n/a
D_{15}	≤ 0.85 inch (22 mm)	≥ No. 200 sieve (0.074 mm)	n/a
D_{10}	≥ No. 10 sieve (2.0 mm)	n/a	≥ No. 4 sieve
D_5	≥ No. 200 sieve (0.074 mm)	n/a	n/a

5) A 2-foot thick clay radon barrier measured vertically. Said radon barrier will be divided into two layers:

~~1.~~i. An upper layer, 1 foot thick, with a field hydraulic conductivity of 5.0E-8 cm/sec or less, and

~~2.~~ii. A lower layer, 1 foot thick with a field hydraulic conductivity of 1.0E-6 cm/sec or less.

Top slope of the embankment shall be between 2% and 4%, as specified on the approved engineering drawings, and side slopes shall be no steeper than approximately 5:1. The outside toe of the clay radon barrier/liner shall extend outward and beyond the outermost edge of the waste layer and shall merge with the bottom clay liner.

b) Waste Layer – the waste layer shall not exceed a final thickness of 43 feet above the top of the bottom clay liner.

c) Clay Bottom Liner – the bottom clay liner shall be constructed below natural grade on slopes no greater than 0.12% north to south and 0.2% east to west. Final grade and elevation for the base of the clay liner will comply with the approved engineering design (Table 2A). This liner will be constructed after excavation of the site to the total design depth, followed by placement of imported clay materials, which meet the approved specifications for material and construction. The new clay liner shall be graded to prevent the accumulation of leachate over the existing 1-foot thick clay liner. The clay liner shall be a minimum of 2 feet thick, measured perpendicular to the slope, constructed in accordance with the approved ~~LARW~~ LLRW and 11e.(2) CQA/QC ~~Plan~~ Manual (Radioactive Materials License, Condition 44), and have a field hydraulic conductivity of 1.0E-6 cm/sec or less.

Table 2A: Approved LARW Cell Engineering Design Drawings

Drawing	Last Revision Date	Subject
9407-2, Rev. E	July 28, 1998	LARW Disposal Cell – Cell Location and Excavation Limits
9407-4, Rev. T	May 16, 2003	LARW Disposal Cell – LARW Cell Closure
9407-4A, Rev. L	May 16, 2003	LARW Disposal Cell – LARW Cell Closure
9407-4B, Rev. J	May 16, 2003	LARW Disposal Cell – LARW Cell Closure
9407-5, Rev. I	February 4, 1999	LARW Disposal Cell – Site Layout
9407-6, Rev. E	July 28, 1998	LARW Disposal Cell – Site Layout
9407-7, Rev. A	June 27, 1994	Drainage Plan – Plan View
9407-7A, Rev. A	June 27, 1994	Drainage Plan – Details
9407-8, Rev. C	October 16, 1998	LARW Disposal Cell Wedge Expansion Cross Section
03046-VO1, Rev. 0	May 16, 2003	LARW Disposal Cell – Radon Barrier Design Sections and Details
03046A-VO1 Rev. -	August 1, 2003	LARW Disposal Cell Closure – Plan and Details
03046A-VO2 Rev. 1	August 1, 2005	LARW Disposal Cell Closure – Sections and Details

Table 2A: Approved LARW Cell Engineering Design Drawings

Drawing	Last Revision Date	Subject
03046A-VO3 Rev. -	August 1, 2003	LARW Disposal Cell – Radon Barrier Redesign Sections and Details
03046A-VO4 Rev. -	August 1, 2003	LARW Disposal Cell – Radon Barrier Redesign Sections and Details
03046A-VO5 Rev. -	August 1, 2003	LARW Disposal Cell – Radon Barrier Redesign Section and Details
L9	July 21, 1993	Fence Details

3. 11e.(2) Disposal Cell Design

The best available technology design standard shall be defined by, and construction of the 11e.(2) cells shall conform to the approved engineering design summarized in Table 2B, below, and the specifications listed in the currently approved LLRW and 11e.(2) CQA/QC ~~Plan~~Manual (Radioactive Material License, Condition 44).

Table 2B: Approved 11e.(2) Cell Engineering Design Drawings

Drawing	Last Revision Date	Subject
07021-G1	1/4/08	Class A South/11e.(2) Disposal Cell - Project Title Sheet
07021-U1	6/9/09	Class A South/11e.(2) Disposal Cell – Buffer Zone
07021-U2	6/9/09	Class A South/11e.(2) Disposal Cell Waste Limits – Latitudes & Longitudes
07021-U3	6/9/09	Class A South/11e.(2) Disposal Cell Environmental Monitoring
07021-V1	6/9/09	Class A South/11e.(2) Disposal Cell Layout
07021-V2	6/9/09	Class A South/11e.(2) Disposal Cell Cover Layout
07021-V3	6/9/09	Class A South/11e.(2) Disposal Cell Cross Sections 1 of 2
07021-V4	6/9/09	Class A South/11e.(2) Disposal Cell Cross Sections 2 of 2
07021-V5	6/9/09	Class A South/11e.(2) Disposal Cell Construction Details 1 of 2
07021-V6	6/9/09	Class A South/11e.(2) Disposal Cell Construction Details 2 of 2
07021-V7	6/9/09	Class A South/11e.(2) Disposal Cell Cover Cross Sections and Gradations
07021-V8	6/9/09	Collection Lysimeters Details
~~9420-4, Rev. F~~	~~March 4, 2002~~	~~11e.(2) Disposal Cell, Layout~~
~~9420-5, Rev. D~~	~~February 21, 2002~~	~~11e.(2) Disposal Cell, Cross Sections~~
~~9420-6, Rev. D~~	~~December 21, 2002~~	~~11e.(2) Disposal Cell, Ditch Cross Sections~~

Said 11e.(2) cell engineering design shall include, but is not limited to, the following elements:

a) Cover System – shall include the following materials, as described from the top down:

1) Top-slope Area – the top-slope shall consist of the following materials, from the top down:

~~III~~i. Riprap Erosion Barrier – a 12-inch thick layer of rock armor material with a particle size ranging from 0.75 to 4.50 inches in diameter with an average diameter between 1.125 and 3.0 inches.

~~IV~~ii. Filter Zone – a single 12-inch thick layer of granular material with a particle size ranging from 0.3125 to 3.0 inches in diameter (coarse sand to fine cobble) and a minimum hydraulic conductivity of 42 cm/sec.

~~V~~iii. Upper Radon Barrier – a layer of clay material at least 12 inches thick with a field hydraulic conductivity of 5.0E-8 cm/sec or less.

~~VI~~iv. Lower Radon Barrier – a layer of clay material at least 3 feet thick with a field hydraulic conductivity of 1.0E-6 cm/sec or less.

The minimum slope for top-slope areas shall be 2.0~~2.1~~%.

2) Side-slope Area – the side-slope area shall consist of the following materials, from the top down:

i. Riprap Erosion Barrier – an 18-inch thick layer of rock armor material with a particle size ranging from 2.0 to 16.0 inches in diameter with an average diameter between 4.5 and 8.0 inches.

ii. Filter Zone – a single 12-inch thick layer of granular material with a particle size ranging from 0.3125 to 3.0 inches in diameter (coarse sand to fine cobble) and a minimum hydraulic conductivity of 42 cm/sec.

iii. Upper Radon Barrier – a layer of clay material at least 12 inches thick with a field hydraulic conductivity of 5.0E-8 cm/sec or less.

iv. Lower Radon Barrier – a layer of clay material at least 2.5 feet thick with a field hydraulic conductivity of 1.0E-6 cm/sec or less.

The minimum slope for side-slope areas shall be 20%.

b) 11e.(2) Waste Layer – the 11e.(2) waste shall not exceed a final thickness of 47 feet above the bottom clay liner.

c) Bottom Clay Liner – the clay liner will be constructed only after excavation of the site to the total design depth, followed by placement of imported clay materials which meet the approved specifications for material and construction. The clay liner shall be a minimum of 2 feet thick, measured perpendicular to the slope, and have a field hydraulic conductivity of 1.0E-6 cm/sec or less.

4. Final Authorized Class A, ~~and~~ Class A North, and Class A South portion of the Class A South/11e.(2) Cell Engineering Design and Specifications

The best available technology design standard shall be defined by, and construction of the Class A, ~~and~~ Class A North, and Class A South facilities shall conform to the engineering plans summarized in Table 2C, below, and the specifications listed in the approved LLRW and 11e.(2) ~~Construction Quality Assurance/Quality Control (~~CQA/QC~~)~~ ~~Plan~~ Manual (Radioactive Materials License, Condition 44):

For the Class A, ~~and~~ Class A North, and Class A South -cells, this engineering design includes, but is not limited to, the following elements:

~~1.~~d) Cover System – top-slope and side-slope areas shall include the following materials or as specified by the approved LLRW and 11e.(2) CQA/QC ~~Plan~~ Manual (Radioactive Materials License, Condition 44), from the top down:

1) An 18-inch thick erosion barrier consisting of a 1.25-inch, or greater, average diameter rock material over the top-slope area, and a 4.5-inch, or greater average diameter rock material over the side-slope area, as specified on the approved engineering drawing number 9821-01,

2) A 6-inch thick upper (Type A) filter zone consisting of sandy gravel material,

3) A 12-inch compacted thickness of sacrificial soil with a minimum Residual Moisture Content of 3.5 % (by weight). Such Residual Moisture Content shall be the asymptotic value measured by ASTM Methods D-3152 and D-2325 at soil tensions above 15 bars,

4) A 6-inch lower (Type B) filter zone consisting of sandy gravel material with a minimum permeability of 3.5 cm/sec, with the exception of the Class A South side slope where the Type B filter zone shall be 18-inches thick,

Material gradation of the sacrificial soil layer and upper and lower filters shall comply with the following requirements:

Particle Size Distribution	Particle Size		
	Upper (Type A) Filter	Sacrificial Soil	Lower (Type B) Filter
D_{100}	≤6.0 inch	≤0.75 inch	≤ 1.5 inch
D_{70}	≤3.0 inch	n/a	n/a
D_{60}	n/a	≥0.375 inch	n/a
D_{50}	≤1.57 inch (40 mm)	n/a	n/a
D_{40}	n/a	n/a	≥ 0.375 inch
D_{35}	n/a	≥No. 4 sieve (4.75 mm)	n/a
D_{15}	≤0.85 inch (22 mm)	≥No. 200 sieve (0.074 mm)	n/a
D_{10}	≥No. 10 sieve (2.0 mm)	n/a	≥ No. 4 sieve
D_{5}	≥No. 200 sieve (0.074 mm)	n/a	n/a

5) A 2-foot thick clay radon barrier measured vertically. Said radon barrier will be divided into two layers:

   i. an upper layer, 1 foot thick, with a field hydraulic conductivity of 5.0E-8 cm/sec or less, and

   ii. a lower layer, 1 foot thick with a field hydraulic conductivity of 1.0E-6 cm/sec or less.

   Top slope of the embankment shall be between 2% and 4%, as specified on the approved engineering drawings, and side slopes shall be no steeper than approximately 5:1. The outside toe of the clay radon barrier/liner shall extend outward and beyond the outermost edge of the waste layer and shall merge with the bottom clay liner.

~~b)~~e) Waste Layer – the waste layer shall not exceed a final thickness of 54 feet above the top of the bottom clay liner.

~~c)~~f) Clay Bottom Liner – the bottom clay liner shall be constructed below natural grade. Final grade and elevation for the base of the clay liner will comply with the approved engineering design (Table 2C). This liner will be constructed after excavation of the site to the total design depth, followed by placement of imported clay materials, which meet the approved specifications for material and construction. The clay liner shall be a minimum of 2 feet thick, measured perpendicular to the slope, constructed in accordance with the approved LLRW and 11e.(2) CQA/QC ~~Plan~~ Manual (Radioactive Materials License, Condition 44), and have a field hydraulic conductivity of 1.0E-6 cm/sec or less.

Table 2C: Approved Class A, ~~and~~ Class A North, and Class A South Cell Engineering Design Drawings

Drawing	Last Revision	Subject
Class A Disposal Embankment		
9821-01, Rev. 1	5/20/05	Class A Disposal Cell – Layout Plan and Cover Details
9821-02, Rev. C	3/22/02	Class A Disposal Cell – Cross Sections
9821-03, Rev. B	3/22/02	Class A Disposal Cell – Ditch Details
9821-04, Rev. A	7/25/00	Class A Disposal Cell – Updated Drainage System
Class A North Disposal Embankment		
04080-C01 Rev. 1	5/19/05	Class A North Disposal Cell – Layout Plan and Cover Details
04080-C02 Rev. 2	5/19/05	Class A North Disposal Cell – Cross Sections
04080-C03 Rev. 1	5/19/05	Class A North Disposal Cell – Ditch Details
Class A South Disposal Embankment		
07021-G1	1/4/08	Class A South/11e.(2) Disposal Cell - Project Title Sheet
07021-U1	6/9/09	Class A South/11e.(2) Disposal Cell – Buffer Zone
07021-U2	6/9/09	Class A South/11e.(2) Disposal Cell Waste Limits – Latitudes & Longitudes
07021-U3	6/9/09	Class A South/11e.(2) Disposal Cell Environmental Monitoring
07021-V1	6/9/09	Class A South/11e.(2) Disposal Cell Layout
07021-V2	6/9/09	Class A South/11e.(2) Disposal Cell Cover Layout
07021-V3	6/9/09	Class A South/11e.(2) Disposal Cell Cross Sections 1 of 2
07021-V4	6/9/09	Class A South/11e.(2) Disposal Cell Cross Sections 2 of 2
07021-V5	6/9/09	Class A South/11e.(2) Disposal Cell Construction Details 1 of 2
07021-V6	6/9/09	Class A South/11e.(2) Disposal Cell Construction Details 2 of 2
07021-V7	6/9/09	Class A South/11e.(2) Disposal Cell Cover Cross Sections and Gradations
07021-V8	6/9/09	Collection Lysimeters Details

5. Disposal Cell Location Restrictions

The LARW, 11e.(2) portion of the Class A South/11e.(2), Class A, ~~and~~ Class A North, and Class A South portion of the Class A South/11e.(2) disposal cells shall be restricted to the following locations in Section 32, Township 1 South, Range 11 West, SLBM, as specified on the currently approved engineering plans, drawings, and the approximate Latitude and Longitude Coordinates provided in Table 3 below:

Table 3: Authorized LARW, 11e.(2), Class A, and Class A North Disposal Cell Locations

Disposal Cell	Edge of Waste Position	Coordinates	
		Latitude	**Longitude**
LARW	NW Corner	40° 41' 10.851418" N	113° 6' 50.846182" W
	SW Corner	40° 40' 52.379041" N	113° 6' 51.184491" W
	SE Corner	40° 40' 52.230624" N	113° 6' 36.713462" W
	NE Corner	40° 41' 10.700524" N	113° 6' 36.372920" W
11e.(2)	NW Corner	40° 41' 12.457 " N~~40° 41' 12.531691" N~~	113° 07' 05.993 " W~~113° 7' 24.037415" W~~
	SW Corner	40° 40' 54.923 " N~~40° 40' 55.004159" N~~	113° 07' 06.210 " W~~113° 7' 24.684273" W~~
	SE Corner	40° 40' 54.845 " N~~40° 40' 54.379460" N~~	113° 06' 55.564 " W~~113° 6' 55.514932" W~~
	NE Corner	40° 41' 12.380" N~~40° 41' 11.913013" N~~	113° 06' 55.346 " W~~113° 6' 54.859752" W~~
Class A	NW Corner	40° 41' 28.004487" N	113° 7' 23.847971" W
	SW Corner	40° 41' 14.175042" N	113° 7' 24.153414" W
	SE Corner	40° 41' 13.717662" N	113° 6' 54.827468" W
	NE Corner	40° 41' 27.547403" N	113° 6' 54.521700" W
Class A North	NW Corner	40° 41' 38.80171" N	113° 7' 24.05346" W
	SW Corner	40° 41' 30.12912" N	113° 7' 24.25350" W
	SE Corner	40° 41' 29.74829" N	113° 6' 55.82096" W
	NE Corner	40° 41' 38.42078" N	113° 6' 55.62003" W
Class A South	NW Corner	40° 41' 12.590"N	113° 07' 24.545"W
	SW Corner	40° 40' 55.055"N	113° 07' 24.761"W
	SE Corner	40° 40' 54.924"N	113° 07' 06.366 "W
	NE Corner	40° 41' 12.458"N	113° 07' 06.148 "W

This description does not include the Mixed Waste facility, located east of the LARW Cell, which is authorized under a separate RCRA permit from the Utah Division of Solid and Hazardous Waste.

6. Definition of LARW Waste

For purposes of this Permit, Low-Activity Radioactive Waste (LARW) is defined as radioactive wastes, which meet the definition of Class A Low-Level Radioactive Waste (LLRW) under the Utah Radiation Control Rules, UAC R313-15-1008, or are defined as Naturally Occurring and Accelerator Produced Radioactive Materials under the Utah Radiation Control Rules, UAC R313-12-3.

7. Definition of Mobile Waste

Any waste containing any of the following isotopes shall be considered a mobile waste and subject to special provisions or requirements under this Permit: aluminum-26, berkelium-247, calcium-41, californium-249, californium-250, carbon-14, chlorine-36, iodine-129, neptunium-237, rhenium-187, sodium-22, technetium-99, terbium-157, terbium-158, or tritium.

8. Definition of PCB/Radioactive Waste

For purposes of this Permit, PCB/Radioactive Waste to be accepted for disposal shall meet the criteria specified in R315-315-7(2)(a) or (3)(b)(i-vi) of the rules designated for disposal in a municipal or non-municipal non-hazardous landfill.

9. Definition of 11e.(2) Waste

For purposes of this Permit, 11e.(2) Waste is defined as "... tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content", as defined in Section 11e.(2) of the U.S. Atomic Energy Act of 1954, as amended.

10. Collection Lysimeters for Future Construction at the Class A, and Class A North, and Class A South Cells

Future construction of the clay bottom liner of Class A, and Class A North, and Class A South portion of the Class A South/11e.(2) Cells shall include the installation of collection lysimeters below the bottom clay liner, in accordance with the CQA Plan Manual for Collection Lysimeter Construction currently approved by the Executive Secretary and included herein as Appendix C. The Permittee shall also comply with the currently approved Operation, Maintenance and Closure Plan for Collection Lysimeters, also included herein as Appendix C. In addition, the Permittee shall comply with the following requirements:

I.A.10.1a) Collection Lysimeter "As-Built" Report – within 30 days of completion of the construction of each lysimeter, the Permittee shall submit an "As-Built" Report for Executive Secretary approval.

b) Future Collection Lysimeter Construction Notification – the Permittee shall submit a notice of construction of additional lysimeters in the Class A, and Class A North, and Class A South portion of the Class A South/11e.(2) Cells. Said notice shall be submitted at least one week prior to construction in order to allow the Executive Secretary to inspect lysimeter construction.

c) Future Collection Lysimeter Construction – in addition to any design or construction requirements found in the currently approved Appendix C, the Permittee shall construct all future collection lysimeters in a manner that will allow the lysimeter to be operated in compliance with all performance standards mandated by Part I.E.11 or monitoring requirements dictated by Part I.F.6 of this Permit. Any changes to the approved design or construction specifications in Appendix C shall require prior Executive Secretary approval.

11. Future Modification of Disposal Cell Engineering Design or Specifications

Any change in the approved engineering design or specifications which causes a significant adverse effect to the infiltration performance of a disposal cell shall require prior submittal and Executive Secretary approval of infiltration and contaminant transport analysis of the proposed change. Said changes must be submitted to the Executive Secretary as a written request with the revised engineering drawings, specifications, ground water flow and contaminant transport models, or any other documentation deemed necessary by the Executive Secretary, at least 180 days prior to the effective date desired by the Permittee.

12. Final Authorized Engineering Design and Specifications for Waste and Wastewater Related Facilities

    Best available technology design standards for related facilities at the disposal site shall be defined by, and construction conform to the engineering plans and specifications summarized in Table 5, below:

Table 5: Approved Engineering Design Drawings for Waste/Wastewater Related Facilities

Related Facility	Drawing No.	Last Revision	Subject / Title
Track 2 Railcar Decontamination Pad	9513-1, Rev. B	May 26, 1996	Plan, Section, and Details
Track 4 Railcar Decontamination Pad	T-100, Rev. 3	Aug. 14, 1999	Foundation
	T-101, Rev. 3	Aug. 16, 1999	Foundation Details
	9906-02, Rev. H	”Feb 26, 2007	Wash Water System As-Built
	9906-02A, Rev. H	Feb. 26, 2007	Wash Water System As-Built
Class A North Containerized Waste Facility and Large Component Area Evaporation Basin	0408-C05, Rev. 2	May 19, 2008	Plan and Section
	0408-C06, Rev. 2	May 19, 2008	
	04080-C06, Rev 2	May 19,2005	
1995 Evaporation Pond	9718-1, Rev. C	March 13, 2007	Facility Layout
	9504-3, Rev. E	Oct. 28, 1999	Storage Pond
	9504-3A, Rev. A	Oct. 28, 1999	Leak Detection System Details, As-Built
	9504-4, Rev. E	Oct. 28, 1999	Facility Details
	9718-4, Rev. A	Aug. 17, 1998	Piping Diagrams and Pump Station
1997 Evaporation Pond	9718-1, Rev. C	March 13, 2007	Facility Layout
	9718-2, Rev. D	Feb. 25, 1999	Evaporation and Storage Pond
	9718-2a, Rev. B	Feb. 25, 1999	Leak Detection System Details, As-Built
	9718-3, Rev. -	Sept. 17, 1997	Details
	9718-4, Rev. A	Aug. 17, 1998	Piping Diagrams and Pump Station
2000 Evaporation Pond	0009-00, Rev. A	July 10, 2000	Site Plan and Facility Layout
	0009-01, Rev. D	Dec. 14, 2007	Plan View
	0009-02, Rev. A	Jan. 29, 2001	Cross Sections
	0009-03, Rev. B	Jan. 29, 2001	Details
	0009-04, Rev. A	Jan. 29, 2001	Sump/Side Slope Cross-Section
	0009-05, Rev. A	Jan. 29, 2001	Leak Detection Details
Mixed Waste	9802-1, Rev. D	Dec. 22, 1999	Facility Layout

Table 5: Approved Engineering Design Drawings for Waste/Wastewater Related Facilities

Related Facility	Drawing No.	Last Revision	Subject / Title
Evaporation Pond	9802-2, Rev. F	Dec. 22, 1999	Water Storage Facility
	9802-3, Rev. D	Dec. 22, 1999	Facility Details As-Built
	9802-4, Rev. B	Dec. 4, 1998	Water Storage Facility
	9802-5, Rev. A	Dec. 22, 1999	Leak Detection System Details, As-Built
	9803-2, Rev. -	Feb. 11, 1998	Storage Pad Drain Line As-Built
Box Washing Facility	9621-1, Rev. C	July 20, 1998	Site Plan As-Built Drawing
	9621-2, Rev. B	July 20, 1998	Foundation Plan As-Built Drawing
	9621-3, Rev. B	July 20, 1998	Elevation Views As-Built Drawing
	9621-4, Rev. B	July 20, 1998	Elevation Views As-Built Drawing
	9621-5, Rev. B	July 20, 1998	Wall Detail As-Built Drawing
Intermodal Unloading Facility	9705-1, Rev. A	July 31, 1998	Plan View
	9705-2, Rev. A	July 31, 1998	Cross Section Drawings
	9813-01, Rev. B	March 13, 2007	Layout
	9813-02, Rev. A	July 31, 1998	Layout (and Details)
	0701-G03, Rev. 1	June 8, 2007	Site Layout and Facility Legend
Railcar Rollover Facility	0221-01	March 26, 2002	Site Layout and Drain Line
	0221-02	March 26, 2002	Fabric Cover Frame Layout
	0221-03	March 26, 2002	Rollover Cover South Elevation
	0221-04, Rev. A	April 24, 2002	Cover Run-off Collection and Drainage
Rail Digging Facility	0107-01, Rev. B	April 25, 2002	Site Layout
	0107-02, Rev. B	April 19, 2002	Digging Track Plan
	0107-03, Rev. B	April 12, 2002	Track and Pad Details
	0107-04A, Rev. A	April 25, 2002	Excavator Ramp
Container Storage Pad	9514-1, Rev. C	March 13, 2007	Plan, Sections and Details
East Truck Unloading Facility	05023-C104, Rev. 9	April 26, 2007	New Site Layout
	05023-C301, Rev. 4	Sept. 22, 2005	Cross Sections
	05023-C401, Rev. 5	Dec. 12, 2005	Truck Unloading Area Plan View
	05023-C402, Rev. 5	De. 12, 2005	Truck Unloading Dock Plan View
	05023-C403, Rev. 7	April 26, 2007	Enlarged Dock Plan View
	05023-C501, Rev. 5	Dec. 12, 2005	Truck Unloading Area Details
	05023-C502, Rev. 4	Dec. 12, 2005	Truck Dock Details
	05023-C503, Rev. 4	Dec. 12, 2005	Truck Dock Details
	05023-S1, Rev. 1	Sept. 22, 2005	Concrete Container Holding Pad Safety Protection
Shredder Facility[1]	05056-F13, Rev._	09/30/06	Shredder Facility; Outfeed Pad Plan and Pad Details (As-Constructed)
	05056-F13A, Rev._	09/30/06	Shredder Facility; Shredder Pad Plan (As-Constructed)
	05056-F13B, Rev._	09/30/06	Shredder Facility; Shredder Pad Details (As-Constructed)
	05056-L1, Rev. 6	09/06	Shredder Facility; Site Layout Plan (As-Built)
	05056-L2, Rev. 2	08/06	Shredder Facility; Containment Pad Water Management Layout Plan
	05056-C1, Rev. 10	09/06	Shredding Facility; Operating Pad Layout (As-Built)

Table 5: Approved Engineering Design Drawings for Waste/Wastewater Related Facilities

Related Facility	Drawing No.	Last Revision	Subject / Title
	05056-C6, Rev. 4	09/06	Shredding Facility; Operating Pad – Sections and Details (As-Built)
	05056-C7, Rev. 6	09/06	Shredding Facility; Catch Basin and Manhole Layouts (As-Built)
	05056-C8, Rev. 1	08/06	Shredding Facility; Drainage System Details
	05056-F1 thru -F14	Various	Details
Rotary Dump Facility[1]	05006-C1, Rev. 3	Oct 6, 2006	Heater Building; Plan sheet
	05006-C2, Rev. 5	Oct 6, 2006	Rotary Dump Building; Plan Sheet
	05006-C3, Rev. 1	Oct 6, 2006	Wash Building; Plan Sheet
	05006-C5, Rev. 3	Oct 6, 2006	Rotary Dump Building; Section A-A
	05006-C6, Rev. 2	Oct 6, 2006	Rotary Dump Building; Section B-B
	05006-C12, Rev. 1	Oct 6, 2006	Heater Building; Drainage Details and Sections
	05006-C7, Rev. 1	Oct 6, 2006	Rotary Dump Building; Section C-C
	05006-C8, Rev. 1	Oct 6, 2006	Rail Car Wash Building; Section D-D
	05006-C9, Rev. 1	Oct 6, 2006	Wash Building, Drainage Plan Sheet
	05006-F1, Rev. 2	Oct 6, 2006	Rotary Dump Facility; Heater, Rotary and Wash Buildings foundation Plan and Details
	05006-F2, Rev. 3	Oct 6, 2006	Rotary Dump Facility; Heater Building Foundation Plan and Details
	05006-F10, Rev. 4	Oct 6, 2006	Rotary Dump Facility; Rotary Dumper Building Foundation Plan and Details
	05006-F13, Rev. 1	Oct 6, 2006	Rotary Dump Facility; Rotary Dumper Building Foundation Plan and Details
	05006-F25, Rev. 3	Oct 6, 2006	Rotary Dump Facility; Rotary Dumper Building Foundation Plan and Details
	05006-F26, Rev. 3	Oct 6, 2006	Rotary Dump Facility; Rotary Dumper Building Foundation Plan and Details
	05006-F27, Rev. 3	Oct 6, 2006	Rotary Dump Facility; Rotary Dumper Building Foundation Plan and Details
	05006-V1, Rev. 2	Dec 1, 2006	Rotary Dump Facility; Water Supply and Waste Water Flow Diagram
	05006-SL100. Rev. 6	Oct 6, 2006	Rotary Dump Building; Sediment Basin Liner Plan
	05006-SL101. Rev. 6	Oct 6, 2006	Rotary Dump Building; Sediment Basin Liner Sections
	05006-SL102. Rev. 6	Oct 6, 2006	Rotary Dump Building; Sediment Basin Liner Section
Intermodal Container Wash Building	05008-G1, Rev. 4	May 19, 2006	Intermodal Container Wash Building; Map Layout and Index
	05008-C100, Rev. 2	May 19, 2006	Intermodal Container Wash Building; Facility Location Map
	05008-C101, Rev. 4	September 26, 2006	Intermodal Container Wash Building; Plan Sheet
	05008-C102, Rev. 2 1	May 19, 2006	Intermodal Container Wash Building; Section A-A
	05008-C103, Rev. 3	May 19, 2006	Intermodal Container Wash Building; Section B-B
	05008-SL100, Rev. 5	August 23, 2006	Intermodal Container Wash Building; Sediment Basin Liner Plan

Table 5: Approved Engineering Design Drawings for Waste/Wastewater Related Facilities

Related Facility	Drawing No.	Last Revision	Subject / Title
	05008-SL101, Rev. 3	August 23, 2006	Intermodal Container Wash Building; Sediment Basin Liner Section A-A
	05008-SL102, Rev. 5	August 23, 2006September 1, 2005	Intermodal Container Wash Building; Sediment Basin Liner Section B-B
Decontamination Access Control Building	05015-G001, Rev. 1	February 23, 2006	Access Control Building; Map Layout and Index
	05015-C100, Rev. 1	February 23, 2006	Access Control Building; Facilities Location Map
	05015-C101, Rev. 2	February 23, 2006	Access Control Building; Floor Plan
	05015-C102, Rev. 2	February 23, 2006	Access Control Building; Elevations
	05015-C103, Rev. 3	February 23, 2006	Access Control Building, Typical Sections
	05015-C104, Rev. 0	February 23, 2006	Access Control Building, Site Layout and Gray Water Tank and Pipe
	05015-S100, Rev. 2	June 30, 2006	Access Control Building, 1000 Gallon Gray Water Tank
	05015-P100, Rev. 1	February 23, 2006	Access Control Building, Plumbing Plan
	05015-P101, Rev. 1	February 23, 2006	Access Control Building, Plumbing Details
East Side Drainage and Gray Water System Modifications	06007-G1, Rev. 5	2/26/06	East Side Drainage, Map Layout and Index
	06007-G2, Rev. 4	2/26/06	East Side Drainage, Notes and Specifications
	06007-C1, Rev. 5	2/26/06	East Side Drainage, General Site Plan
	06007-C2, Rev. 5	2/26/06	East Side Drainage, Storm Water Drainage Plan
	06007-C3, Rev. 5	2/26/06	East Side Drainage, Internal Container Wash Facility Gray Water System Plan
	06007-C4, Rev. 4	2/26/07	East Side Drainage, Decon Access Control Gray Water System
	06007-D1, Rev. 4	2/26/07	East Side Drainage, Section and Details
	06007-P1, Rev. 4	2/26/07	East Side Drainage, Pipelines #4 and #5 Alignments and Profiles
	06007-SL1, Rev. 3	3/14/07	East Side Drainage, Storm Water Lift Sump Plan
	06007-SL2, Rev. 3	3/14/07	East Side Drainage, Storm Water Lift Sump Section
	06007-SL3, Rev. 3	3/14/07	East Side Drainage, Storm Water Lift Sump Section
	06007-V1, Rev. 3	2/26/07	East Side Drainage, Storm Water and Waste Flow Diagram
	06007-P2, Rev. 1	4/5/07	Pipeline 4A and 5A Extension into the 1997 Pond

Northwest Corner Evaporation Pond	06021-G1	TBD	Northwest Corner Pond; Title Sheet
	06021-C1	TBD	Northwest Corner Pond; General Site Plan and Profile
	06021-C2	TBD	Northwest Corner Pond; Pond Plan View
	06021-C3	TBD	Northwest Corner Pond; Sections and Details
	06021-C4	TBD	Northwest Corner Pond; Sections and Details
	06021-C5	TBD	Northwest Corner Pond; Sump Plan, Sections, and Details
	06021-C6	TBD	Northwest Corner Pond; Leak Detection System Sections and Details
	06021-C7	TBD	Northwest Corner Pond; Leak Detection System Sections and Details

~~i.~~1. Drawings cited do not include numerous drawings that present information not directly related to waste or waste water containment. Drawings listed are Executive Secretary approved design drawings, which will be replaced later by final As-Built drawings after approval of the required As-Built Reports.

~~ii.~~2. TBD = to be determined after submittal and approval of the required As-Built drawings.

13. Authorized Mixed Waste Cell Engineering Design and Specifications

The best available technology standards for the Mixed Waste Cell shall be defined by those requirements mandated by the Utah Division of Solid and Hazardous Waste State-issued Part B Permit, issued April 4, 2003 (as amended), hereafter State-issued Part B Permit. All Mixed Waste Cell engineering design and specifications shall comply with State-issued Permit, Module V.

E. BAT Performance and Best Management Practice Standards

~~1~~14. Waste Restrictions

~~□~~d) Reserved.

~~b)~~e) 11e.(2) Waste – any change effecting the non-radiologic content of the waste to be disposed of in the 11e.(2) portion of the Class A South/11e.(2) Cell, including additional types or concentrations of non-radiologic contaminants, above and beyond those defined in Table 6 below, shall require prior approval from the Executive Secretary, after submittal of satisfactory technical justification to demonstrate that the requirements of Part I.D.1 of this Permit will be met.

~~c)~~f) Solid Waste Landfill Equivalency – PCB/Radioactive Waste as defined in the currently approved Appendix I shall only be disposed of as designated in Appendix I.

~~d)~~g) Mixed Waste, Class A, ~~and~~ Class A North, and Class A South portion of the Class A South/11e.(2) Cells – waste to be disposed of in the Mixed Waste, Class A, ~~and~~ Class A North, and Class A South portion of the Class A South/11e.(2) Cells shall be limited to wastes which meet the definition of Class A Low-Level Radioactive Waste (LLRW) under the Utah Radiation Control Rules, UAC R313-15-1008, or are defined as Naturally Occurring and Accelerator Produced Radioactive Materials under the Utah Radiation Control Rules, UAC R313-12-3

2.15. Prohibited Wastes

4.a) Hazardous Waste – the disposal of hazardous waste as defined by the Utah Hazardous Waste Management Rules (UAC R315-2-3) is prohibited in the Class A, Class A North, and Class A South/ and 11e.(2) Disposal Cells. The disposal of any LLRW Class A, or 11e.(2) waste that exceeds the regulatory concentration levels of the Toxic Characteristic Leaching Procedure (TCLP) as defined in 40 CFR Part 261 Subpart C, Table 1 is prohibited, unless specifically authorized in Part I.E.5 of this Permit orTable 6A, below. Waste samples shall be collected in accordance with the currently approved Waste Characterization Plan (Radioactive Materials License, Condition 58) or the Procedure for Certification of 11e.(2) Waste in the currently approved Appendix E of this Permit, and analyzed for those exclusive parameters listed in Table 6A, below and for PCB/Radioactive Waste, the currently approved Plan for the Management of Waste Containing Polychlorinated Biphenyls (PCBs), Appendix I. Leachate concentrations from the TCLP test shall not exceed the maximum allowable concentrations in Table 6A, below. The Permittee may use the results of Total analyses to determine whether a TCLP limit may be exceeded by dividing the total analytical result by 15 and comparing the quotient against the TCLP limit to determine if the waste is hazardous.

The disposal of any waste that exceeds the Maximum Allowable TCLP Leachate Concentration or Total Waste Concentration not listed in Part I.E.5 or in Table 6A is prohibited without prior written approval from the Executive Secretary. The disposal of any LLRWor 11e.(2) Waste which exceeds the TCLP regulatory concentrations for organic compounds identified in 40 CFR 261.24, Table 1, is expressly prohibited without prior written approval from the Executive Secretary.

Table 6A: Maximum Allowable Concentrations in 11e.(2) Waste

Parameter	TCLP Leachate Regulatory Limit (mg/l)	Total Waste Concentration (mg/kg)
Volatile Organic Compounds		
Acetone	n/a	10.0
2-Butanone	200.0	10.0
Carbon Disulfide	n/a	10.0
Chloroform	6.0	10.0
1,1-Dichloroethane	0.5	10.0
Diethyl Phthalate	n/a	80.0
Methylene Chloride	n/a	70.0
2-Methylnaphthalene	n/a	80.0
Naphthalene	n/a	80.0
1,1,2-Trichloroethane	n/a	7.27
Vinyl Chloride	0.2	0.66

b) Liquid Waste – acceptance of liquids and liquid content of all wastes shall be in accordance with the Radioactive Materials License.

c) Chelating Agents – the disposal of any waste containing chelating agents shall be limited to the Mixed Waste Cell and is prohibited in the Class A, Class A North, and Class A South/11e.(2) Disposal Cells. The disposal of any waste in the Mixed Waste Cell containing chelating agents in excess of 22% by weight is prohibited.

~~3.~~16. Failure to Construct as per Approval

Failure to construct any portion of the facility in compliance with the approved engineering design and specifications or in a manner inconsistent with the applicable LLRW and 11e.(2) CQA/QC ~~Plan~~ Manual (Radioactive Materials License UT 2300249, Condition 44) shall be cause for the Executive Secretary to require excavation of the materials and remedial construction, retrofit of the embankment or any other mitigative action to prevent the release of pollutants to soil or ground water.

~~4.~~17. Unsaturated Soil Moisture Content Monitoring

The Permittee shall conduct soil moisture content monitoring to verify performance of the engineered containment systems for the LARW, ~~11e.(2),~~ Class A, ~~and~~ Class A North, and Class A South/11e.(2) Disposal Cells in accordance with the requirements of Part 1.H.17 of this Permit and Radioactive Material License Condition 28. This monitoring shall consist of instrumentation, as approved by the Executive Secretary, installed in the Cover Test Cell.

The Permittee shall maintain and replace all soil moisture instrumentation as directed by the Executive Secretary.

The Executive Secretary reserves the right to require similar soil moisture content monitoring in the radon barrier at the 11e.(2) Cell. The Permittee shall install and make operational any soil moisture instrumentation in compliance with the schedule to be determined by the Executive Secretary.

~~5.~~18. Allowable Hazardous Waste

Waste containing any of the following non-radionuclide metals: Arsenic, Barium, Cadmium, Chromium, Copper, Lead, Mercury, Selenium, Silver, and Zinc can be disposed of in the Class A, Class A North, ~~or~~ or Class A South/11e.(2) Cells at any concentrations.

~~6.~~19. Open Cell Time Limitation

For each open portion of any disposal cell, the radon barrier shall be constructed and completed in accordance with the approved engineering plans and specifications (Part I.D.2, 3, and 4) within 12 years of the date of initial placement of the first lift of any LLRW waste in that portion of the open cell. Any modification of this 12-year limitation shall require submittal of ground water flow and contaminant transport modeling of open cell conditions or other technical information as necessary, and prior Executive Secretary approval. Said modeling report or other studies must be submitted in their entirety to the Executive Secretary 180 days prior to the expiration date of the respective 12-year open cell time limit. Failure to secure Executive Secretary approval prior to expiration of the 12-year deadline shall not be cause for the Permittee to postpone construction of the cover of any cell in accordance with the currently approved engineering design and specifications in Part I.D.2 or 3 or 4 of this Permit.

~~7.~~20. General Stormwater Management Requirements

The Permittee shall not begin pumpage or remove stormwater that falls inside the restricted area that has not contacted the waste (i.e., non-contact stormwater) before beginning removal of contact stormwater. The Permittee shall contain all stormwater runoff at the Class A, Class A North, and Class A South/11e.(2) Disposal Cells which has contacted the waste (i.e., contact stormwater), including runoff from:

~~d)~~a) Waste disposed in excavated, below grade, areas of the Class A, Class A North, and Class A South/11e.(2) Disposal Cells, and

b) Reserved

c) Within 24 hours of discovery of an accumulation of contact stormwater, the Permittee shall immediately begin pumpage and removal of said wastewater in compliance with the following priority schedule, ranked from highest to lowest priority:

   1) Contact stormwater inside the footprint of the Class A, Class A North, and Class A South/11e.(2) Disposal Cells,

   2) Contact stormwater at the Rollover Facility, and

   3) Contact stormwater at the Intermodal Unloading Facility.

The Permittee shall pump and remove contact stormwater in an uninterrupted manner until it is completely removed from said location. Under no circumstance will the Permittee begin pumpage and removal of contact stormwater at a lower priority location without first completing removal at all higher priority location(s).

d) All contact stormwater accumulated and pumped shall be disposed of in the evaporation ponds only as explicitly approved by the Executive Secretary. However, contact stormwater from the Class A, Class A North, and Class A South/11e.(2) disposal cells may be used for minimal engineering and dust control purposes on the waste in the Class A, ~~and~~ Class A North, and the Class A South portion of the Class A South/11e.(2) disposal cells.

e) Class A North Containerized Waste Facility and Large Component Evaporation Basin – precipitation that falls on the Class A North Containerized Waste Facility and Large Component Area shall be allowed to accumulate in an engineered evaporation basin constructed in accordance with the following conditions:

1) The evaporation basin shall be constructed in accordance with the design specifications in engineering drawings listed in Table 5 for the Class A North Embankment and the requirements of the currently approved Construction Project Plan for the LLRW Embankment.
2) Fluid head in the evaporation basin shall not exceed a 1-foot level above the lowest point of the bottom clay liner of the basin. The occurrence of fluid levels above this 1-foot maximum allowable head limit shall constitute a violation of this Permit.
3) The Permittee shall ensure that the physical integrity of the clay liner is not compromised by desiccation or freeze/thaw cycles by implementing quality assurance/quality control requirements in the currently approved Construction Project Plan for the LLRW Embankment.

~~8.~~21. 11e.(2) Waste Management Requirements

The Permittee shall manage the 11e.(2) Waste and related activities at the facility in accordance with all applicable requirements of the currently approved Radioactive Materials License for the following activities and procedures:

~~1.~~a) Spill response and prevention

b) Runon and runoff containment

c) Decontamination of vehicles, equipment, and containers

d) Unloading procedures

e) Waste storage time limits

f) Stormwater/wastewater collection and disposal

g) Leaking waste shipments

In addition, the Permittee shall manage 11e.(2) waste storage and handling in compliance with the containment and spill prevention requirements of Part I.E.10.a of this Permit.

~~9.~~22. 11e.(2) Waste Storage

Storage of 11e.(2) waste at the facility shall be explicitly limited to areas within the confines of the 11e.(2) portion of the Class A South/11e.(2) Disposal Cell~~s~~ having completed and approved clay liner.

~~10.~~23. Class A, ~~and~~ Class A North, and Class A South ~~Cell~~ Waste Management Performance Requirements

The Permittee shall operate and maintain all facilities in compliance with the following performance requirements:

~~2.~~a) Contaminant Containment and Spill Prevention – the Permittee shall manage all site operations to:

1) Prevent contact of wastes with the ground surface.

2) Prevent spills of wastes or liquids contained therein from any contact with the ground surface or ground water.

3) Prevent contact of surface water or stormwater run-on with the waste.

4) Control any runoff, which may have contacted the waste from subsequent contact with the ground surface or ground water by means of approved engineering containment. Any accumulations of such contact runoff or leachates shall be immediately removed and placed for evaporation disposal in the approved evaporation ponds.

5) Prevent wind dispersal of wastes.

6) Minimize the time any waste is held in temporary storage without disposal in the embankment. In no case shall any waste be stored beyond 365 days after date of waste entry into the controlled area.

7) Identify all wastes held in storage by use of clear and legible placards, signs, or labels which identify the generator, waste stream number and dates that said waste or waste container both entered the controlled area and was placed into temporary storage.

8) Maintain all waste containers in a closed, strong tight and watertight condition.

9) Open-air storage of PCB/Radioactive waste is prohibited. PCB/Radioactive waste located within a disposal cell must be covered at the end of the working day with soil or non-PCB soil-like waste material, or other cover systems (i.e., tarps) to prevent wind dispersal.

10) All containers in storage shall be inspected daily.

11) Waste in bags shall be managed as bulk waste.

b) Containerized Waste Storage Pad – the Permittee shall operate and maintain waste containers and the asphalt surface of the Containerized Waste Storage Pad so as to prevent the discharge of stormwater or leachate to subsurface soils or ground water, by completing the following actions. Also, for PCB/Radioactive Waste, the currently approved Plan for the Management of Waste Containing Polychlorinated Biphenyls (PCBs), Appendix I as applicable:

1) Repair or otherwise seal and render impermeable any and all cracks, ruptures, damage, or porous areas found in the asphalt surface as soon as possible after discovery.

2) Fill any areas of subsidence and return the asphalt surface to its original design grade permeability, and appearance, in order to prevent the impoundment of any storm water or leachate on the pad as soon as possible after discovery.

3) Prevent contact of waste with precipitation or stormwater by maintaining all containers in a closed and watertight condition.

4) Manage leaking containers in accordance with the Waste Characterization Plan and Radioactive Materials License.

5) Adequately operate and maintain the stormwater collection sump, pump, and pipeage to ensure containment and conveyance of stormwaters to the approved evaporation ponds . Under no circumstances are stormwaters to be maintained in the collection sump for more than 72 hours at any time.

c) Prohibition and Restrictions for Dry Active Waste Storage – dry active waste is defined as contaminated materials without soil-like texture or characteristics, and have a dry weight density of 70 pounds per cubic foot or less (e.g., contaminated paper, plastic, personal protective equipment, cloth, or other similar soft-type debris). Open-air storage of dry active waste is prohibited at the facility. All temporary storage of dry active waste shall be conducted either inside buildings or in watertight containers at the Containerized Waste Storage Pad. Dry active waste located within a disposal cell must be covered at the end of the working day with soil or soil-like waste material to prevent wind dispersal.

d) Intermodal Unloading Facility – the Permittee shall operate and maintain the LLRWIntermodal Unloading Facility to provide free draining conditions on both the unloading pad and in the stormwater drainage pipeline system.

e) Containerized Waste Management – the following locations are approved for management and storage of Class A waste received in containers (does NOT include waste received for disposal in the Containerized Class A Facility):

- Containerized Waste Storage Pad
- Intermodal Unloading Facility
- Railcar Rollover Facility
- East Truck Unloading Facility
- Decontamination Facilities (Box Wash, Rail Car Wash Track #2 and #4)
- Class A ~~and Class A North~~ Disposal Cells
- Shredder Facility
- Rotary Dump Facility

f) Bulk Waste Management – the following locations are approved for management and storage of bulk Class A waste:

- Intermodal Unloading Facility
- Railcar Rollover Facility
- East Truck Unloading Facility (raised dock area excluded)

- Decontamination Facilities (Box Wash, Rail Car Wash Track #2 and #4)
- Class A ~~and Class A North~~ Disposal Cells
- Rail Digging Facility (bulk waste transfer only, waste storage prohibited)
- Shredder Facility in accordance with requirements in the currently approved Appendices I and J
- Rotary Dump Facility

~~11.~~24. LARW, Class A, Class A North, Class A South portion of the Class A South/11e.(2) Cell Collection Lysimeters: Operation, Maintenance and Annual Inspection

The Permittee shall operate and maintain all collection lysimeters in compliance with the currently approved Appendix C of this Permit. Said operation shall include at least an annual video log inspection of each collection lysimeter constructed at the LARW, Class A, ~~and~~ Class A North, and Class A South portion of the Class A South/11e.(2) Cells. Each video inspection shall log the entire length of the drainage pipe to ensure proper operation and free drainage of each collection lysimeter. Failure to satisfactorily complete an annual video log inspection or a determination that free draining conditions no longer exist in a collection lysimeter shall constitute failure to maintain best available technology pursuant to Part I.G.4 of this Permit. Such failures shall be reported to the Executive Secretary in accordance with the requirements of Part I.H.10 of this Permit.

~~12.~~25. Stormwater Drainage Works Performance Criteria

All stormwater drainage works constructed and operated at the LARW, Class A, Class A North, and Class A South/-11e.(2) facilities shall be performed in accordance with the following criteria:

~~3.~~a) Seepage Control to Prevent Ground Water Mounding – all drainage works at the facility shall be constructed of either low-permeability clay liner materials or of an impermeable man-made conveyance in order to control and prevent any alteration of local natural ground water hydraulic gradients or velocities. This infiltration control shall address seepage during periods of storm water storage in the drainage system.

b) Free Drainage – all stormwater drainage works shall be free draining and under gravity conditions shall convey stormwater from the contributing facilities to an off-site location.

c) Temporary Stormwater Drainage Works – plans and specifications for any temporary stormwater drainage works shall be submitted for Executive Secretary review and approval prior to installation. As-Built reports shall be submitted for Executive Secretary approval within 30 days following installation. Prior to site closure, the Permittee shall remove all temporary stormwater drainage works (e.g., drainage grates, piping, ditches, etc. not approved under Part I.D.4) as part of the site Decontamination and

Decommissioning Plan required under Radioactive Materials License, Condition 74.

~~13.~~26. Reserved

~~14.~~27. Wastewater Management Requirements

The Permittee shall operate and maintain all wastewater storage, treatment, and disposal facilities in accordance with Best Available Technology requirements approved by the Executive Secretary, as follows:

~~4.~~a) 1995, 1997, 2000, Mixed Waste, and Northwest Corner Evaporation Ponds – the Permittee shall operate and maintain the 1995, 1997, 2000 , and Northwest Corner evaporation ponds and the Mixed Waste evaporation pond to prevent release of fluids to subsurface soils or groundwater, in accordance with the following requirements:

1) Leak Detection System Pumping and Monitoring Equipment Continuous Operation – the Permittee shall provide continuous operation of the leak detection system pumping and monitoring equipment, including, but not limited to, the submersible pump, pump controller, head/pressure transducer, and flow meter equipment approved by the Executive Secretary. Failure of any pumping or monitoring equipment not repaired and made fully operational within 24 hours of discovery shall constitute failure of Best Available Technology and a violation of this Permit.

2) Maximum Allowable Daily Leakage Volumes – the Permittee shall measure the daily volume of all fluids pumped from the respective leak detection systems of the 1995, 1997, 2000, Mixed Waste, and Northwest Corner evaporation ponds. Under no circumstance shall the daily leak detection system flow volume, as determined pursuant to Part I.F. a.3, exceed the following limits:

~~c)~~i.	1995 Evaporation Pond:	162 gallons/day
~~d)~~i.	1997 Evaporation Pond:	171 gallons/day
~~e)~~i.	Mixed Waste Evaporation Pond:	171 gallons/day
~~f)~~i.	2000 Evaporation Pond:	382 gallons/day
~~g)~~i.	Northwest Corner Evaporation Pond:	326 gallons/day

Daily leak detection system flow volumes in excess of these limits shall constitute failure of Best Available Technology and a violation of this Permit.

3) Maximum Allowable Head – the Permittee shall measure fluid head in the respective leak detection sumps of the 1995, 1997, 2000, the Mixed Waste, and Northwest Corner evaporation ponds by use of pressure transducer equipment approved by the Executive Secretary. Under no circumstance shall fluid head in the leak detection system sump exceed a 1-foot level above the lowest point in the lower flexible

membrane liner. The occurrence of leak detection system fluid levels above this 1-foot limit shall constitute failure of Best Available Technology and a violation of this Permit.

4) 2-foot Minimum Vertical Freeboard Criteria – the Permittee shall operate and maintain at least 24 inches of vertical freeboard in the 1995, 1997, 2000, Mixed Waste, and Northwest Corner evaporation ponds to ensure total containment of fluids. This vertical distance shall be determined by use of a gauging station approved by the Executive Secretary. If at any time the Permittee operates the pond with less than 24 inches of vertical freeboard, such operation shall constitute failure of Best Available Technology and a violation of this Permit.

5) PCB Monitoring – the Permittee shall monitor for PCBs according to the requirements of this Permit, or its appendices, or as required by the Executive Secretary.

b) Box-Washing Facility – the Permittee shall operate and maintain the Box-Washing Facility to ensure:

1) Free draining conditions exist across the floor to the wastewater collection sumps.

2) The integrity of the concrete working surface to prevent discharge.

3) Water level is maintained below the collection sump grate.

4) Maintenance of a freeboard in each concrete wastewater storage tank (at or below three fourths full).

c) Rail Car Wash Facilities – the Permittee shall operate and maintain the new Rail Car Wash Facility on Track No. 4 and the old Rail Car Wash Facility on Track No. 2 in accordance with the currently approved BAT Performance Monitoring Plan and BAT Contingency Plan in Appendices J and K, respectively of this Permit.

~~15.~~28. Filter Construction Settlement Performance Standards

Cover system filter placement shall begin only after the Permittee demonstrates that 95% of the maximum consolidation has been achieved at the upper surface of the radon barrier. Any filter construction undertaken without this demonstration and prior Executive Secretary approval shall constitute a violation of this Permit.

~~16.~~29. Mixed Waste Cell BAT Performance and Best Management Practice Standards

Performance and best management practice standards for waste storage, and stormwater and wastewater storage, treatment, and disposal at the Mixed Waste Cell shall be defined by requirements mandated by the State-issued Part B Permit.

~~17.~~30. Railcar Rollover Facility BAT Performance and Best Management Practice Standards

The Permittee shall operate and maintain the railcar rollover facility to ensure the physical integrity and the asphalt ramps and concrete bay to prevent discharge to the subsurface. Daily inspections shall be documented to ensure compliance with the stormwater management requirements in Part I.E.7c.2.

On an annual basis during the second quarter of each year, the Permittee shall remove all waste from the facility, pressure wash all surfaces to remove all foreign material, and inspect the entire concrete bay and asphalt ramps of the rollover facility. The Permittee shall repair or otherwise seal and render impermeable any and all cracks, ruptures, damage, or porous areas prior to resuming use of the facility. The Permittee shall submit a written notice of inspection to the Executive Secretary at least one week prior to the annual inspection to allow the Executive Secretary the opportunity to have a DRC representative present.

~~18.~~31. Evaluation of Effect of Proposed Pumping Well(s)

The Permittee will evaluate the effect of any proposed pumping well at the facility on the local ground water flow field and ground water monitoring. This evaluation will be undertaken with the use of analytical or numeric ground water flow models, which conform to the guidance provided to the Permittee by the Bureau of Radiation Control in the November 26, 1990 Notice of Deficiency, Comment WPC-1 K. The Permittee will submit the results of this evaluation and receive Executive Secretary approval before any construction of the withdrawal well.

~~19.~~32. Management of 2000 Evaporation Pond Waste Material

The Permittee shall dispose of all waste material generated during the everyday use and operation of the pond in the Class A, ~~or~~ Class A North, or Class A South portion of the Class A South/11e.(2) Cell only. Waste material includes, but is not limited to: sludge, soil contaminated from spills or releases, miscellaneous debris, and material or equipment repaired or replaced such as synthetic liner, pumps, piping, cables, floats, etc. All material associated with the final demolition of the pond, including underlying contaminated soil, must be disposed of in the Class A, ~~or~~ Class A North, or Class A South portion of the Class A South/11e.(2) Cell and is expressly prohibited from disposal in the 11e.(2) portion of the Class A South/11e.(2) cell.

~~20.~~33. Shredder Facility

The Permittee shall operate and maintain the Shredder Facility:

a) In accordance with the currently approved BAT Performance Monitoring Plan and BAT Contingency Plan in Appendices J and K, respectively of this Permit.

b) To ensure the physical integrity of all concrete surfaces to prevent discharge to subsurface soils or ground water.

c) On an annual basis during the second quarter of each year, the Permittee shall remove all waste from the Shredder Facility, pressure wash all surfaces to remove all foreign material, and inspect all concrete surfaces. The Permittee shall repair or otherwise seal and render impermeable any and all cracks, ruptures, damage, or porous areas prior to resuming use of the facility. At least one week prior to the annual inspection the Permittee will submit written notice to allow the Executive Secretary the opportunity to have a DRC representative present.

d) To ensure that free draining conditions over the entire concrete pad to each of the seven catch basins, and to ensure the water level in each catch basin is below its respective grate.

e) To ensure wastewater level in Manhole #1 is maintained at or below the invert to the outlet pipe, and free draining conditions exist in the conveyance pipe to the Rotary Dump Sediment Basin.

~~21.~~34. Rotary Dump Facility

The Permittee shall operate and maintain the Rotary Dump Facility::

~~I.A.33.1~~a) In accordance with the currently approved BAT Performance Monitoring Plan and BAT Contingency Plan in Appendices J and K, respectively of this Permit.

b) To ensure the physical integrity of all concrete surfaces to prevent discharge to subsurface soils or ground water.

c) On an annual basis during the second quarter of each year, the Permittee shall remove all waste from the Rotary Dump Facility and pressure wash all surfaces to remove all foreign material, and inspect all surface areas of the concrete access drives and concrete floor of the Rotary Dump Building. The Permittee shall repair or otherwise seal and render impermeable any and all cracks, ruptures, damage, or porous areas prior to resuming use of the facility. At least one week prior to the annual inspection, the Permittee shall submit written notice to allow the Executive Secretary the opportunity to have a DRC representative present.

d) To ensure that free draining conditions exist in all wastewater transfer pipes without release or discharge to subsurface soils or ground water.

e) To ensure the leak detection annulus of the sediment basin is free of fluids.

f) To ensure the water level in the sediment basin is below the level of the grate covering the pump sump.

g) The dual-walled pipe used to transfer fluids from the sediment basin is free draining, and the leak detection annulus within the secondary pipe is free of fluids.

~~22.~~35. Intermodal Container Wash Building

The Permittee shall operate and maintain the Intermodal Container Wash Building:

~~1)~~a) In accordance with the currently approved BAT Performance Monitoring Plan and BAT Contingency Plan in Appendices J and K, respectively of this Permit.

b) To ensure free draining conditions exist:

~~5).~~i. Within each wash bay and trench drain to the sediment basin, and

~~6).~~ii. From each boot wash station to the sediment basin.

c) To ensure the integrity of all concrete surfaces to prevent discharge of waste water to subsurface soils or ground water.

d) To ensure the sediment basin provides a total containment system and does not cause a direct or in-direct discharge to subsurface soils or ground water.

e) To ensure the water level in the sediment basin is always maintained below the grate located over the pump sump.

f) To ensure the leak detection annulus of the sediment basin is free of liquids.

g) To ensure the dual-walled pipe used to transfer fluids from the sediment basin is free draining, and the leak detection annulus within the secondary pipe is free of fluids.

~~23.~~36. Decontamination Access Control Building

The Permittee shall operate and maintain the Decontamination Access Control Building:

a) In accordance with the currently approved BAT Performance Monitoring Plan and BAT Contingency Plan in Appendices J and K, respectively of this Permit.

b) To ensure free draining conditions exist from the bootwash and all graywater lines (i.e., eyewash, emergency shower, respirator wash sink, etc.) to the underground wastewater collection tank located outside the southeast corner of the building.

c) To ensure the dual-walled leak detection annulus of the wastewater collection tank is maintained free of fluids.

d) To ensure the fluid level in the wastewater collection tank is maintained below the invert of the inlet pipe.

e) To ensure the dual-walled piping from the wastewater collection tank to the 1997 Evaporation Pond via the East Side Drainage System is free draining and the leak detection annulus within the secondary pipe remains free of fluids.

~~24.~~37. East Side Drainage Project

The Permittee shall operate and maintain the East Side Drainage Project:

~~a)~~f) In accordance with the currently approved BAT Performance Monitoring Plan and BAT Contingency Plan in Appendices J and K, respectively, of the Permit.

b)g) To ensure the leak detection annulus of the dual-walled piping system is always maintained free of fluids, including the drip pans found inside manholes #1 and #2.

c)h) To ensure the fluid level in the 11 stormwater catch basins is always maintained below the level of their respective outlet pipes

d)i) To ensure the stormwater, graywater, and wastewater piping throughout the entire East Side Drainage Project remains free draining at all times.

e)j) To ensure the fluid level in the stormwater lift sump is always maintained below the level of the inlet piping.

F. Compliance Monitoring

1.38. Compliance Monitoring Wells

Ground water monitoring wells used as compliance monitoring points shall meet the following requirements:

a) LARW, Class A, Class A North, Class A South, and 11e.(2) Compliance Monitoring Wells – the following wells shall be sampled and analyzed for purposes of compliance monitoring:

1) LARW Cell – existing wells GW-128, GW-16R, GW-20, GW-22, GW-23, GW-24, GW-29, GW-56R, GW-64, GW-77, GW-103, GW-104, and GW-105.

2) 11e.(2) portion of the Class A South/11e.(2) Cell – existing wells GW-19A, GW-20, GW-24, GW-25, GW-26, GW-27, GW-28, GW-29, GW-36, GW-37*, GW-38R*, GW-57, GW-58, GW-60, GW-63, GW-92, GW-93, GW-126, and GW-127.

* Wells 37 and 38R shall be monitored only for ground water elevations.

3) Class A Cell – existing wells GW-81, GW-82, GW-83, GW-84, GW-85, GW-86, GW-88, GW-89, GW-90, GW-91, GW-92, GW-93, GW-94, GW-95, GW-99, GW-100, GW-101, and GW-102.

4) Class A North Cell – existing wells GW-106, GW-107, GW-108, GW-109, GW-110, GW-111, GW-112, GW-113, GW-114, GW-115, GW-116, GW-117, and GW-125.

5). Class A South portion of the Class A South/11e.(2) Cell- existing wells GW-19A, GW-25, GW-26, GW-27, GW-28, GW-57, GW-58, GW-63, GW-94, GW-95, and the horizontal well under the Class A South/11e.(2) Clay Barrier.

b) Mixed Waste Cell Compliance Monitoring Wells (radiologic contaminants only) – including wells defined on drawing 0201-KO6 Rev. B, dated January 6, 2003, shall be sampled and analyzed for purposes of compliance monitoring, as follows: GW-41, GW-42, GW-67, GW-68, GW-69, GW-70,

GW-118, GW-119, GW-120, GW-121, GW-122, GW-123R, GW-124, and I-1-30.

c) Evaporation Pond Monitoring Wells – monitoring wells P3-95 NECR, P3-95 SWC, and P3-97 NECR shall be sampled and analyzed for purposes of compliance monitoring for the 1995 and 1997 Ponds, well GW-66R shall be sampled and analyzed for purposes of compliance monitoring for the Mixed Waste Pond, and wells GW-19A, GW-36, and GW-58 shall be sampled and analyzed for purposes of compliance monitoring for the 2000 Evaporation Pond in addition to the 11e.(2) portion of the Class A South/11e.(2)cell. Monitoring well GW-129 shall be sampled and analyzed for purposes of compliance monitoring for the Northwest Corner Evaporation Pond.

d) Well Construction Criteria – any ground water monitoring well used as a compliance monitoring point shall be:

1) Located hydrologically downgradient of waste disposal,

2) Completed exclusively in the uppermost aquifer,

3) Located as close as practicable to the waste and no more than 90 feet from edge of waste,

4) Constructed in conformance to guidelines found in the EPA RCRA Ground Water Monitoring Technical Enforcement Guidance Document, 1986, OSWER-9950.1.

e) Well Network Early Warning Requirement – any network of ground water monitoring wells used as points of compliance shall be adequately constructed, both in location and spacing, to provide early warning of a contaminant release from a waste embankment before the contaminant leaves the embankment's 100-foot wide buffer zone, as defined in Table 7, below. For purposes of this Permit, early warning shall be provided by a compliance monitoring well network with an inter-well spacing distance to be approved by the Executive Secretary.

f) Buffer-Zone Requirements – waste disposal is prohibited inside the buffer zone, as described in Tables 3 and 7 of this Permit.

Table 7: Buffer Zone Boundary Locations

Disposal Cell	Edge of Buffer Zone Position	Coordinates	
		Latitude	Longitude
LARW	NW Corner	40° 41' 11.839937" N	113° 6' 52.144756" W
	SW Corner	40° 40' 51.390522" N	113° 6' 52.483065" W
	SE Corner	40° 40' 51.242105" N	113° 6' 35.313888" W
	NE Corner	40° 41' 11.689043" N	113° 6' 35.074346" W
Class A	NW Corner	40° 41' 28.993053" N	113° 7' 25.146795" W
	SW Corner	40° 41' 13.186476" N	113° 7' 25.452238" W
	SE Corner	40° 41' 12.729096" N	113° 6' 53.528644" W
	NE Corner	40° 41' 28.535969" N	113° 6' 53.222876" W
Class A North	NW Corner	40° 41' 39.45503" N	113° 7' 24.88218" W
	SW Corner	40° 41' 29.49834" N	113° 7' 25.11180" W

Table 7: Buffer Zone Boundary Locations

Disposal Cell	Edge of Buffer Zone Position	Coordinates	
		Latitude	**Longitude**
	SE Corner	40° 41' 29.09492" N	113° 6' 54.99235" W
	NE Corner	40° 41' 39.05149" N	113° 6' 54.76161" W
Class A South portion of the Class A South/11e.(2)	NW Corner	40° 41' 13.587"N40° 41' 13.520469" N	113° 07' 25.832"W113° 7' 25.336344" W
	SW Corner	40° 40' 54.077"N40° 40' 54.015381" N	113° 07' 26.070"W113° 7' 25.983192" W
	SE Corner	40° 40' 53.935"N40° 40' 53.624289" N	113° 07' 06.222"W113° 7' 8.390974" W
	NE Corner	40° 41' 13.445"N40° 41' 13.134998" N	113° 07' 05.980"W113° 7' 7.749387" W
11e.(2) portion of the Class A South/11e.(2)	NW Corner	40° 41' 13.446" N40° 41' 40' 13.520469" N	113° 07' 06.136" W113° 7' 25.336344" W
	SW Corner	40° 40' 53.936" N40° 40' 54.015381" N	113° 07' 06.378" W113° 7' 25.983192" W
	SE Corner	40° 40' 53.849" N40° 40' 53.390682" N	113° 06' 54.279" W113° 6' 54.216013" W
	NE Corner	40° 41' 13.359" N40° 41' 12.901791" N	113° 06' 54.037" W113° 6' 53.560833" W

g) Protection of Monitoring Network – all compliance monitoring wells must be protected from damage due to surface vehicular traffic or contamination due to surface spills. All monitoring wells shall be maintained in full operational condition for the life of this Permit.

The criteria for determining full operational condition are:

1) Accessibility – each well must be accessible for sampling and shall not be located in an area of standing water.

2) Casing Measuring Point – each well shall have a permanent surveyed reference point such as the top of the protective casing.

3) Physical Integrity – any physical disturbance to any well, which may alter the surveyed water level measuring point, is prohibited. In addition, all wells shall have an adequate surface seal around the well casing to prevent surface or storm water from entering the well.

4) Chemical Integrity – all well and sampling materials shall be constructed of inert materials to prevent the introduction of contaminants from leaching or corrosion.

5) Silt Content – if the measured water column of any well is less than 90% of the theoretical water column, the monitoring well shall be redeveloped prior to sampling.

Any well that becomes damaged beyond repair or is rendered unusable for any reason will be replaced by the Permittee within 90 days or as directed by the Executive Secretary.

2.39. BAT Compliance Monitoring Points

The Permittee shall inspect, sample, analyze, or otherwise monitor other points of compliance in order to confirm compliance with this Permit. These points or instruments shall include:

a)h) East Truck Unloading Area – including monitoring of free draining conditions to the stormwater collection troughs, water level in the collection troughs, and physical condition/integrity of all exposed asphalt and concrete surfaces.

b)i) LARW, Class A, and Class A North, and Class A South Cell Collection Lysimeters – all collection lysimeters constructed at the LARW, Class A, and Class A North, and Class A South portion of the Class A South/11e.(2) Cells in accordance with the requirements of Part I.D.10 of this Permit.

c)j) LARW Containerized Waste Storage Pad – including monitoring of water in the stormwater collection sump and physical condition of containers on the pad.

d)k) 1995, 1997, 2000, Mixed Waste, and Northwest Corner Evaporation ponds – including monitoring of: 1) vertical freeboard at the water level gauging stations approved by the Executive Secretary, 2) operational status and required BAT performance parameters of all leak detection pump-back system equipment, including but not limited to, leak detection system pump, head pressure transducer, and flow meters required by Part I.E.13.a.2 of this Permit and approved by the Executive Secretary.

e)l) Intermodal Unloading Facility – including monitoring of free draining conditions at both the unloading pad and throughout the length of the contact stormwater drainage discharge pipeline that discharges to the 1995 and 1997 evaporation ponds.

f)m) Box-Washing Facility – including monitoring of free draining conditions, physical condition and integrity of concrete floor and floor sumps, sump pump in floor sump is operational, free drainage is maintained through the pipeline discharging wastewater into the concrete holding tanks, and water level in concrete holding tanks is maintained at or below three-quarters full.

g)n) Track No. 4 and Track No. 2 Rail Car Wash Facilities – including monitoring of free draining conditions and physical condition and integrity of rail bay concrete floor, floor sumps, conveyance pipe, Collected Water Receiver Tank, Filtered Water Storage Tank, and concrete secondary containment vault.

h)o) Rail Digging Facility – including monitoring of free draining conditions to the concrete collection basins and throughout the drainage system after the collection basins, and physical integrity of the asphalt and concrete surfaces.

~~i)~~p) Shredder Facility – including monitoring to determine:

1) Free draining conditions throughout the concrete surfaces to the seven catch basins,

2) Physical integrity of all concrete surfaces,

3) Water level at each catch basin and manhole, and

4) Free draining conditions of all wastewater transfer piping.

~~j)~~q) Rotary Dump Facility – including monitoring to determine:

1) Free draining conditions, physical condition, and integrity of all concrete surfaces,

2) Presence or absence of fluids in the Sediment Basin leak detection annulus,

3) Water level in the sediment basin,

4) Free draining conditions in all wastewater transfer piping, and

5) Presence or absence of fluids in the leak detection annulus within the secondary pipe of all dual-walled wastewater transfer piping systems.

~~k)~~r) Intermodal Container Wash Building – including monitoring to determine:

1) Free draining conditions, physical condition, and integrity of concrete floor and floor trenches,

2) Presence or absence of fluids in the sediment basin leak detection annulus,

3) Fluid level in the sediment basin, and

4) Presence or absence of fluids in the leak detection annulus within the secondary pipe of all dual-walled wastewater transfer piping systems.

~~l)~~s) Decontamination Access Control Building – including monitoring to determine:

1) Free draining conditions in all wastewater transfer piping,

2) Presence or absence of fluids in the gray water collection tank leak detection annulus,

3) Water level in the gray water collection tank, and

4) Presence or absence of fluids in the leak detection annulus within the secondary pipe of all dual-walled wastewater transfer piping systems.

~~m)~~t) East Side Drainage Project – including monitoring to determine the presence or absence of fluids in the leak detection annulus within the secondary piping of all dual-wall wastewater transfer systems. All dual-walled pressurized pipe connected to the East Side Drainage Project, that does not gravity drain to a leak detection port, including both primary and secondary piping, shall be pressure tested annually by an independent Professional Engineer registered in the State of Utah.

~~3.~~40. Future Modification of Compliance Monitoring Systems or Equipment

If at any time the Executive Secretary determines that additional systems, mechanisms or instruments are necessary to monitor ground water quality or Best Available Technology compliance at the facility, the Permittee shall submit within 30 days of receipt of notification, a plan and compliance schedule to modify the compliance monitoring equipment, for Executive Secretary approval. Any failure to construct the required compliance monitoring system or equipment in accordance with the approved plan and schedule shall constitute a violation of this Permit.

~~4.~~41. Compliance Monitoring Period

Monitoring shall commence upon issuance of this Permit, or upon:

a) Completion of each collection lysimeter in accordance with Part I.D.11 of this Permit and

b) Completion of the soil moisture instrumentation required by Part I.E.4.

Thereafter, compliance monitoring shall continue through the life of the Permit.

~~5.~~42. Monitoring Requirements and Frequency

Measurements or analysis done for monitoring will be conducted in compliance with the requirements below, and reported to the Executive Secretary as per the requirements of Part I.H.

a) Water Level Measurements – water level measurements shall be made monthly in each monitoring well and piezometer. Measurements made in conjunction with semiannual ground water sampling shall be completed prior to any collection of ground water samples in accordance with the currently approved Water Monitoring Quality Assurance Plan in Appendix B of this Permit. These measurements will be made from a permanent single reference point clearly demarcated on the top of the well or surface casing. Measurements will be made to the nearest 0.01 feet.

b) Specific Gravity Measurements – ground water-specific gravity measurements shall be made semiannually in each monitoring well and piezometer in conjunction with each semiannual ground water quality sampling event.

c) Ground Water and Pore Water Quality Sampling and Analysis – except for arsenic and molybdenum, grab samples of ground water from compliance monitoring wells and pore water from lysimeters (as available) will be collected for chemical analysis on a semiannual basis, in conformance with Part II.A and B and the currently approved Water Monitoring Quality Assurance Plan in Appendix B of this Permit.

1) Ground/Pore Water Analytical Methods – methods used to analyze ground water samples must comply with the following:

i. Are methods cited in UAC R317-6-6.3A(13) or have been approved by the Executive Secretary in the currently approved Water Monitoring Quality Assurance Plan, Appendix B of this Permit, and

ii. Have detection limits which do not exceed the Ground Water Quality Standards or Protection Levels listed in Tables 1A and 1C of this Permit.

2) Analysis Parameters – the following analyses will be conducted on all samples collected for ground water monitoring:

i. Field Parameters – dissolved oxygen, pH, temperature, specific gravity, and specific conductance.

Laboratory Parameters – including:

- General Inorganic Parameters: Chloride, Sulfate, Carbonate, Bicarbonate, Sodium, Potassium, Magnesium, Calcium, bromide, iron, and total anions and cations
- Total PCBs if requested by the Executive Secretary according to the currently approved Plan for the Management of Waste Containing Polychlorinated Biphenyls (PCBs), Appendix I
- General Radiologic Parameters: potassium-40, gross beta
- All Protection Level Parameters – individual analysis for all parameters found in Part I.C, Tables 1A, 1B, 1C, 1D, 1E, and 1F of this Permit
- Radiologic Parameters for Wells at the 11e.(2) Cells, including: radium-226, radium-228, thorium-230, thorium-232, and total uranium

3) Arsenic and Molybdenum – arsenic and molybdenum samples will be collected for chemical analysis every 5 years at License and Permit renewal.

~~6.~~43. Collection Lysimeter Sampling

Collection lysimeter sampling shall be conducted in compliance with the currently approved Water Monitoring Quality Assurance Plan approved by the Executive Secretary, as provided in Appendix B of this Permit. Sample analysis shall conform to the requirements of Part I.F.5(c) of this Permit.

Water quality samples shall be collected within 24 hours of initial discovery of fluid. The priority of sample parameters shall conform to the currently approved Appendix C of this Permit, with special emphasis on selection of mobile and predominant contaminants found within the capture area of the lysimeter.

~~7.~~44. Modification of Monitoring or Analysis Parameters

If at any time the Executive Secretary determines the monitoring or analysis parameters to be inadequate, the Permittee shall modify all required monitoring parameters immediately after receipt of written notification from the Executive Secretary. Upon any change in the currently approved waste parameters defined in Conditions 6, 7, and 8 of the Utah Radioactive Materials License UT 2300249, the Permittee shall revise the currently approved Water Monitoring Quality Assurance Plan in Appendix B.

~~8.~~45. Waste Characterization Monitoring

~~a)~~d) Class A Waste – all Class A waste received by the Permittee shall be fully characterized to determine its chemical and radiological constituents and the presence and concentration of any chelating agents both before shipment and emplacement for disposal, in accordance with the requirements of the currently approved Waste Characterization Plan in the Radioactive Materials License UT 2300249, Condition 58 and for PCB/Radioactive Waste, in the currently approved Plan for the Management of Waste Containing Polychlorinated Biphenyls (PCBs), Appendix I. Said waste characterization shall include sampling and analysis of all contaminants authorized by Part I.E.1 and of those prohibited by Part I.E.2 of this Permit.

~~b)~~e) 11e.(2) Waste – all 11e(2) Waste received by the Permittee shall be fully characterized both before shipment and after arrival at the facility to identify any new non-radiologic contaminants not authorized by this Permit by Parts I.C.1 and I.F.5(c)(2). Said waste characterization shall include sampling and analysis of all non-radiologic contaminants prohibited by Part I.E.2 of this Permit.

The Permittee shall maintain records of all Class A, and 11e.(2) Waste sampling and analysis on site.

~~9.~~46. Waste Liquid Content Monitoring

All wastes received shall be tested for liquids in accordance with the currently approved LLRW Waste Characterization Plan in the Radioactive Materials License, Condition 58. In accordance with UAC R313-15-1008(2)(a)(iv), solid waste received for disposal shall contain as little free-standing and non-corrosive liquid as reasonably achievable, but shall contain no more free liquids than 1% of the volume of the waste. In the event that solid waste is received or observed to contain free liquids in excess of 1% by volume, the Licensee/Permittee shall immediately notify the Division of Radiation Control that the shipment(s) failed the requirements for acceptance.

~~10.~~47. Post-Closure Monitoring

Post-closure monitoring shall conform to the requirements of the currently approved Post-Closure Monitoring Plan in Appendix F of this Permit.

~~11.~~48. On-Site Meteorological Monitoring

The Permittee shall provide continuous monitoring of the following minimum meteorological parameters, in accordance with the currently approved Weather Station Monitoring Plan found in Appendix G of this Permit:

~~a)~~f) Wind direction and speed

~~b)~~g) Temperature

~~c)~~h) Daily Precipitation

~~d)~~i) Pan evaporation

The Permittee shall maintain records of this monitoring on site. The Permittee shall submit an annual meteorological report for the facility in compliance with the requirements of Part I.H.10 of this Permit. The objective of this report shall be to show that the meteorological assumptions made in the infiltration and unsaturated zone modeling used to support issuance of the Permit were conservative or representative of the actual conditions at the site. In addition, and in conjunction with an application for permit renewal, 180 days before expiration of the Permit, the Permittee shall submit a summary report of all meteorological data collected since issuance of the last Permit (minimum of 4 years of data). Said report shall compare the data observed against regional normal values, as available, and provide summary statistics of all meteorological data collected.

~~12.~~49. Containerized Waste Storage Area: Leakage/Spill Monitoring and BAT Status

The Permittee shall conduct daily inspections of the containerized waste storage area in order to remediate any container leakage or spillage in accordance with the currently approved BAT Performance Monitoring Plan in Appendix J of this Permit, and for PCB/Radioactive Waste, in the currently approved Plan for the Management of Waste Containing Polychlorinated Biphenyls (PCBs), Appendix I. Said inspections shall also evaluate compliance with the Best Available Technology requirements of Part I.E.10 of this Permit. The Permittee shall maintain a written record of these inspections on site. All daily inspection records shall comply with the requirements of Part II.G of this Permit.

~~13.~~50. Evaporation Ponds Monitoring

a) 1995, 1997, 2000, Mixed Waste, and Northwest Corner Evaporation Pond Daily Monitoring – the Permittee shall conduct daily inspections of the 1995, 1997, 2000, Mixed Waste, and Northwest Corner evaporation ponds to determine compliance with the Best Available Technology requirements of Part I.E.14.a of this Permit, including:

1) Measurement of pond water level, relative to pond spillway centerline, to determine pond freeboard.

2) Determination of operational status of leak detection system pump, pump controller, head/pressure transducer, and flow meter equipment.

3) Measurement of daily leak detection system flow volume. For BAT compliance monitoring purposes for the 1995, 1997, 2000, Mixed Waste, and Northwest Corner evaporation ponds, the Permittee shall calculate an average daily leakage volume across a consecutive 6-day period. The Permittee shall perform this calculation for each evaporation pond weekly.

4) Measurement of daily leak detection system head. For BAT compliance monitoring purposes for the 1995, 1997, 2000, Mixed Waste, and Northwest Corner evaporation ponds, the Permittee shall determine the maximum head limit to be measured by the approved head/pressure transducer construction that complies with the 1-foot BAT head performance standard of Part I.E.14.a.3. On a daily basis, the Permittee shall compare the daily measured head against the maximum head limit for each evaporation pond.

The Permittee shall maintain written records of the findings of these daily inspections on site. All daily inspection records shall comply with the requirements of Part II.G of this Permit.

b) 1995, 1997, 2000, Mixed Waste, and Northwest Corner Evaporation Pond Leak Detection System Pump Tests – the Permittee shall conduct a pump test of the evaporation pond's leak detection sump within 5 days of discovery that the average daily leak detection system flow volume (Part 1.F.2.d)exceeds the following limits:

1)	1995 Evaporation Pond:	155 gallons/day
2)	1997 Evaporation Pond:	160 gallons/day
3)	Mixed Waste Evaporation Pond:	160 gallons/day
4)	2000 Evaporation Pond:	355 gallons/day
5)	Northwest Corner Evaporation Pond:	300 gallons/day

Said pump test shall comply with the currently approved BAT Contingency Plan in Appendix K of this Permit.

c) Semiannual Monitoring – on a semiannual basis, the Permittee shall:

1) Collect water quality samples from fluids stored in the approved evaporation ponds.

2) Analyze said water samples for all ground water quality protection level parameters defined in Part I.F.5.b.2 Table 1A, above, including a complete gamma spectroscopic analysis.

Sampling and analyses at all evaporation ponds shall comply with the currently approved Water Monitoring Quality Assurance Plan in Appendix B of this Permit.

d) Annual Pump Inspection – on an annual basis, the Permittee shall remove the submersible pump from the leak detection system of the 1995, 1997, 2000, Mixed Waste, and Northwest Corner evaporation ponds and check both the winding resistance and insulation resistance. If either the winding resistance or insulation resistance is outside of the manufacturer specifications, the pump will be replaced and/or repaired with a pump that satisfies all manufacturer specifications within 24 hours. Within 30 days of completing the annual pump inspection, a bor-o-scope video inspection shall be performed to ensure the pump was correctly reinstalled.

~~14.~~51. Confined Aquifer Head Monitoring

The Permittee shall conduct monthly monitoring of water levels and semiannual specific gravity measurements in the following wells completed in the deep confined aquifer: I-1-100, I-3-100, GW-19B, and GW-27D. Semiannual water levels and specific gravity measurements shall be made in conjunction with the semiannual ground water quality sampling events.

~~15.~~52. Mixed Waste Leachate Monitoring

On a semiannual basis, the Permittee shall collect representative samples of leachate from the Mixed Waste Cell leachate collection system (upper leachate collection access pipe) and analyze for radioactive contaminants. Said radioactive contaminants shall include:

a) All Ground Water Protection Level Parameters found in Tables 1E and 1F of this Permit

b) A complete gamma spectroscopic analysis to determine all other gamma-emitting radioisotopes that may be present

~~16.~~53. Intermodal Unloading Facility Monitoring

The Permittee shall conduct daily monitoring of the Intermodal Unloading Facility to determine and ensure free draining conditions exist both on the unloading pad and across the contact stormwater drainage pipeline that discharges to the 1995 and 1997 evaporation ponds. The Permittee shall maintain written records of the findings of these daily inspections on site. All daily inspection records shall comply with the requirements of Part II.G of this Permit.

~~17.~~54. Box-Washing Facility Monitoring

The Permittee shall conduct daily monitoring of the Box-Washing facility to demonstrate compliance with the Best Available Technology requirements of Part I.E.14.b of this Permit, including:

a) Free draining conditions

b) Physical integrity of concrete surfaces

c) Wastewater catch basin (sump) water level

d) Water level in wastewater storage tanks

e) Absence of discharge to the ground or ground water

The Permittee shall maintain written records of the findings of these daily inspections on site. All daily inspection records shall comply with the requirements of Part II.G of this Permit.

~~18.~~55. Rail Car Wash Facility Monitoring

The Permittee shall conduct daily monitoring of the Track No. 4 and Track No. 2 Rail Car Wash facilities to demonstrate compliance with the Best Available Technology requirements of Part I.E.14.d of this Permit in accordance with the currently approved BAT Performance Monitoring Plan and BAT Contingency Plan in Appendices J and K, respectively of this Permit.

The Permittee shall maintain written records of the findings of these daily inspections on site. All daily inspection records shall comply with the requirements of Part II.G of this Permit.

~~19.~~56. Railcar Rollover Facility Monitoring

The Permittee shall conduct daily monitoring of the Railcar Rollover Facility to demonstrate compliance with the BAT Performance and Best Management Practice Standards of Parts I.E.7 and I.E.17 of the Permit in accordance with the currently approved BAT Performance Monitoring Plan and Contingency Plan in Appendices J and K, respectively, of this Permit.

~~20.~~57. Open Cell Time Limit Monitoring

The Permittee shall demonstrate compliance with the open cell time limitation requirements of Part I.E.6 of this Permit by observing and recording the following dates of completion for each working area in the LARW cell:

a) Initial placement of waste on the first lift on the clay liner

b) Completion of construction of the clay radon barrier

The Permittee shall maintain written records of this monitoring on site. All monitoring records shall comply with the requirements of Part II.G of this Permit.

~~21.~~58. PCB Monitoring

The Permittee shall monitor for PCBs in accordance with the requirements of this Permit or its appendices, or as requested by the Executive Secretary.

~~22.~~59. BAT Performance Monitoring Plan

The Permittee shall demonstrate compliance with the BAT requirements and performance standards and Best Management Practices in Parts I.D and I.E of this Permit by implementing the most current BAT Performance Monitoring Plan approved by the Executive Secretary and provided in Appendix J of this Permit.

~~23.~~60. BAT Contingency Plan

In the event that BAT failure occurs at any facility, the Permittee shall implement the most current BAT Contingency Plan approved by the Executive Secretary and provided in Appendix K of this Permit to regain the BAT requirements and performance standards and Best Management Practices specified in Parts I.D and I.E of this Permit.

~~24.~~61. Stormwater Monitoring

The Permittee shall demonstrate compliance with stormwater removal requirements of Part I.E.7 of this Permit by maintaining daily written records for the following stormwater management activities:

a) Date, time, and location of discovery of stormwater accumulation

b) Date and time when stormwater removal activities were initiated at each location

c) Date and time when stormwater removal was completed at each location

d) First and last name(s) of all personnel involved with stormwater removal activities

e) Unique identity of locations of where stormwater was removed

f) Type of stormwater removed: contact or non-contact stormwater

g) Identify equipment used to remove contact and non-contact stormwater

h) Volumes of stormwater removed at each location

i) Location(s) where stormwater was disposed

~~25.~~62. Shredder Facility

The Permittee shall conduct daily monitoring of the Shredder Facility to demonstrate compliance with the Best Available Technology requirements of Part I.E.20 of this Permit in accordance with the currently approved BAT Performance Monitoring Plan and BAT Contingency Plan in Appendices J and K of this Permit, respectively, including:

a) Free draining conditions

b) Physical integrity of concrete surfaces

c) Absence of discharge to the ground or ground water

The Permittee shall maintain written records of the findings of these daily inspections on site. All daily inspection records shall comply with the requirements of Part II.G of this Permit.

~~26.~~63. Rotary Dump Facility

The Permittee shall conduct daily monitoring of the Rotary Dump Facility to demonstrate compliance with the Best Available Technology requirements of Part I.E.21 of this Permit in accordance with the currently approved BAT Performance Monitoring Plan and BAT Contingency Plan in Appendices J and K of this Permit, respectively, including:

a) Free draining conditions

b) Physical integrity of concrete surfaces

c) Water level in Sediment Basin sump

d) Presence of fluids in the Sediment Basin leak detection system

e) Absence of discharge to the ground or ground water

f) Absence of fluid in annular space between the primary and secondary pipes of the leak detection system for pressurized pipes

The Permittee shall maintain written records of the findings of these daily inspections on site. All daily inspection records shall comply with the requirements of Part II.G of this Permit.

~~27.~~64. Intermodal Container Wash Building

The Permittee shall conduct daily monitoring of the Intermodal Container Wash Building to demonstrate compliance with the Best Available Technology requirements of Part I.E.22 of this Permit in accordance with the currently approved BAT Performance Monitoring Plan and BAT Contingency Plan in Appendices J and K, respectively of this Permit, including:

~~a)~~g) Free draining conditions,

~~b)~~h) Physical integrity of concrete surfaces,

~~c)~~i) Water level in Settlement Basin,

~~d)~~j) Presence of fluids in the settlement basin leak detection system, and

~~e)~~k) Absence of discharge to the ground or ground water.

The Permittee shall maintain written records of the findings of these daily inspections on site. All daily inspection records shall comply with the requirements of Part II.G of this Permit.

~~28.~~65. Decontamination Access Control Building

The Permittee shall conduct daily monitoring of the Decontamination Access Control Building to demonstrate compliance with the Best Available Technology requirements of Part I.E.23 of this Permit in accordance with the currently

approved BAT Performance Monitoring Plan and BAT Contingency Plan in Appendices J and K, respectively of this Permit, including:

~~l)~~a) Free draining conditions in all wastewater transfer piping,

b) Water level in the gray water collection tank,

c) Presence of fluids in the gray water collection tank leak detection annulus, and

d) Absence of discharge to the ground or ground water,

The Permittee shall maintain written records of the findings of these daily inspections on site. All daily inspection records shall comply with the requirements of Part II.G of this Permit.

~~29.~~66. East Side Drainage Project

The Permittee shall conduct daily monitoring of the East Side Drainage Project to demonstrate compliance with the Best Available Technology requirements of Part I.E.24 of this Permit in accordance with the currently approved BAT

Performance Monitoring Plan and BAT Contingency Plan in Appendices J and K, respectively of this Permit, including:

~~p)~~e) Free draining conditions in all wastewater transfer piping,

~~b)~~f) Absence of fluids in the leak detection annulus within the secondary pipe of the dual-walled piping system, and

~~c)~~g) Absence of discharge to the ground or ground water.

G. Non-Compliance Status. Ground Water Monitoring and Best Available Technology

1. Noncompliance with the Ground Water Protection Levels

Noncompliance with the ground water protection levels in Part I.C, Tables 1A, 1B, 1C, 1D, 1E, and 1F as applied to the compliance monitoring wells defined in Part I.F.1 of this Permit shall be defined as follows:

~~s)~~a) Monitoring for probable out-of-compliance shall be defined as any one sample in excess of the protection level in Tables 1A, 1B, 1C, 1D, 1E, or 1F of this Permit for any parameter from the same compliance monitoring well.

b) Out-of-Compliance Status –defined as two (2) consecutive samples in excess of the protection level in Tables 1A, 1B, 1C, 1D, 1E, or 1F of this Permit for any parameter from the same compliance monitoring well.

c) Other Methods to Determine Ground Water Quality Compliance Status – at the discretion of the Executive Secretary, other methods may be employed to determine the compliance status of the facility with respect to ground water quality data, including:

   1) Trend and/or Spatial Analysis – analysis of any contaminant concentration trend through time in a single compliance monitoring point, and /or spatial analysis of the same from any group of compliance monitoring points.

   2) EPA RCRA Statistical Methods – other applicable statistical methods may be used to determine out-of-compliance status, as defined in the EPA document "Statistical Analysis of Ground Water Monitoring Data at RCRA Facilities", February 1989, or as amended.

2. Requirements for Ground Water Monitoring for Probable Out-of-Compliance Status

The Permittee shall evaluate the results of each round of ground water sampling and analysis to determine existence of monitoring for probable out-of-compliance status as defined in Part I.G.1(a) of this Permit. Upon any determination that probable out-of-compliance status exists, the Permittee shall:

a) Notify the Executive Secretary of the probable out-of-compliance (POOC) status within 30 days of the initial detection. In addition, the Permittee shall submit a written report describing all POOC wells and parameters with the associated semiannual ground water monitoring report, which is due on either March 1 or September 1.

b) Immediately implement a schedule of quarterly ground water sampling and analysis for the well(s)/parameter(s) of concern, consistent with the requirements Part I.F.5(b) and the currently approved Water Monitoring Quality Assurance Plan, Appendix B of this Permit. This quarterly sampling will continue until the compliance status can be determined by the Executive Secretary. Reports of the results of this sampling will be submitted to the Executive Secretary no later than 90 days from the submittal of the associated semiannual monitoring report, or no later than June 1 or December 1.

3. Requirements for Ground Water Out-of-Compliance Status

~~c)~~a) Notification and Accelerated Monitoring – the Permittee shall evaluate the results of each round of ground water sampling and analysis to determine existence of out-of-compliance status as defined in Part I.G.1(b) of this Permit. Upon any determination that an out-of-compliance status exists the Permittee shall:

1) Verbally notify the Executive Secretary of the out-of-compliance status within 24 hours, and provide written notice within 5 days of the detection and

2) Immediately implement an accelerated schedule of monthly ground water monitoring of the monitoring wells of concern for the parameters in question. This monitoring shall continue for at least 2 months or until the facility is brought into compliance, as determined by the Executive Secretary. At the discretion of the Executive Secretary, the Permittee may be required to sample and analyze for additional inorganic, organic, or radiochemical parameters in order to determine the compliance status of the facility. Reports of the results of this sampling will be submitted to the Executive Secretary as soon as they are available, but not later than 45 days from each date of sampling.

b) Source and Contamination Assessment Study Plan – within 30 days of the verbal notice to the Executive Secretary required in Part I.G.3(a) of this Permit, the Permittee shall submit for Executive Secretary approval an assessment study plan and compliance schedule for:

1) Assessment of the source or cause of the contamination and determination of steps necessary to correct the source.

2) Assessment of the extent of the ground water contamination and any potential dispersion.

3) Evaluation of potential remedial actions to restore and maintain ground water quality and ensure that the ground water standards will not be exceeded at the compliance monitoring wells, and best available technology will be reestablished.

c) Contingency Plan – in the event that Out-of-Compliance status is determined as per Part I.G.1(b) or (c), and upon written notification from the Executive Secretary, the Permittee shall immediately implement the currently approved Contingency Plan in Appendix A of this Permit.

4. <u>Definition and Requirements for Failure to Maintain Best Available Technology</u>

a) Definition of Failure to Maintain Best Available Technology (BAT) Requirements – any violation of the BAT Design Standards in Part I.D, including design, design specifications, or construction requirements shall constitute failure to meet the best available technology requirements of this Permit. Any violation of the BAT Performance Standards in Parts I.D.1 or I.E shall also constitute failure to meet the best available technology requirements of this Permit.

b) Requirements for Failure to Maintain Best Available Technology – in the event that the Permittee fails to maintain best available technology in accordance with Parts I.D and I.E, above, the Permittee shall:

1) Notify the Executive Secretary verbally within 24 hours of discovery of the BAT failure, and provide written notice within 5 days of discovery.

2) Submit within 5 days of discovery a complete written description of:

   i. The cause of the BAT failure,

   ii. Any measures taken by the Permittee to mitigate the BAT failure,

   iii. Time frame of the discovery of the BAT failure and any mitigation measures were implemented, and

   iv. Evidence to demonstrate that any discharge or potential discharge caused by the BAT failure did not and will not result in a violation of UAC 19-5-107.

c) BAT Contingency Plan – in the event that Out-of-Compliance status is determined as per Part I.G.4(a) or by daily implementation of the currently approved BAT Performance Monitoring Plan in Appendix J of this Permit, the Permittee shall immediately implement the currently approved BAT Contingency Plan in Appendix K of this Permit.

5. <u>Affirmative Defense Relevant to Best Available Technology Failures</u>

In the event that a compliance action is initiated against the Permittee for violation of Permit conditions relating to best available technology, the Permittee may affirmatively defend against that action by demonstrating the following:

a) The Permittee submitted notification according to UAC R317-6-6.13,

b) The failure was not intentional or caused by the Permittee's negligence, either in action or in failure to act,

c) The Permittee has taken adequate measures to meet permit conditions in a timely manner or has submitted to the Executive Secretary, for Executive Secretary approval, an adequate plan and schedule for meeting permit conditions, and

d) The provisions of UAC 19-5-107 have not been violated.

H. Reporting Requirements

Notwithstanding any other environmental monitoring and reporting required by the Radioactive Materials License, the Permittee shall submit the following reporting information.

1. <u>Semiannual Monitoring</u>

Monitoring required in Part I.F of this Permit, shall be reported according to the following schedule, unless modified by the Executive Secretary:

Half	Report Due On
1st (January thru June)	September 1
2nd (July thru December)	March 1

2. Water Level Measurements

The Permittee shall comply with the following ground water water level reporting requirements:

a) General Requirements – monthly water level measurements from all ground water monitoring wells will be reported semiannually in both measured depth to ground water and saline ground water elevations above mean sea level. In addition, semiannual freshwater equivalent head elevations will be reported for each well and will be derived from semiannual ground water specific gravity measurements made in that well during each semiannual sampling event.

b) Maps and Diagrams Format – distribution of freshwater equivalent head will be summarized on a semiannual basis in the form of:

1) Potentiometric maps of the uppermost aquifer for each semiannual sampling event and

2) Vertical diagrams or cross-sections for each nested well group illustrating water level elevations in both the shallow and confined aquifers (I-1-30 / I-1-100, I-3-30 / I-3-100, GW-19A / GW-19B, and GW-27D).

Said potentiometric maps, diagrams, cross-sections, and data will be submitted with the semiannual monitoring reports required by Part I.H.1.

c) Horizontal Hydraulic Gradient Reporting – on a monthly basis the Permittee shall calculate and provide:

1) A site-wide summary of maximum, minimum, and average horizontal hydraulic gradient for all wells located in Section 32 based on saline ground water elevations. Transects for each of the maximum, minimum, and average gradient locations shall be indicated on the monthly equipotential maps required by Part I.H.2.b and

2) Individual disposal cell summary of maximum, minimum, and average horizontal hydraulic gradient based on saline ground water elevations for the Class A, Class A North, Class A South portion of the Class A South/11e.(2), LARW, 11e.(2) portion of the Class A South/11e.(2), and Mixed Waste disposal facilities. Determination of these individual hydraulic gradients shall be made after division of each disposal cell into smaller sub-areas for purposes of hydraulic gradient comparisons through time, as approved by the Executive Secretary. On an

individual cell basis, the Permittee shall indicate those cell sub-areas where the said monthly maximum, minimum, and average hydraulic gradients occurred.

In the event that the horizontal hydraulic gradient of any subarea exceeds the cell-specific Permit limit specified below, the Permittee shall report this exceedance and identify the sub-area in which the exceedance occurred with submission of the semiannual ground water monitoring report required by Part I.H.1 of this Permit.

Disposal Cell	Horizontal Hydraulic Gradient Limit
Class A	1.00E-3
Class A North	1.00E-3
Class A South portion	3.29E-3
LARW	9.67E-4
Mixed Waste	9.67E-4
11e.(2) portion	3.29E-3

3. Ground Water and Pore Water Quality Sampling

Reporting will include:

a) Field Data Sheets – or copies thereof, including the field measurements, required in Part I.F.5(b)(2) of this Permit, and other pertinent field data, such as:

   1) Ground Water Monitoring – well name/number, date and time, names of sampling crew, type of sampling pump or bail, measured casing volume, volume of water purged before sampling, volume of water collected for analysis.

b) Results of Ground Water, Pore Water, and Surface Water Analysis – including date sampled, date received; and the results of analysis for each parameter, including: value or concentration, units of measurement, reporting limit (minimum detection limit for the examination), analytical method, the date of the analysis, counting error for each radiochemical analysis, and total anions and cations for each inorganic analysis.

c) Quality Assurance Evaluation – with every sampling report the Permittee shall include a quality assurance evaluation of the reported ground water and pore water data. Said report shall evaluate the sample collection techniques, sample handling and preservation, and analytical methods used in sampling with the objective of verifying the accuracy of the compliance monitoring results.

d) Electronic Data Files and Format – in addition to written results required for every sampling report, the Permittee shall provide an electronic copy of all laboratory results for ground water, pore water, and surface water quality sampling. Said electronic files shall consist of a Comma Separated Values (CSV) file format, or as otherwise approved by the Executive Secretary.

4. Spill Reporting

   The Permittee shall report as per UAC 19-5-114 and for PCB/Radioactive Waste, the currently approved Plan for the Management of Waste Containing Polychlorinated Biphenyls (PCBs), Appendix I, any spill or leakage of waste or waste liquids which come in contact with native soil or ground water in compliance with Part II.I of this Permit. For spills of solid waste greater than 100 kg, the spill must be reported to the Division of Radiation Control within 5 business days of discovery.

5. Post-Closure Monitoring

   Reporting of post-closure monitoring shall comply with the requirements of the currently approved Post-Closure Monitoring Plan in Appendix F of this Permit.

6. Annual "As-Built" Report

   The Permittee shall submit an annual "As-Built" Report to document construction of the Class A, Class A North, and Class A South/11e.(2) Disposal cells in compliance with the currently approved design and specifications and LLRW and 11e.(2) C~~onstruction~~ Q~~uality~~ A~~ssurance~~/Q~~uality~~ C~~ontrol~~ ~~Plan~~ Manual (Radioactive Materials License, Condition 44). ~~This~~ The reports will be submitted for the Executive Secretary's approval on or before March 31 of each calendar year and will include for each embankment the embankment's approved design capacity, capacity used to date, and remaining capacity. This report shall include engineering plans and cross-sections to document the construction. Said plans shall be based on an elevation survey, conducted and certified by a Utah licensed land surveyor, of all pertinent elements of construction at the facility.

7. Waste Characterization Reporting

   In the event that a new contaminant is detected in any waste at the facility, which has not been authorized by Part I.E.1, or if concentrations of approved contaminants are detected above the limits established in Part I.E.2 of this Permit, the Permittee shall notify the Executive Secretary in writing within 5 working days from the date of discovery.

8. Collection Lysimeter Reporting

   The Permittee shall provide a verbal report to the Executive Secretary within 24 hours of discovery of the presence of any fluid in the standpipe of the collection lysimeters. The Permittee shall provide a written report of the incident to the Executive Secretary within 5 working days of discovery. The Permittee shall provide a report of the annual video log survey of the lysimeter's drainpipe, as required by the currently approved Appendix C of this Permit, on or before December 31 of each calendar year.

9. Reporting of Mechanical Problems or Discharge System Failures

   The Permittee shall verbally notify the Executive Secretary within 24 hours of initial discovery of any mechanical or discharge system failure that could affect the chemical characteristics or volume of the discharge. The Permittee shall submit a written report of the failure within 5 days of said failure.

10. Meteorological Reporting

    On or before March 1 of each calendar year, the Permittee shall submit an annual meteorological report for the previous meteorological year (January 1 to December 31) for Executive Secretary approval.

11. Containerized Waste Storage Area Reporting

    The Permittee shall report the following events in accordance with the requirements of Part I.E.10:

    a) Failure of sump pump or other equipment to provide removal of stormwater and free and uninterrupted drainage of the pad, and

    b) Any container spill or leakage that may have caused a release to the subsurface soils or ground water via cracks or other damage to the asphalt surface.

12. Evaporation Ponds Reporting

    a) Semiannual Water Quality Sampling – semiannual water quality samples collected and analyzed shall be reported in conjunction with the ground water quality monitoring report required by Part I.H.1 of this Permit.

    b) 1995, 1997, 2000, Mixed Waste, and Northwest Corner Evaporation Pond Daily Monitoring – the Permittee shall report results of daily monitoring for the 1995, 1997, 2000, Mixed Waste, and Northwest Corner evaporation ponds as follows:

        1) BAT Failure Reporting – the Permittee shall report the following monitoring requirements pursuant to Part I.G.4.b:

            a) Failure to maintain the 24-inch vertical freeboard requirement of Part I.E.14.a.4,

            b) Failure of operational status for leak detection system pump, pump controller, head/pressure transducer, and/or flow meter equipment, pursuant to Part I.E.14.a.1,

            c) Daily average leak detection pumpage volumes in excess of the volume monitoring thresholds established in Part I.F.14.b, or the BAT performance standards listed in Part I.E.14.a.2, and

            d) Daily leak detection sump head values in excess of the BAT performance standards established pursuant to Part I.E.14.a.3.

        2) Leak Detection System Pump Test Reporting – within 15 calendar days of completion of any leak detection system pump test required by Part I.F.13.b of this Permit, the Permittee shall submit a written report for Executive Secretary approval to document equipment, methods, and results of said pump test.

    c) Annual Pump Inspection – results of the annual pump inspection and bor-o-scope video inspection conducted in accordance with Part I.F.13.d shall be submitted for the Executive Secretary's approval as part of the second quarter BAT Quarterly Monitoring Report.

13. Annual Ground Water Usage Report

    On or before March 1 of each calendar year the Permittee shall survey and report the location of all ground water withdrawals within at least a 1-mile radius of the facility boundary. The purpose of this report will be to locate all points near the facility where ground water is pumped or otherwise removed for any consumptive use, including domestic, agricultural, or industrial purposes. This report shall include a survey of water right appropriations found in the area of interest, identify the owners thereof, and disclose the physical location and depths of all such ground water withdrawals.

14. Reserved

15. Mixed Waste Cell Leachate Reporting

    The Permittee shall report the results of Mixed Waste Leachate water quality sampling and analysis required by Part I.F.15 of this Permit with the semiannual ground water monitoring reports required by Parts I.H.1 and I.H.3.

16. BAT Non-Compliance Reporting Requirements

    For all facilities subject to requirements under the currently approved BAT Performance Monitoring Plan and BAT Contingency Plan (Appendix J and K, respectively) the Permittee shall provide verbal notification to the Executive Secretary of any BAT failures that are not corrected within 24 hours. All such verbal notifications shall be followed-up with a written notification within 5 business days.

17. Annual Cover Test Cell Report

    On or before March 1 of each calendar year the Permittee shall submit an annual report for Executive Secretary approval. The annual report shall detail the Permittee's progress in implementing the corrective action plan required under Radioactive Material License Condition 28, provide the data collected in the past year, analyze the data, and interpret the meaning of the data relative to the overall objective of the corrective action plan.

18. Reserved.

19. Railcar Rollover Facility Reporting

    The Permittee shall submit the daily inspection results required in Part I.E.7c.2 with each Quarterly BAT Monitoring Report. The annual inspection and repair activities required under Part I.E.17 shall be submitted with the Second Quarterly BAT Monitoring Report of each calendar year. The annual inspection report shall document all inspection and repair activities including photographs of the condition of the surfaces both before and after repairs.

20. BAT Quarterly Monitoring Report

The Permittee shall submit a quarterly BAT monitoring report to document compliance with the BAT performance standards mandated by Part I.E of this Permit. The report shall provide results, calculations, and evaluations of daily BAT monitoring data required in Part I.F of this Permit, including but not limited to the following:

~~a)~~d) 1995, 1997, 2000, Mixed Waste, and Northwest Corner Evaporation Ponds – the BAT quarterly monitoring report shall:

1) Include a quality assurance evaluation of all daily leak detection system flow volume and head data collected,
2) Include results of daily flow and head monitoring of the leak detection sump at each pond,
3) Include results of weekly calculation of daily average flow volumes from the leak detection sump at each pond, pursuant to Part I.F.13.a.3 of this Permit,
4) Evaluate any apparent trends in daily flow and head monitoring with respect to the pond's ability to comply with the BAT performance standards mandated by Part I.E.14 of this Permit.

~~b)~~e) Stormwater Management – the BAT quarterly report shall include:

1) Date, time, and location of discovery of stormwater accumulation,
2) Date and time when stormwater removal was initiated at each location,
3) Date and time when stormwater removal was completed at each location, and
4) Volumes of stormwater removed at each location.

Daily Reports will include:

1) First and last name(s) of all personnel involved with stormwater removal activities,
2) Unique identity of locations of where stormwater was removed,
3) Type of stormwater removed: contact or non-contact stormwater,
4) Identify equipment used to remove contact and non-contact stormwater, and
5) Location(s) where stormwater was disposed.

~~c)~~f) Reporting Schedule – the BAT Quarterly Monitoring Report shall be submitted for Executive Secretary approval in accordance with the following schedule:

Quarter	Report Due On
1st (January, February, March)	May 1

2nd (April, May, June*)	August 1
3rd (July, August, September)	November 1
4th (October, November, December)	February 1

*SecondQuarter Report shall include results of the required annual pressure tests for dual-walled pipe as identified in Part I.F.2.m.

21. PCB Reporting

The Permittee shall submit to the Executive Secretary the following:

a) Reports as required in the currently approved Plan for the Management of Waste Containing Polychlorinated Biphenyls (PCBs), Appendix I,

b) Routine reports in accordance with the Permittee's Radioactive Materials License UT 2300249, and

c) Non-compliance reporting as required by this Permit.

22. Comprehensive Ground Water Quality Evaluation Report

180 days prior to Permit expiration, the Permittee shall submit for Executive Secretary approval a comprehensive ground water quality evaluation report for the site. In submittal of this report, the Permittee shall present a complete and thorough evaluation of all ground water and vadose zone water quality data available for the LARW 11e.(2), and Mixed Waste facilities. Said report shall be similar to the September 1, 2004 Comprehensive Ground Water Quality Evaluation Report and shall include but not be limited to:

a) Graphs of temporal concentration trends for all compliance monitoring parameters and wells across the entire period of record, and an evaluation of parameter temporal relationships,

b) Number of water quality data available for each compliance parameter for each well,

c) Statistical tests of normality for each compliance parameter water quality data population, including univariate tests or equivalent,

d) Calculation of mean concentration and standard deviation on direct concentration values; for water quality parameter populations that fail the normality test, provide mean concentrations and standard deviations on transformed values that are normally distributed,

e) Calculation of mean concentration plus the second standard deviation for comparison with existing ground water protection levels to identify parameters that warrant an evaluation for ground water protection level adjustments based on natural variations in background concentrations, and

f) Isoconcentration maps of spatial concentration trends across Section 32 and an evaluation of facies and spatial relationships of water quality parameters that warrant an evaluation for ground water protection level adjustments based on section e) above.

23. Reserved.

24. Revised Hydrogeologic Report

    180 days prior to Permit expiration, the Permittee shall submit for Executive Secretary approval a revised hydrogeologic report for the disposal facility and surrounding area. In submittal of this report the Permittee shall provide a comprehensive and thorough description of hydrogeologic conditions at the facility current through the time of report submittal. This report will include an updated evaluation and reinterpretation of the site hydrogeology using all available data including new or additional data acquired since Executive Secretary approval of the last revised hydrogeologic report dated September 1, 2004.

I. Compliance Schedule

1. Ground Water Institutional Control Plan

   The Permittee shall submit a ground water institutional control plan for Executive Secretary approval at the time the site Decontamination and Decommissioning Plan required under Radioactive Materials License Condition 74 is submitted. In submittal of this plan the Permittee shall eliminate future inadvertent intrusion into potentially contaminated ground water at the disposal facilities and subsequent routes of exposure to the public and the environment. Said plan shall include at least one of the options listed in the July 27, 1998 Utah Division of Radiation Control Request for Information.

2. Background Ground Water Quality Report for Class A North and 2000 Pond Compliance Wells.

   In conjunction with the Semiannual Ground Water Monitoring Report for the second half of 2006 (due on March 1, 2007), the Permittee shall submit for Executive Secretary approval a background ground water quality report for the following Class A North and 2000 Pond compliance monitoring wells for the parameters of gross alpha, radium-226, and radium-228:

GW-106	GW-110	GW-114	GW-125
GW-107	GW-111	GW-115	GW-19A
GW-108	GW-112	GW-116	GW-36
GW-109	GW-113	GW-117	GW-58

   At a minimum, this report shall include:

   ~~a)~~g) Graphs of temporal concentration trends in each well for each monitoring constituent with an evaluation of seasonal and analytical variations,

~~b)~~h) Normality testing along with a discussion of those data points, if any, that are outliers and justification of why the outliers should or should not be culled from the population prior to performing statistical calculations,

~~c)~~i) Calculation of mean concentration and standard deviation for each constituent in each well, and

~~d)~~j) Calculation of mean concentration plus two (2) standard deviations for each constituent in each well.

After review and approval of this report, the Executive Secretary may reopen this Permit and revise ground water protection levels for the Class A North cell and/or 2000 Pond compliance wells. The Executive Secretary anticipates the background concentrations for gross alpha as well as the sum of radium-226 and radium-228 may be greater than their respective ground water protection levels. As a result, compliance monitoring for these parameters will not commence in the Class A North cell or 2000 Pond compliance wells until the Executive Secretary has incorporated approved ground water protection levels into the Permit. In the interim, ground water samples for gross alpha, radium-226, and radium-228 will be collected and reported from the Class A North cell and 2000 Pond compliance wells on the same frequency as all other compliance ground water parameters to build a larger data population with which to calculate background values. In the event the Executive Secretary requires additional information, the Permitee shall provide all information requested and resolve all issues raised by a deadline approved by the Executive Secretary.

3. Shredder Facility and PCBs

Prior to operation of the Shredder Facility to process wastes containing polychlorinated biphenyls (PCBs), the Permittee shall submit a revised Plan for the Management of Waste Containing Polychlorinated Biphenyls (Appendix I), and receive Executive Secretary approval.

II. MONITORING, RECORDING AND REPORTING REQUIREMENTS

A. Representative Sampling

Samples taken in compliance with the monitoring requirements established under Part I shall be representative of the monitored activity. Failure by the Permittee to conduct all ground water and pore water sampling in compliance with the currently approved Ground Water Monitoring Quality Assurance/Quality Control Plan in Appendix B of this Permit shall be considered a failure to monitor and may subject the Permittee to enforcement action.

B. Analytical Procedures

Water sample analysis must be conducted according to test procedures specified under UAC R317-6-6.3(L), unless other test procedures have been specified in this Permit. All sample analysis shall be performed by laboratories certified by the State Health Laboratory, or otherwise after prior written approval by the Executive Secretary.

C. Penalties for Tampering

The Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate, any monitoring device or method required to be maintained under this Permit shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than six months per violation, or by both.

D. Reporting of Monitoring Results

Monitoring results obtained during each reporting period specified in the Permit, shall be submitted to the Executive Secretary, Utah Division of Water Quality at the following address no later than the 15th day of the month following the completed reporting period:

Utah Department of Environmental Quality
Division of Radiation Control
168 North 1950 West
P.O. Box 144850
Salt Lake City, Utah 84114-4850
Attention: Ground Water Quality Program

E. Compliance Schedules

Reports of compliance or noncompliance with, or any progress reports on interim and final requirements contained in any Compliance Schedule of this Permit shall be submitted no later than 14 days following each schedule date.

F. Additional Monitoring by the Permittee

If the Permittee monitors any pollutant more frequently than required by this Permit, using approved test procedures as specified in this Permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted. Such increased frequency shall also be indicated.

G. Records Contents

Records of monitoring information shall include:

1. The date, exact place, and time of sampling or measurements,
2. The individual(s) who performed the sampling or measurements,
3. The date(s) and time(s) analyses were performed,
4. The individual(s) who performed the analyses,
5. The analytical techniques or methods used, and
6. The results of such analyses.

H. Retention of Records

The Permittee shall retain records of all monitoring information, including all calibration and maintenance records and copies of all reports required by this Permit, and records of all data used to complete the application for this Permit, for a period of at least 3 years from the date of the sample, measurement, report or application. This period may be extended by request of the Executive Secretary at any time.

I. Twenty-Four Hour Notice of Noncompliance Reporting

1. The Permittee shall verbally report any noncompliance which may endanger public health or the environment as soon as possible, but no later than 24 hours from the time the Permittee first became aware of the circumstances. The report shall be made to the Utah Department of Environmental Quality 24-hour number, (801) 536-4123, or to the Division of Water Quality, Ground Water Protection Section at (801) 538-6146, during normal business hours (8:00 am – 5:00 pm Mountain Time).
2. A written submission shall also be provided to the Executive Secretary within 5 days of the time that the Permittee becomes aware of the circumstances. The written submission shall contain:
   a) A description of the noncompliance and its cause,
   b) The period of noncompliance, including exact dates and times,
   c) The estimated time noncompliance is expected to continue if it has not been corrected, and
   d) Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.
3. Reports shall be submitted to the addresses in Part II.D, Reporting of Monitoring Results.

J. Other Noncompliance Reporting

Instances of noncompliance not required to be reported within 24 hours shall be reported at the time that monitoring reports for Part II.D are submitted.

K. Inspection and Entry

The Permittee shall allow the Executive Secretary or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to:

1. Enter upon the Permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of the Permit;
2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this Permit;
3. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Permit; and
4. Sample or monitor at reasonable times, for the purpose of assuring permit compliance or as otherwise authorized by the Act, any substances or parameters at any location.

L. Monitoring Well "As-Built" Reports

In the event that additional ground water monitoring wells are required by the Executive Secretary, diagrams and description describing the final completion of the monitoring wells shall be submitted within 30 days of construction of each well. These reports will include:

1. Casing: depth, diameter, type of material, type of joints.
2. Screen: length, depth interval, diameter, material type, slot size.
3. Sand Pack: depth interval, material type and grain size.
4. Annular Seals: depth interval, material type.
5. Surface Casing(s) and Cap: depth, diameter, material type.
6. Survey Coordinates and Elevation: ground surface and elevation of water level measuring point in feet above mean sea level, measured to 0.01 of a foot. Said coordinates and elevation shall be conducted and certified by a Utah Licensed Land Surveyor.
7. Results of slug tests to determine local aquifer permeability in the vicinity of the well. Said tests shall conform with ASTM Method 4044-91. Test results and data analysis thereof shall be submitted for Executive Secretary approval.

M. Plugging and Abandonment Reports

Within 30 days of completion of plugging and abandonment of any environmental measurement system or instrument, including but not limited to ground water monitoring wells, piezometers, soil tensiometers or moisture instrumentation, or any other stationary device to make environmental measurements, the Permittee shall submit an "As-Plugged" report for Executive Secretary approval. Failure to comply with any condition of said approval shall constitute a violation of this Permit.

III. COMPLIANCE RESPONSIBILITIES

A. Duty to Comply

The Permittee must comply with all conditions of this Permit. Any permit noncompliance constitutes a violation of the Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application. The Permittee shall give advance notice to the Executive Secretary of the Water Quality Board of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

B. Penalties for Violations of Permit Conditions

The Act provides that any person who violates a permit condition implementing provisions of the Act is subject to a civil penalty not to exceed $10,000 per day of such violation. Any person who willfully or negligently violates permit conditions is subject to a fine not exceeding $25,000 per day of violation. Any person convicted under Section 19-5-115(2) of the Act a second time shall be punished by a fine not exceeding $50,000 per day. Nothing in this Permit shall be construed to relieve the Permittee of the civil or criminal penalties for noncompliance.

C. Need to Halt or Reduce Activity not a Defense

It shall not be a defense for a Permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this Permit.

D. Duty to Mitigate

The Permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this Permit which has a reasonable likelihood of adversely affecting human health or the environment.

E. Proper Operation and Maintenance

The Permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the Permittee to achieve compliance with the conditions of this Permit. Failure to maintain all treatment and control systems in fully functional operating order or condition at the facility is a violation of this Permit. Proper operation and maintenance also includes adequate laboratory controls and quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by a Permittee only when the operation is necessary to achieve compliance with the conditions of the Permit.

IV. GENERAL REQUIREMENTS

A. Prior Approval

Pursuant to UAC R317-6-6.1.A, the Permittee may not construct, install, or operate waste or wastewater storage, treatment, or disposal facilities, or any other facility that discharges or may discharge pollutants that may move directly or indirectly into ground water without a ground water discharge permit from the Executive Secretary. Pursuant to UAC R317-6-6.3.J, the Permittee shall submit engineering plans, specifications, and plans for operation and maintenance of a proposed facility prior to Executive Secretary approval.

B. Planned Changes

The Permittee shall give notice to the Executive Secretary as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required when the alteration or addition could significantly change the nature of the facility or increase the quantity of pollutants discharged.

C. Modification of Approved Engineering Design, Specifications, or Construction

Any modification to the approved engineering design, specifications, or construction of the facility cited in this Permit shall require prior Executive Secretary approval. Said facilities shall include, but are not limited to:

1. Waste and Wastewater Disposal and Containment Facilities – including all related engineering containment such as liner, cover, and drainage systems,
2. Waste and Wastewater Handling and Storage Facilities – used to handle, manage or store wastes prior to permanent disposal,
3. Decontamination Facilities – used to decontaminate equipment used in the transportation or disposal of waste, and
4. Environmental Monitoring Systems and Equipment – including ground water monitoring wells, piezometers, meteorological monitoring equipment, soil moisture and lysimeter instrumentation, or any other permanent system, mechanism, or instrument to make environmental measurements required by this Permit.

D. Anticipated Noncompliance

The Permittee shall give advance notice of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

E. Permit Actions

This Permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the Permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

F. Duty to Reapply

If the Permittee wishes to continue an activity regulated by this Permit after the expiration date of this Permit, the Permittee must apply for and obtain a permit renewal or extension. The application should be submitted at least 180 days before the expiration date of this Permit.

G. Duty to Provide Information

The Permittee shall furnish to the Executive Secretary, within a reasonable time, any information which the Executive Secretary may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this Permit, or to determine compliance with this Permit. The Permittee shall also furnish to the Executive Secretary, upon request, copies of records required to be kept by this Permit.

H. Other Information

When the Permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or any report to the Executive Secretary, it shall promptly submit such facts or information.

I. Signatory Requirements

All applications, reports or information submitted to the Executive Secretary shall be signed and certified.

1. All permit applications shall be signed as follows:
    a) For a corporation: by a responsible corporate officer.
    b) For a partnership or sole proprietorship: by a general partner or the proprietor, respectively.
    c) For a municipality, State, Federal, or other public agency: by either a principal executive officer or ranking elected official.
2. All reports required by the permit and other information requested by the Executive Secretary shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:
    a) The authorization is made in writing by a person described above and submitted to the Executive Secretary, and,
    b) The authorization specified either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.)
3. Changes to Authorization. If an authorization under Part IV.I.2 is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of Part IV.I.2 must be

4. submitted to the Executive Secretary prior to or together with any reports, information, or applications to be signed by an authorized representative.

5. Certification. Any person signing a document under this section shall make the following certification: "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

J. Penalties for Falsification of Reports

The Act provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this Permit, including monitoring reports or reports of compliance or noncompliance shall, upon conviction be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

K. Availability of Reports

Except for data determined to be confidential by the Permittee, all reports prepared in accordance with the terms of this Permit shall be available for public inspection at the offices of the Executive Secretary. As required by the Act, permit applications, permits, effluent data, and ground water quality data shall not be considered confidential.

L. Property Rights

The issuance of this Permit does not convey any property rights of any sort, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations.

M. Severability

The provisions of this Permit are severable, and if any provision of this Permit, or the application of any provision of this Permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this Permit, shall not be affected thereby.

N. Transfers

This Permit may be automatically transferred to a new Permittee if:

1. The current Permittee notifies the Executive Secretary at least 30 days in advance of the proposed transfer date;

2. The notice includes a written agreement between the existing and new Permittee containing a specific date for transfer of permit responsibility, coverage, and liability between them; and,

3. The Executive Secretary does not notify the existing Permittee and the proposed new Permittee of his or her intent to modify, or revoke and reissue the permit. If this notice is not received, the transfer is effective on the date specified in the agreement mentioned in paragraph 2 above.

O. State Laws

Nothing in this Permit shall be construed to preclude the institution of any legal action or relieve the Permittee from any responsibilities, liabilities, penalties established pursuant to any applicable state law or regulation under authority preserved by Section 19-5-117 of the Act.

P. Reopener Provision

This Permit may be reopened and modified, following proper administrative procedures, to include the appropriate limitations and compliance schedule, if necessary, if one or more of the following events occur:

1. If new ground water standards are adopted by the Board, the Permit may be reopened and modified to extend the terms of the Permit or to include pollutants covered by new standards. The Permittee may apply for a variance under the conditions outlined in R317-6.4(D)
2. Changes have been determined in background ground water quality.
3. Determination by the Executive Secretary that changes are necessary in either the Permit or the facility to protect human health or the environment.

APPENDIX A:

Contingency Plan
for
Exceedances of Ground Water Protection Levels

SUBMITTED: August 5, 1991

APPROVED: September 24, 1991

RETITLED: June 30, 1999

APPENDIX B:

Water Monitoring Quality Assurance Plan

APPROVED: December 5, 1991

LATEST REVISION: February 14, 2005

APPENDIX C:

Construction Quality Assurance Plan for Collection Lysimeter Construction and Operation, Maintenance, and Closure Plans for Collection Lysimeters and Related Approvals

SUBMITTED: September 16, 1992 and October 21, 1992, respectively

APPROVED: September 21, 1992 and November 27, 1992, respectively

REVISED: January 9, 2004

APPENDIX D:

Reserved

APPENDIX E:

Procedure
for
Certification of 11e.(2) Material

REVISED: March 1994

APPENDIX F:

Post-Closure Monitoring Plan for LARW and 11e.(2) Disposal Cells

APPROVED: September 13, 1994

REVISED: January 18, 2000

APPENDIX G:

Weather Station Monitoring Plan

APPROVED: September 14, 1994
REVISED: June 26, 2007

APPENDIX H:

Reserved

APPENDIX I:

Plan for the Management of Waste Containing Polychlorinated Biphenyls (PCBs)

APPROVED: October 20, 1999

LATEST REVISION: July 12, 2005

APPENDIX J:

Best Available Technology (BAT) Performance Monitoring Plan

LATEST REVISION: January 25, 2008

APPENDIX K:

Best Available Technology (BAT) Contingency Plan

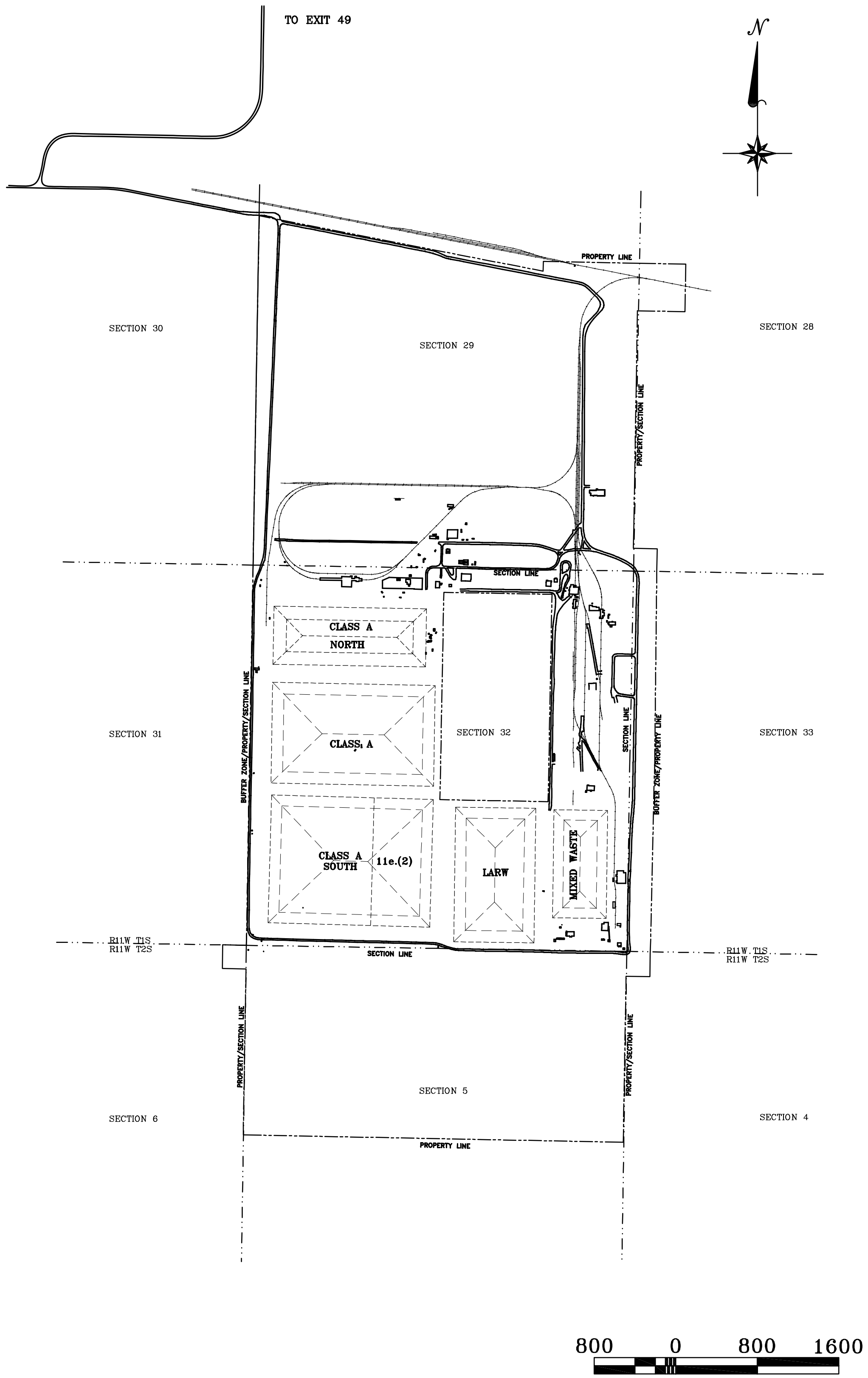
LATEST REVISION: January 25, 2008

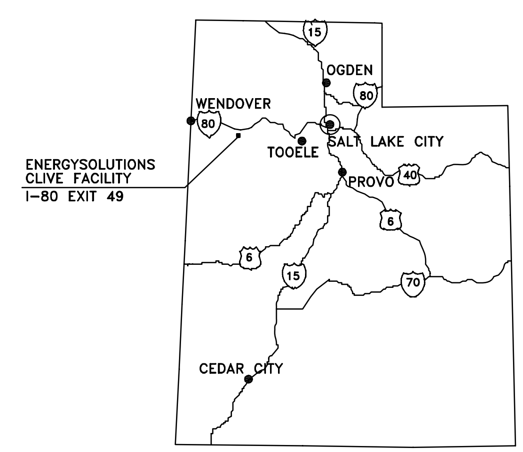
2

ENERGYSOLUTIONS' CLASS A SOUTH/11E.(2) DISPOSAL CELL DRAWINGS

CLASS A SOUTH/11e.(2) DISPOSAL CELL

DWG. NO.	DESCRIPTION
07021-G1	PROJECT TITLE SHEET
07021-U1	DISPOSAL CELL BUFFER ZONE
07021-U2	DISPOSAL CELL WASTE LIMITS-LATITUDES & LONGITUDES
07021-U3	DISPOSAL CELL ENVIRONMENTAL MONITORING
07021-V1	CELL LAYOUT
07021-V2	CELL COVER LAYOUT
07021-V3	CELL CROSS SECTIONS 1 OF 2
07021-V4	CELL CROSS SECTIONS 2 OF 2
07021-V5	CELL CONSTRUCTION DETAILS 1 OF 2
07021-V6	CELL CONSTRUCTION DETAILS 2 OF 2
07021-V7	COVER CROSS SECTIONS AND GRADATIONS
07021-V8	COLLECTION LYSIMETERS DETAILS





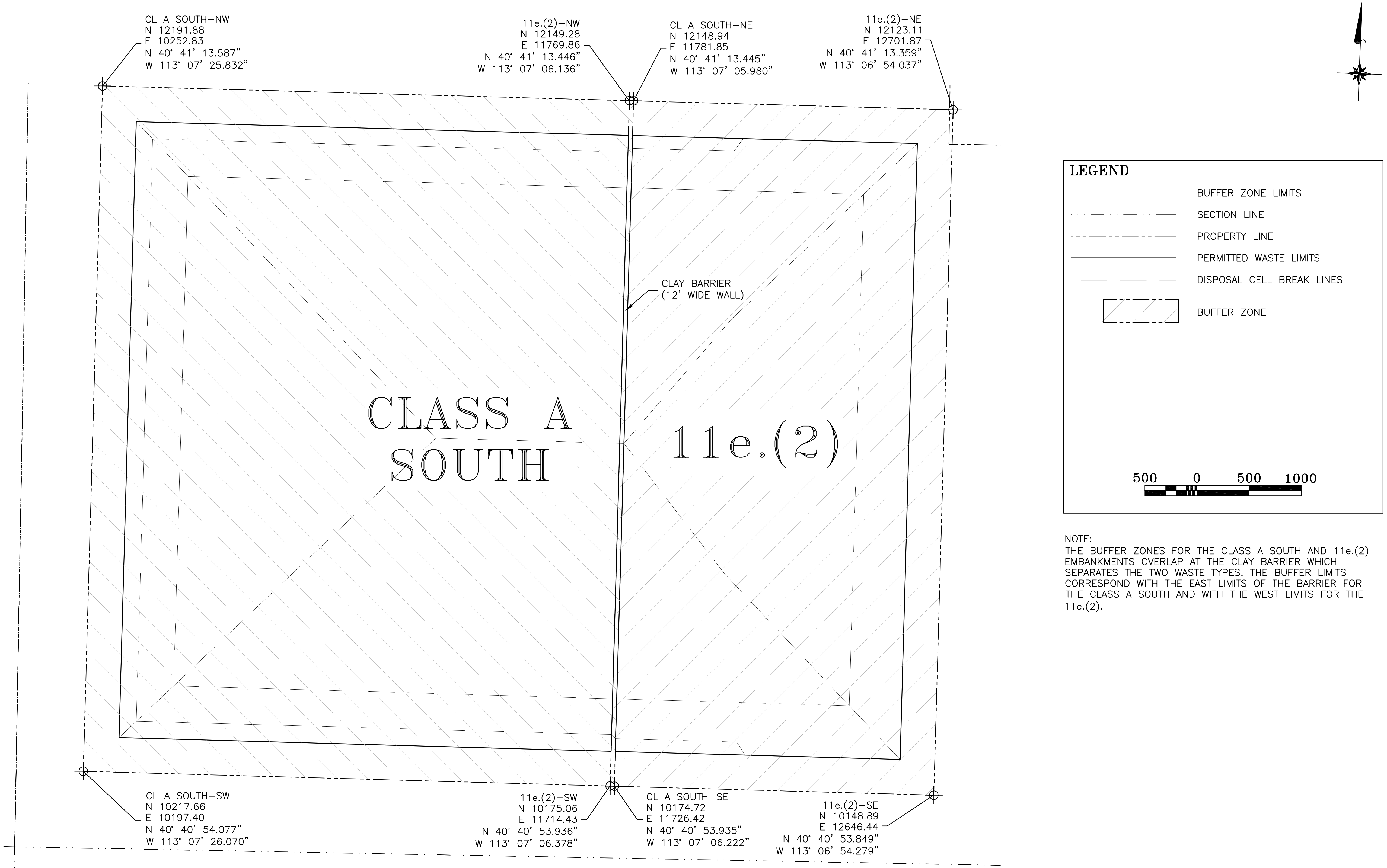
UTAH
VICINITY MAP

DATE	BY	DESCRIPTION OF CHANGE
1/4/08	DFB	ISSUED FOR PERMITTING

ENERGYSOLUTIONS

CLIVE FACILITY
CLASS A SOUTH/11e.(2) DISPOSAL CELL
PROJECT TITLE SHEET
CLIVE, UTAH

DRAFTED BY D.BOOTH
REVIEWED BY G.DUTSON
APPROVED BY D.BOOTH
SCALE AS NOTED
DATE 01/04/08
REV. 1
DRAWING NO. 07021 G1



LEGEND

- BUFFER ZONE LIMITS
- SECTION LINE
- PROPERTY LINE
- PERMITTED WASTE LIMITS
- DISPOSAL CELL BREAK LINES
- BUFFER ZONE

500 0 500 1000

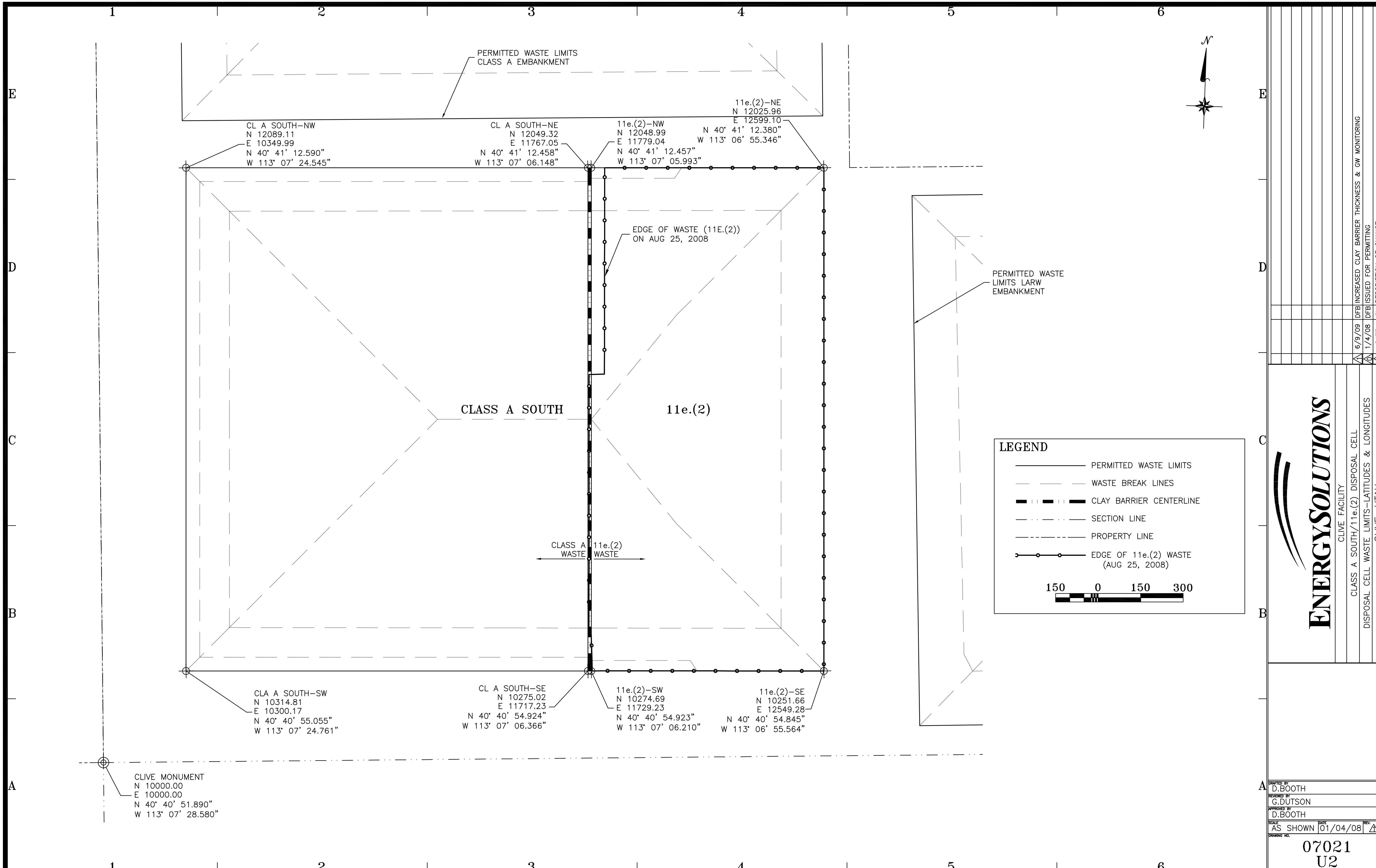
NOTE:
THE BUFFER ZONES FOR THE CLASS A SOUTH AND 11e.(2) EMBANKMENTS OVERLAP AT THE CLAY BARRIER WHICH SEPARATES THE TWO WASTE TYPES. THE BUFFER LIMITS CORRESPOND WITH THE EAST LIMITS OF THE BARRIER FOR THE CLASS A SOUTH AND WITH THE WEST LIMITS FOR THE 11e.(2).

	DATE	BY	DESCRIPTION OF CHANGE
1	6/9/09	DFB	INCREASED CLAY BARRIER THICKNESS & GW MONITORING
0	1/4/08	DFB	ISSUED FOR PERMITTING

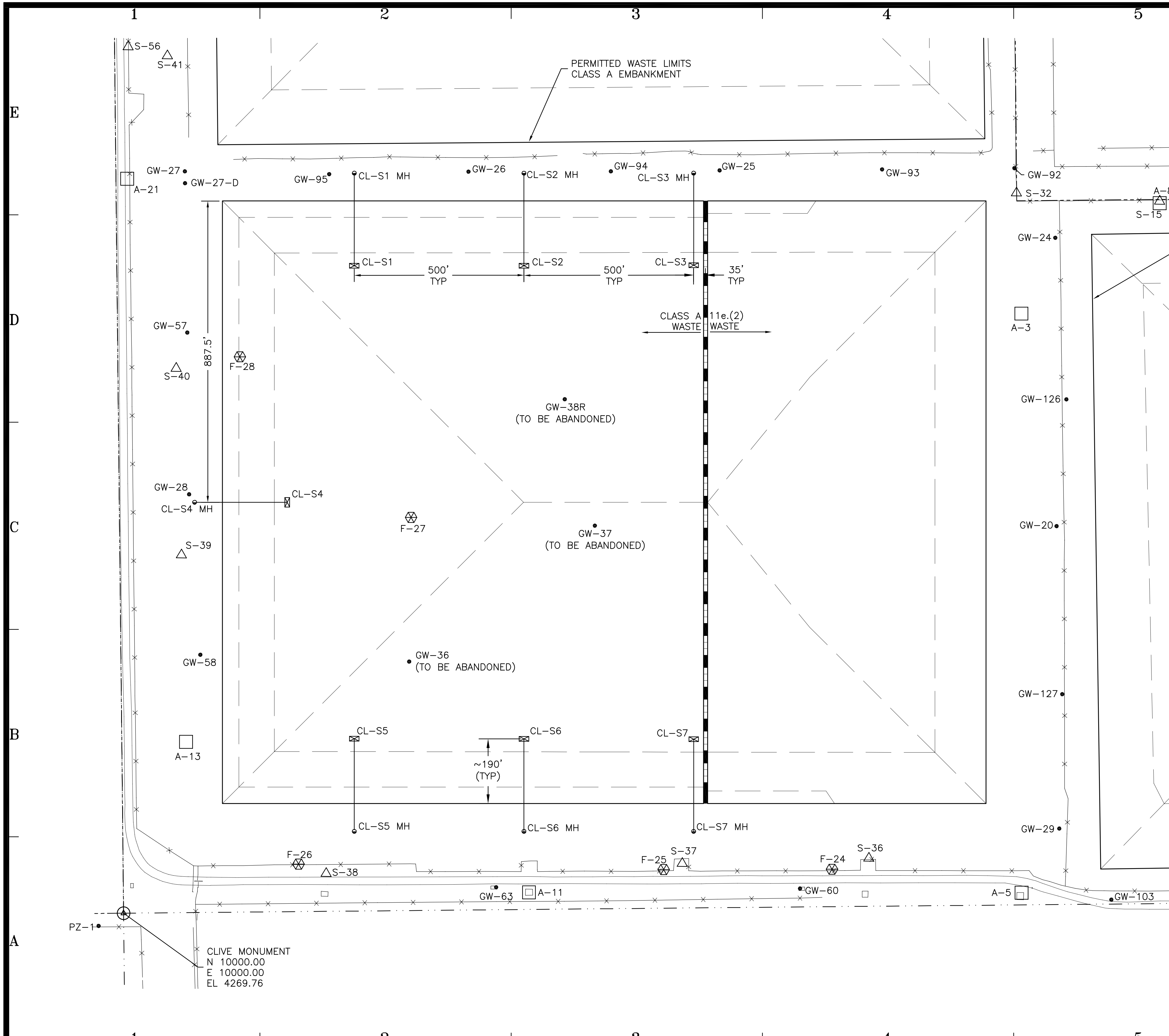
ENERGYSOLUTIONS

CLIVE FACILITY
CLASS A SOUTH/11e.(2) DISPOSAL CELL
DISPOSAL CELL BUFFER ZONE
CLIVE, UTAH

DRAFTED BY: D.BOOTH
REVIEWED BY: G.DUTSON
APPROVED BY: D.BOOTH
SCALE: AS NOTED
DATE: 01/04/08
REV.: 1
DRAWING NO.: 07021 U1



PERMITTED WASTE LIMITS
CLASS A EMBANKMENT
CL A SOUTH—NW
N 12089.11
E 10349.99
N 40° 41' 12.590"
W 113° 07' 24.545"
CL A SOUTH—NE
N 12049.32
E 11767.05
N 40° 41' 12.458"
W 113° 07' 06.148"
11e.(2)—NW
N 12048.99
E 11779.04
N 40° 41' 12.457"
W 113° 07' 05.993"
11e.(2)—NE
N 12025.96
E 12599.10
N 40° 41' 12.380"
W 113° 06' 55.346"
EDGE OF WASTE (11E.(2))
ON AUG 25, 2008
PERMITTED WASTE
LIMITS LARW
EMBANKMENT
CLASS A SOUTH
11e.(2)
CLASS A
WASTE
11e.(2)
WASTE
LEGEND
PERMITTED WASTE LIMITS
WASTE BREAK LINES
CLAY BARRIER CENTERLINE
SECTION LINE
PROPERTY LINE
EDGE OF 11e.(2) WASTE
(AUG 25, 2008)
150 0 150 300
CLA A SOUTH—SW
N 10314.81
E 10300.17
N 40° 40' 55.055"
W 113° 07' 24.761"
CL A SOUTH—SE
N 10275.02
E 11717.23
N 40° 40' 54.924"
W 113° 07' 06.366"
11e.(2)—SW
N 10274.69
E 11729.23
N 40° 40' 54.923"
W 113° 07' 06.210"
11e.(2)—SE
N 10251.66
E 12549.28
N 40° 40' 54.845"
W 113° 06' 55.564"
CLIVE MONUMENT
N 10000.00
E 10000.00
N 40° 40' 51.890"
W 113° 07' 28.580"
6/9/09 DFB INCREASED CLAY BARRIER THICKNESS & GW MONITORING
1/4/08 DFB ISSUED FOR PERMITTING
DATE BY DESCRIPTION OF CHANGE
ENERGYSOLUTIONS
CLIVE FACILITY
CLASS A SOUTH/11e.(2) DISPOSAL CELL
DISPOSAL CELL WASTE LIMITS-LATITUDES & LONGITUDES
CLIVE, UTAH
DRAFTED BY D.BOOTH
REVIEWED BY G.DUTSON
APPROVED BY D.BOOTH
SCALE AS SHOWN
DATE 01/04/08
DRAWING NO. 07021
U2



LEGEND

- PERMITTED WASTE LIMITS
- WASTE BREAK LINES
- CLAY BARRIER CENTERLINE
- SECTION LINE
- PROPERTY LINE
- PAVED ROAD
- EXISTING FENCE (RESTRICTED AREA BNDRY)
- GROUNDWATER MONITORING WELL
- LYSIMETER PAN
- LYSIMETER MANHOLE
- EXISTING AIR MONITORING STATION
- EXISTING SOIL MONITORING STATION
- EXISTING FENCE EPERM (AIR RADIOACTIVITY MONITOR)

150 0 150 300

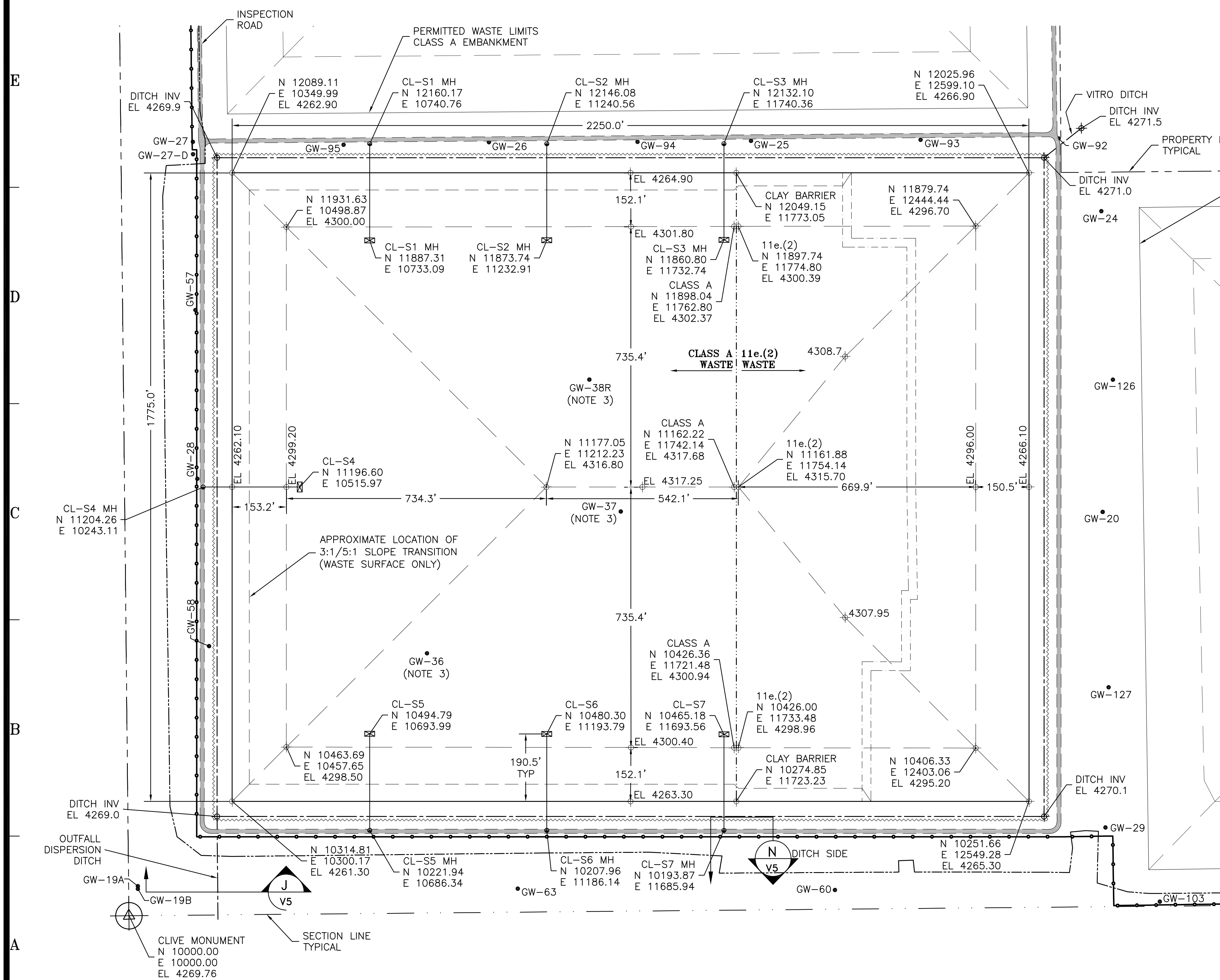
NOTE: GROUNDWATER MONITORING BETWEEN THE CLASS A SOUTH AND THE 11e.(2) DISPOSAL AREAS WILL CONSIST OF A CONTINUOUS HORIZONTAL MONITORING WELL LOCATED 2 FT EAST OF THE EAST CLASS A SOUTH WASTE LIMITS (WEST BOUNDARY OF THE CLAY BARRIER WALL).

REV	DATE	BY	DESCRIPTION OF CHANGE
2	6/9/09	DFB	INCREASED CLAY BARRIER THICKNESS & GW MONITORING
1	1/4/08	DFB	ISSUED FOR PERMITTING

ENERGYSOLUTIONS

CLIVE FACILITY
CLASS A SOUTH/11e.(2) DISPOSAL CELL
DISPOSAL CELL ENVIRONMENTAL MONITORING
CLIVE, UTAH

DRAFTED BY: D.BOOTH
REVIEWED BY: G.DUTSON
APPROVED BY: D.BOOTH
SCALE: AS SHOWN
DATE: 01/04/08
DRAWING NO. 07021 U3



LEGEND

- PERMITTED WASTE LIMITS
- CLAY BARRIER CENTERLINE
- INSPECTION ROAD
- WASTE BREAK LINES
- LINER LIMITS (MINIMUM)
- DRAINAGE DITCH CENTERLINE
- 11e.(2) COVER TRANSITION
- RUNON BERM CENTERLINE
- SECTION LINE
- PROPERTY LINE
- CLOSURE FENCE
- GROUNDWATER MONITORING WELL
- LYSIMETER PAN
- LYSIMETER MANHOLE

150 0 150 300

NOTES

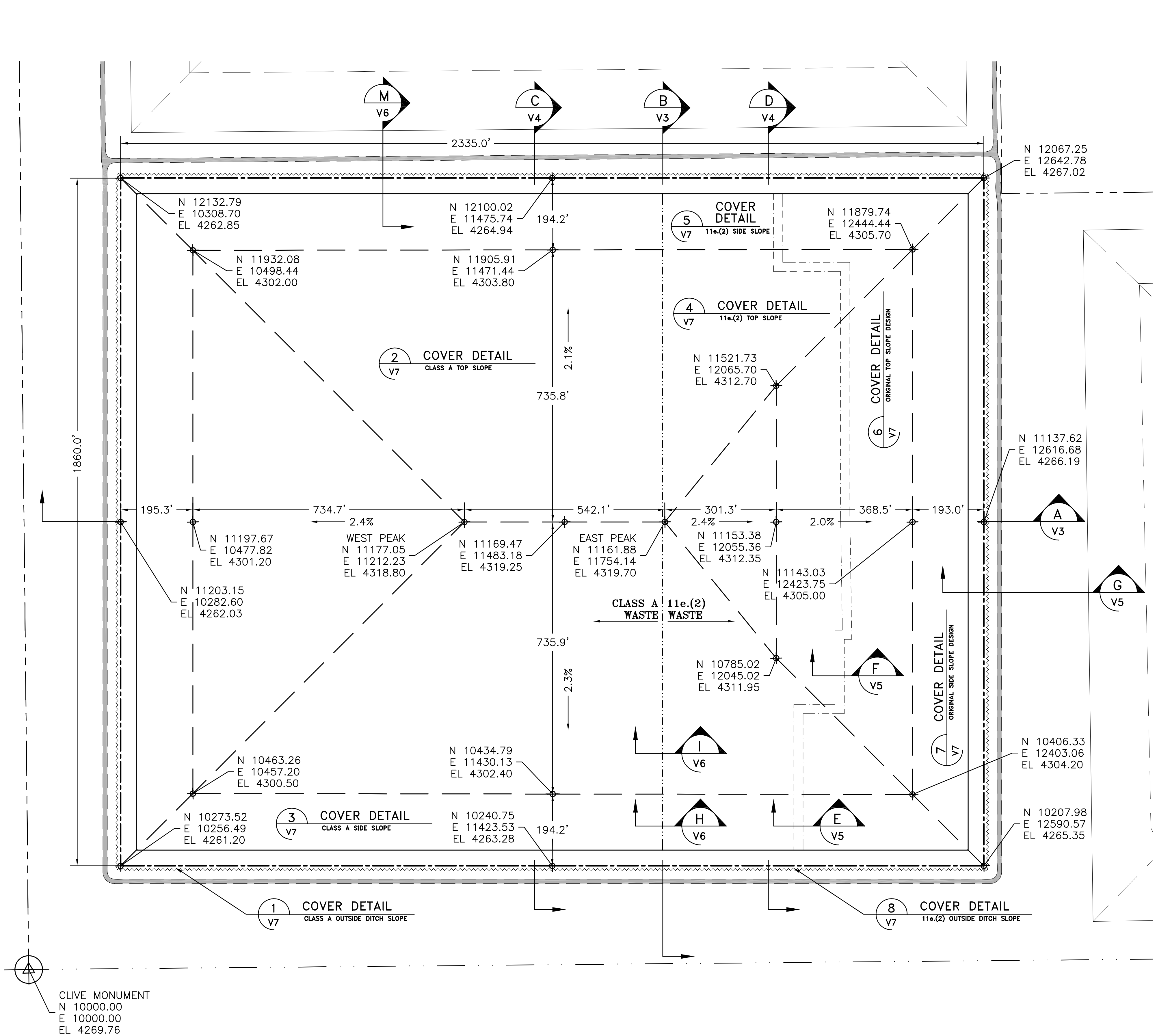
1. ALL ELEVATIONS SHOWN ARE FOR TOP OF WASTE UNLESS OTHERWISE NOTED.
2. COORDINATES ARE BASED ON THE CLIVE MONUMENT.
3. THESE WELLS WILL BE ABANDONED PRIOR TO CONSTRUCTION OF CELL LINER.
4. INSPECTION ROAD AND DITCH CENTERLINE TO BE DETERMINED AT TIME OF COVER CONSTRUCTION.
5. LYSIMETER PAN AND MANHOLE ELEVATIONS WILL BE DETERMINED AT TIME OF LINER CONSTRUCTION.

REV	DATE	BY	DESCRIPTION OF CHANGE
1	6/9/09	DFB	INCREASED CLAY BARRIER THICKNESS & GW MONITORING
0	1/4/08	DFB	ISSUED FOR PERMITTING

ENERGYSOLUTIONS

CLIVE FACILITY
CLASS A SOUTH/11e.(2) DISPOSAL CELL
CELL LAYOUT
CLIVE, UTAH

DRAFTED BY D.BOOTH
REVIEWED BY G.DUTSON
APPROVED BY D.BOOTH
SCALE AS NOTED | DATE 01/04/08 | REV. 1
DRAWING NO. 07021 V1



LEGEND

- PERMITTED WASTE LIMITS
- RADON BARRIER LIMITS
- CLAY BARRIER CENTERLINE
- INSPECTION ROAD
- RADON BARRIER BREAK LINES
- LINER LIMITS (MINIMUM)
- 11e.(2) COVER TRANSITION
- SECTION LINE
- PROPERTY LINE

150 0 150 300

NOTES

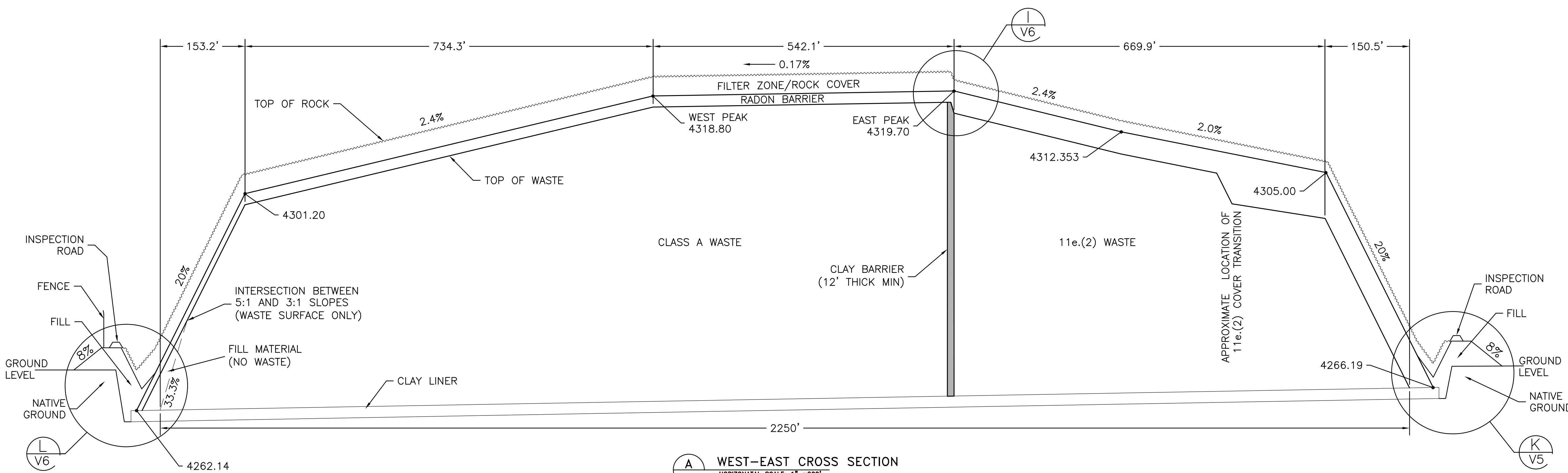
1. ELEVATIONS SHOWN ARE FOR TOP OF RADON BARRIER (5x10−8 CM/SEC) LAYER UNLESS OTHERWISE NOTED.
2. COORDINATES ARE BASED ON THE CLIVE MONUMENT.

DATE	BY	DESCRIPTION OF CHANGE
6/9/09	DFB	INCREASED CLAY BARRIER THICKNESS & GW MONITORING
1/4/08	DFB	ISSUED FOR PERMITTING

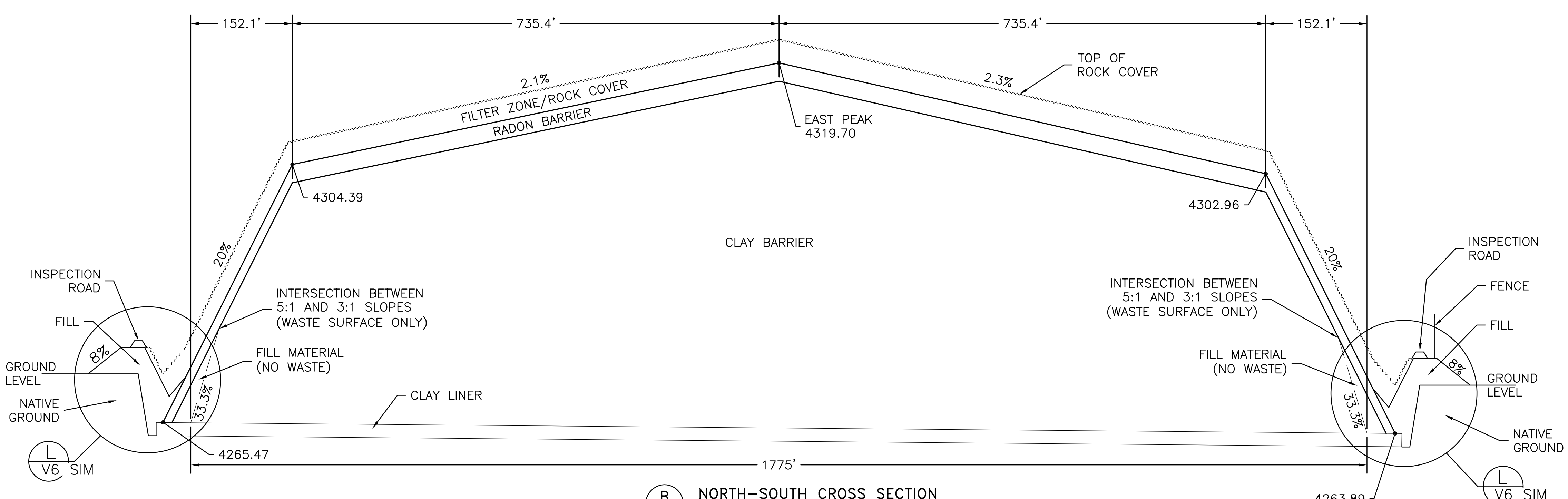
ENERGYSOLUTIONS

CLIVE FACILITY
CLASS A SOUTH/11e.(2) DISPOSAL CELL
CELL COVER LAYOUT
CLIVE, UTAH

DRAFTED BY: D.BOOTH
REVIEWED BY: G.DUTSON
APPROVED BY: D.BOOTH
SCALE: AS NOTED
DATE: 01/04/08
DRAWING NO. 07021 V2



A
V2
WEST-EAST CROSS SECTION
HORIZONATAL SCALE: 1" =200'
VERTICAL SCALE: 1" = 20'



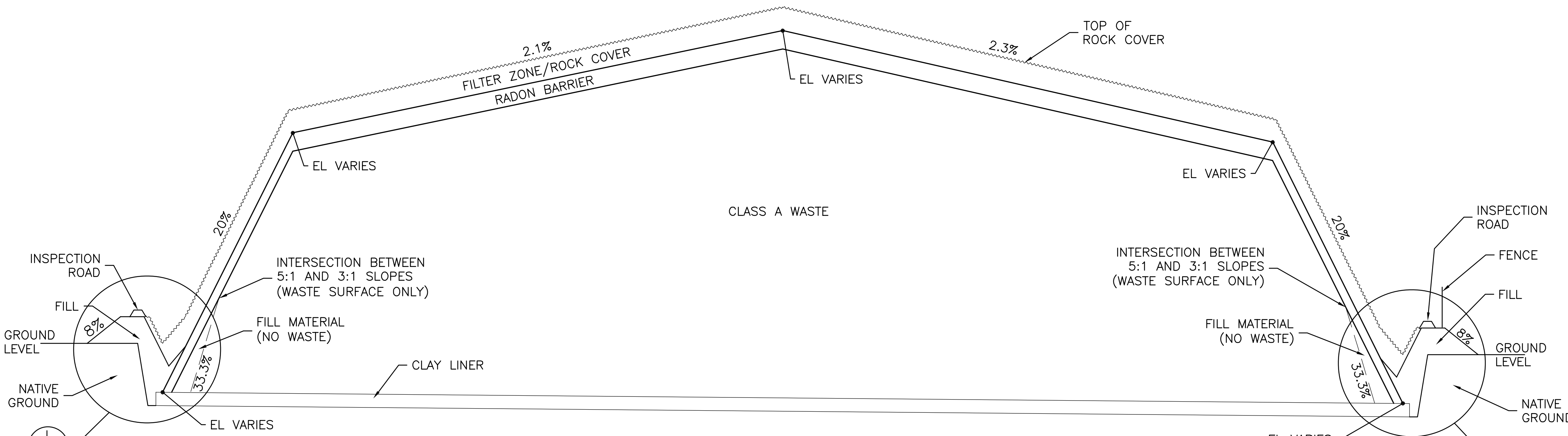
B
V2
NORTH-SOUTH CROSS SECTION
HORIZONATAL SCALE: 1" =200'
VERTICAL SCALE: 1" = 20'

	DATE	BY	DESCRIPTION OF CHANGE
2	6/9/09	DFB	INCREASED CLAY BARRIER THICKNESS & GW MONITORING
1	1/4/08	DFB	ISSUED FOR PERMITTING

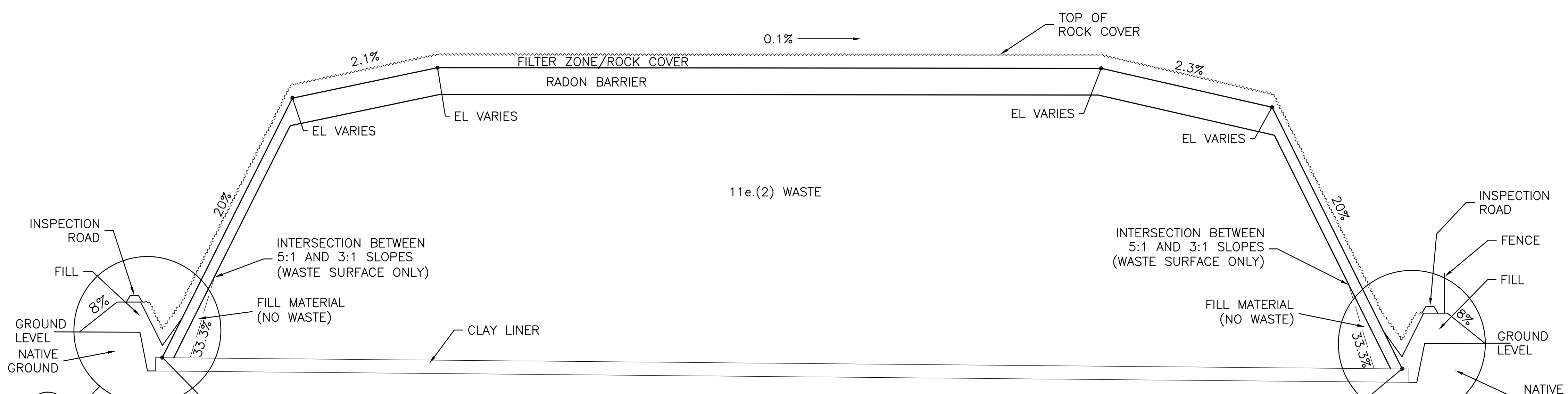
ENERGYSOLUTIONS

CLIVE FACILITY
CLASS A SOUTH/11e.(2) DISPOSAL CELL
CELL CROSS SECTIONS 1 OF 2
CLIVE, UTAH

DRAFTED BY: D.BOOTH
REVIEWED BY: G.DUTSON
APPROVED BY: D.BOOTH
SCALE: NTS
DATE: 01/04/08
REV.: 2
DRAWING NO.: 07021 V3



C
V2
CLASS A SOUTH
NORTH-SOUTH CROSS SECTION
HORIZONATAL SCALE: 1" =200'
VERTICAL SCALE: 1" = 20'



D
V2
11e.(2)
NORTH-SOUTH CROSS SECTION
HORIZONATAL SCALE: 1" =200'
VERTICAL SCALE: 1" = 20'

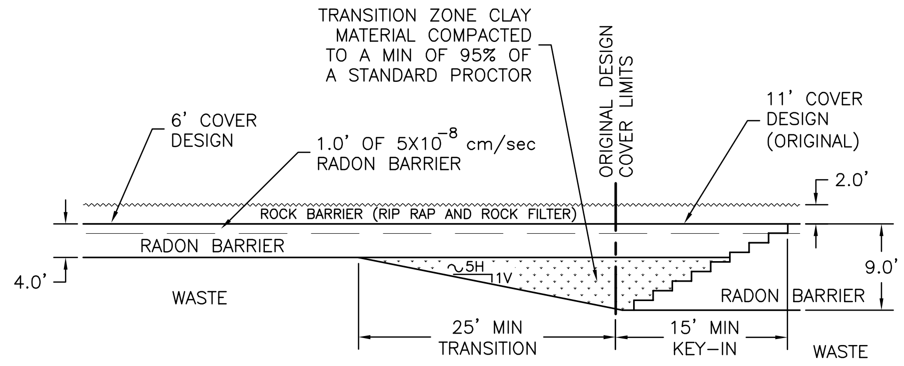
DATE	BY	DESCRIPTION OF CHANGE
1/4/08	DFB	ISSUED FOR PERMITTING

ENERGYSOLUTIONS

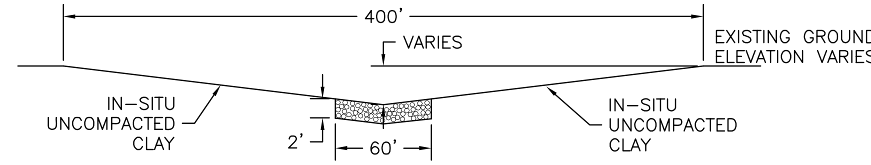
CLIVE FACILITY
CLASS A SOUTH/11e.(2) DISPOSAL CELL
CELL CROSS SECTIONS 2 OF 2
CLIVE, UTAH

DRAFTED BY D.BOOTH
REVIEWED BY G.DUTSON
APPROVED BY D.BOOTH
SCALE NTS
DATE 01/04/08
REV. 1

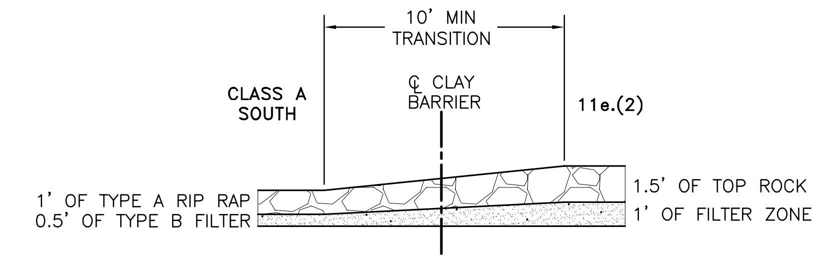
DRAWING NO.
07021
V4



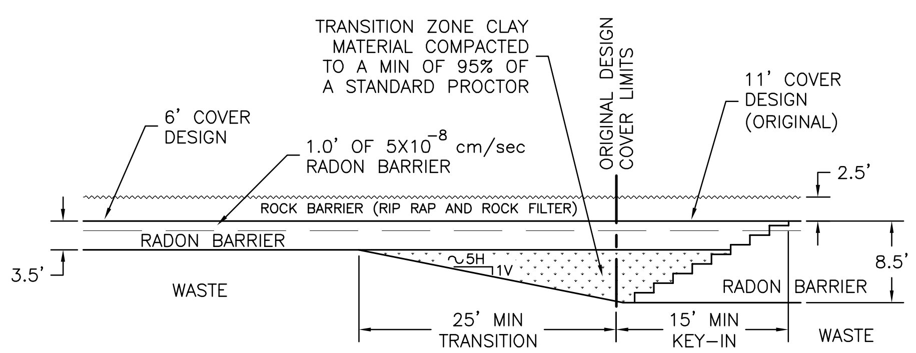
F V2 11e.(2) TOP SLOPE COVER TRANSITION
NOT TO SCALE



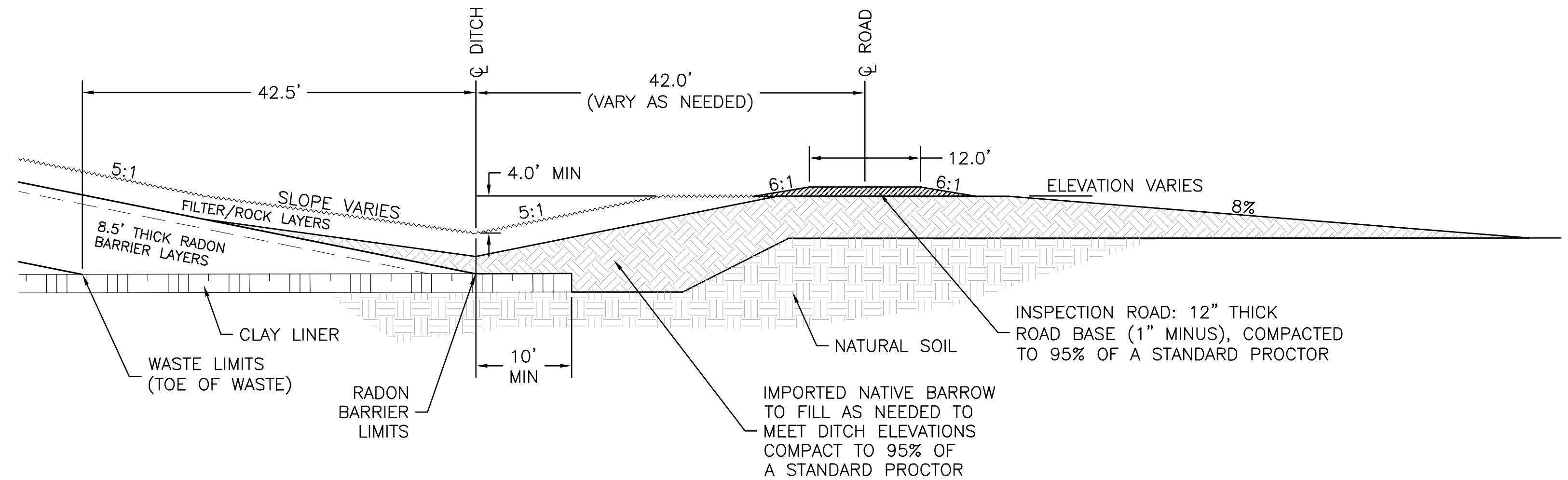
J V1 DISPERSION DITCH CROSS SECTION
HORIZONATAL SCALE: 1" = 120'
VERTICAL SCALE: 1" = 20'



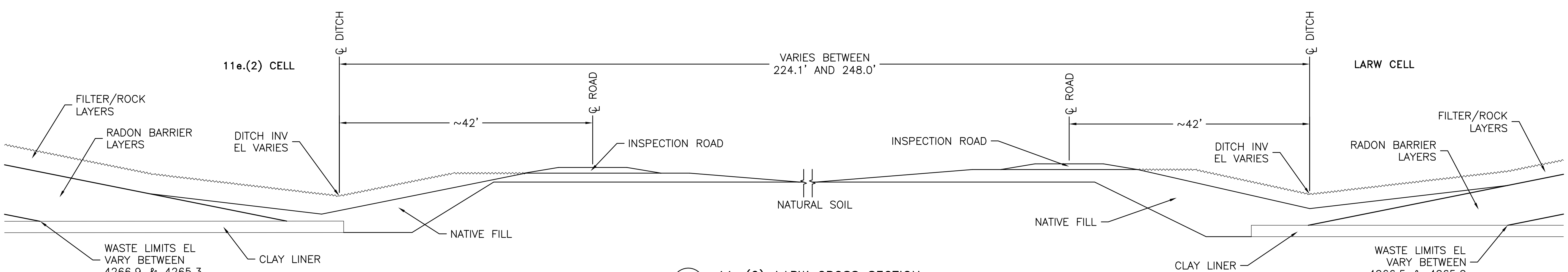
N V1 DITCH SIDE SLOPE TRANSITION OUTSIDE OF CENTERLINE
HORIZONATAL SCALE: 1" = 8'



E V2 11e.(2) SIDE SLOPE COVER TRANSITION
NOT TO SCALE



K V3 ORIGINAL DITCH CROSS SECTION
10 0 10 20



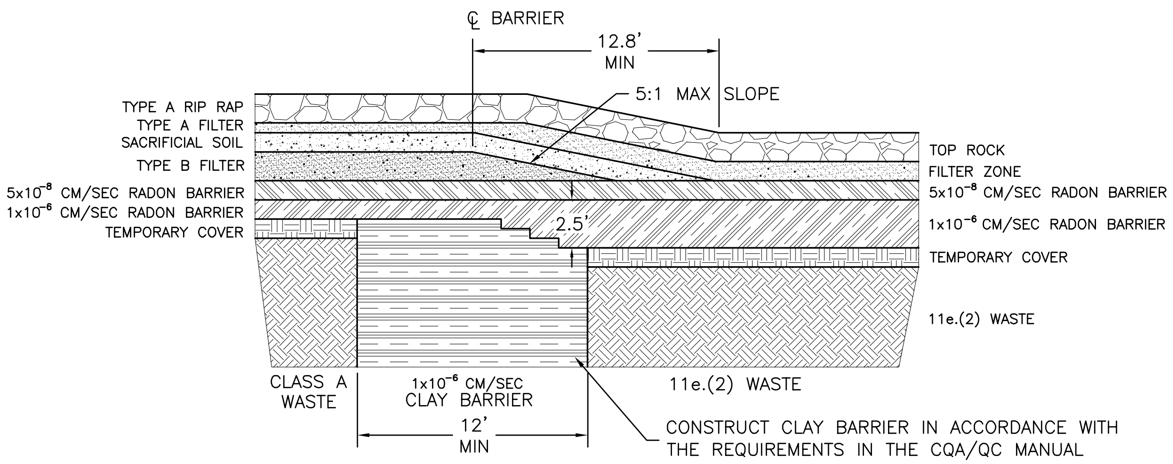
G V2 11e.(2)-LARW CROSS SECTION
10 0 10 20

DATE	BY	DESCRIPTION OF CHANGE
1/4/08	DFB	ISSUED FOR PERMITTING

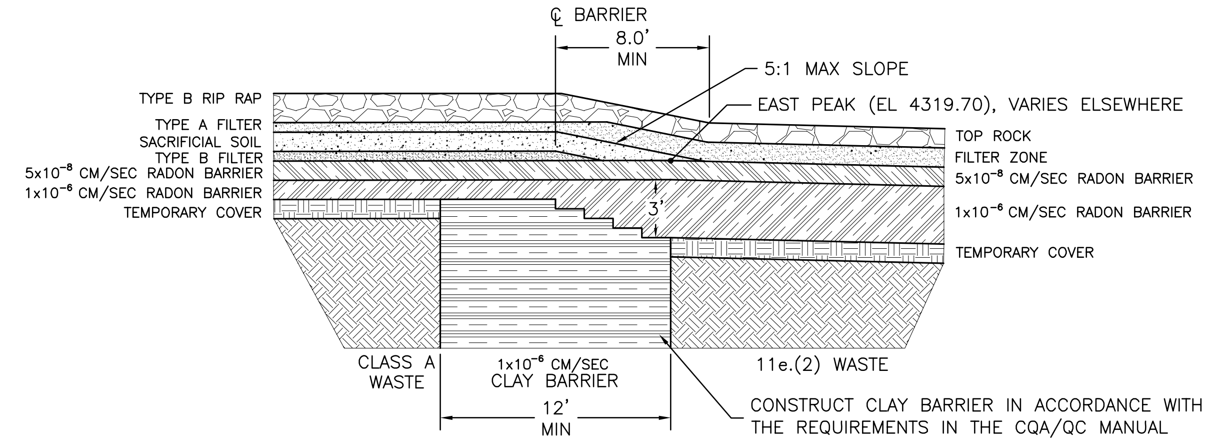
ENERGYSOLUTIONS

CLIVE FACILITY
CLASS A SOUTH/11e.(2) DISPOSAL CELL
CELL CONSTRUCTION DETAILS 1 OF 2
CLIVE, UTAH

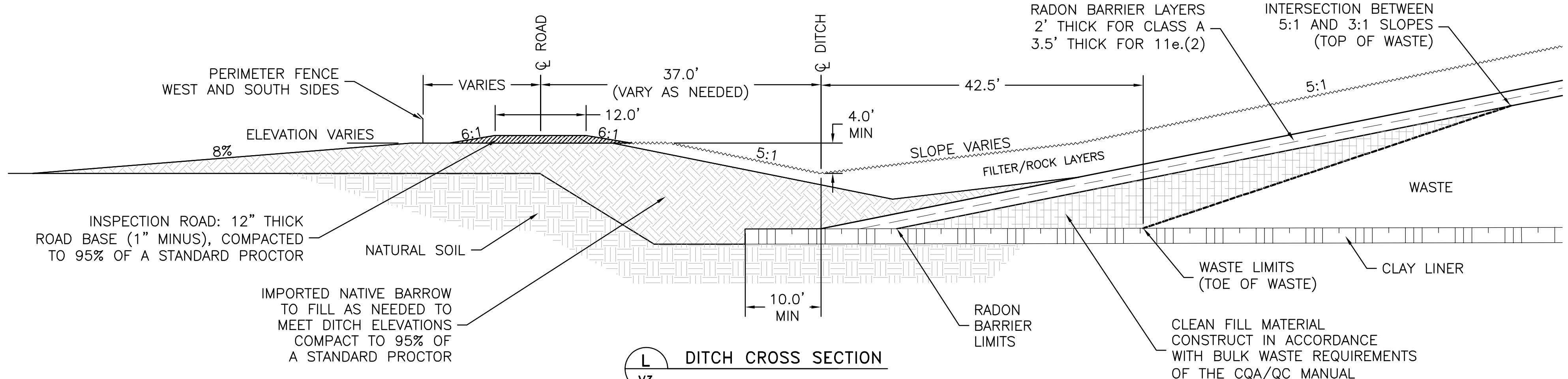
DRAFTED BY D.BOOTH
REVIEWED BY G.DUTSON
APPROVED BY D.BOOTH
SCALE NTS
DATE 01/04/08
DRAWING NO. 07021 V5



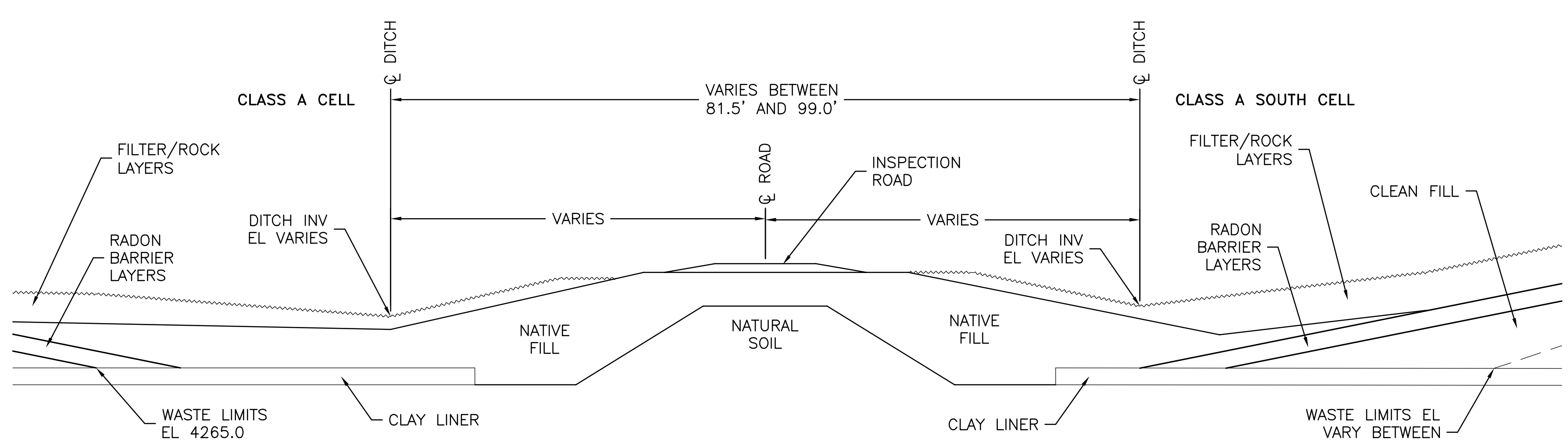
H / V2 SIDE SLOPE COVER TRANSITION @ CLAY BARRIER
SCALE: 1" =10'



I / V2 TOP SLOPE COVER TRANSITION @ CLAY BARRIER
SCALE: 1" =10'



L / V3 DITCH CROSS SECTION
10 0 10 20



M / V2 CLASS A–CLASS A SOUTH CROSS SECTION
10 0 10 20

NOTE: CLASS A–11e.(2) CROSS SECTION IS SIMILAR.

	DATE	BY	DESCRIPTION OF CHANGE
2	6/9/09	DFB	INCREASED CLAY BARRIER THICKNESS
1	1/4/08	DFB	ISSUED FOR PERMITTING

ENERGYSOLUTIONS

CLIVE FACILITY
CLASS A SOUTH/11e.(2) DISPOSAL CELL
CELL CONSTRUCTION DETAILS 2 OF 2
CLIVE, UTAH

DRAFTED BY D.BOOTH
REVIEWED BY G.DUTSON
APPROVED BY D.BOOTH
SCALE NTS | DATE 01/04/08 | REV. 2
DRAWING NO. 07021 V6

11e.(2) COVER DESIGNS

ROCK
12" THICK TOP ROCK
12" THICK FILTER ZONE
12" OF 5 X 10^{-8} CM/SEC RADON BARRIER
CLAY
3' OF 1 X 10^{-6} CM/SEC RADON BARRIER

4 / V2 — 11e.(2) TOP SLOPES

ROCK
18" THICK SIDE ROCK
12" THICK FILTER ZONE
12" OF 5 X 10^{-8} CM/SEC RADON BARRIER
CLAY
2.5' OF 1 X 10^{-6} CM/SEC RADON BARRIER

5 / V2 — 11e.(2) SIDE SLOPES

ROCK
12" THICK TOP ROCK
12" THICK FILTER ZONE
12" OF 5 X 10^{-8} CM/SEC RADON BARRIER
CLAY
8' OF 1 X 10^{-6} CM/SEC RADON BARRIER

6 / V2 — 11e.(2) TOP SLOPES
ORIGINAL DESIGN

ROCK
18" THICK SIDE ROCK
12" THICK FILTER ZONE
12" OF 5 X 10^{-8} CM/SEC RADON BARRIER
CLAY
7.5' OF 1 X 10^{-6} CM/SEC RADON BARRIER

7 / V2 — 11e.(2) SIDE SLOPES
ORIGINAL DESIGN

ROCK
18" THICK SIDE ROCK
12" THICK FILTER ZONE
NATURAL GROUND OR IMPORTED NATIVE BARROW MATERIAL

8 / V2 — PERIMETER DITCH
OUTSIDE SLOPE ONLY

GRADATIONS – ASTM C-136

TOP ROCK
- D_{100} 2-1/2 TO 4-1/2 INCHES
- D_{50} 1-1/8 TO 3 INCHES
- D_{15} 3/4 TO 1-1/2 INCHES

SIDE ROCK
- D_{100} 12 TO 16 INCHES
- D_{95} 8 TO 12 INCHES
- D_{50} 4-1/2 TO 8 INCHES
- D_{15} 2 TO 4 INCHES

FILTER ZONE
- D_{100} = 1.5 TO 3. 0 INCHES
- D_{85} = 1.0 TO 2.5 INCHES
- D_{50} = 0.75 TO 2.0 INCHES
- D_{15} = 0.3.125 TO 0.625 INCHES
- D_{10} >= #10 SIEVE (2.0 mm)
- D_{5} >= #200 SEIVE (0.074 mm)

CLASS A SOUTH COVER DESIGNS

12" THICK TYPE A RIP RAP
6" THICK TYPE A FILTER ZONE
NATURAL GROUND OR IMPORTED NATIVE BARROW MATERIAL

1 / V2 — PERIMETER DITCH
OUTSIDE SLOPE ONLY

ROCK
18" THICK TYPE B RIP RAP
6" THICK TYPE A FILTER ZONE
12" THICK SACRIFICIAL SOIL
6" THICK TYPE B FILTER ZONE
CLAY
12" OF 5 X 10^{-8} CM/SEC RADON BARRIER
12" OF 1 X 10^{-6} CM/SEC RADON BARRIER

2 / V2 — CLASS A SOUTH TOP SLOPES

ROCK
18" THICK TYPE A RIP RAP
6" THICK TYPE A FILTER ZONE
12" THICK SACRIFICIAL SOIL
18" THICK TYPE B FILTER ZONE
CLAY
12" OF 5 X 10^{-8} CM/SEC RADON BARRIER
12" OF 1 X 10^{-6} CM/SEC RADON BARRIER

3 / V2 — CLASS A SOUTH SIDE SLOPES

GRADATIONS – ASTM C-136

TYPE A RIP RAP
- D_{100} <= 16 INCH
- D_{90} <= 12 INCH
- D_{50} >= 4-1/2 INCH
- D_{10} >= 2 INCH
- D_{5} >= NO. 200 SIEVE

TYPE B RIP RAP
- D_{100} <= 4-1/2 INCH
- D_{50} >= 1-1/4 INCH
- D_{10} >= 3/4 INCH
- D_{5} >= NO. 200 SIEVE

TYPE A FILTER ZONE
- D_{100} <= 6 INCH
- D_{70} <= 3 INCH
- D_{50} <= 1.57 INCH (40 mm)
- D_{15} <= .85 INCH (22 mm)
- D_{10} >= NO. 10 SIEVE (2mm)
- D_{5} >= NO. 200 SIEVE

TYPE B FILTER & SACRIFICIAL SOIL

TYPE B FILTER & SACRIFICAIL SOIL MATERIAL GRADATIONS ARE DETERMINED BY THE FOLLOWING SPECIFICATION:

$\frac{\text{D15 (MAX) FILTER}}{\text{D85 (MIN) SOIL}}$ MUST BE < 5

$\frac{\text{D50 (MAX) FILTER}}{\text{D50 (MIN) SOIL}}$ MUST BE ≤ 25

TYPE B FILTER MIN PERMEABILITY = 3.5 cm/sec

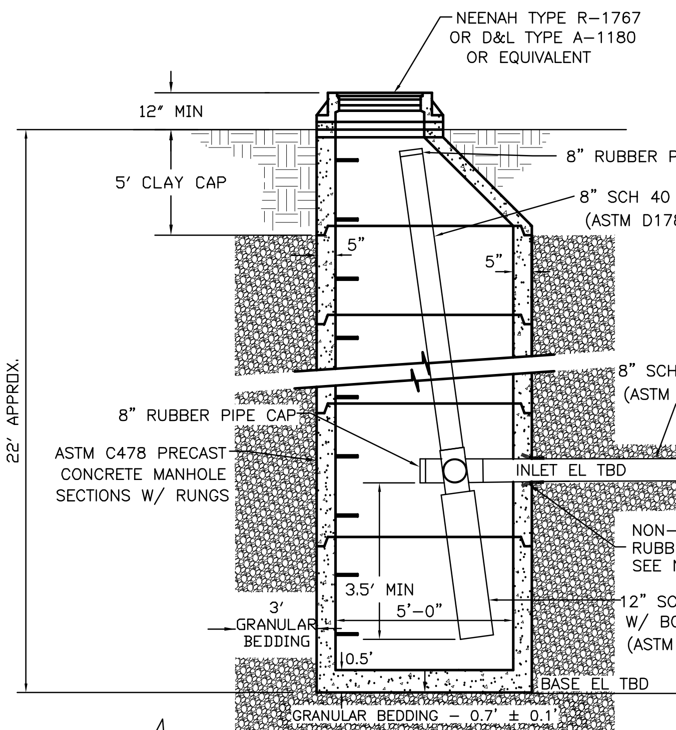
SACRIFICIAL SOIL MIN MOISTURE @ 15 atm = 3.5%

DATE	BY	DESCRIPTION OF CHANGE
1/4/08	DFB	ISSUED FOR PERMITTING

ENERGYSOLUTIONS

CLIVE FACILITY
CLASS A SOUTH/11e.(2) DISPOSAL CELL
COVER CROSS SECTIONS AND GRADATIONS
CLIVE, UTAH

DRAFTED BY: D.BOOTH
REVIEWED BY: G.DUTSON
APPROVED BY: D.BOOTH
SCALE: NTS
DATE: 01/04/08
DRAWING NO. 07021 V7

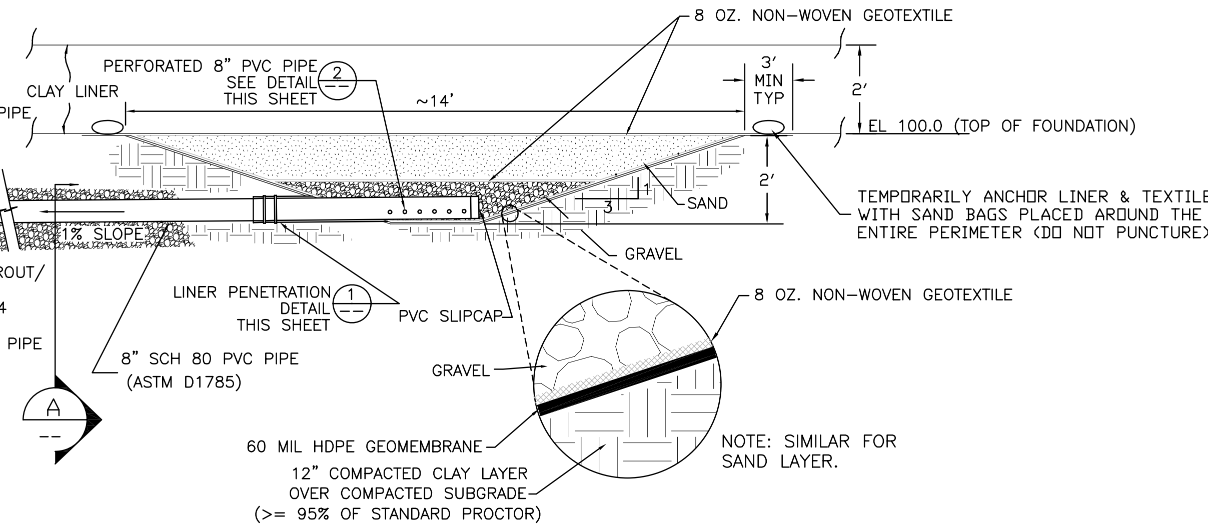


NOTES:

1. THE MANHOLE EXCAVATION SHALL EXTEND 0.9 ±0.2-FOOT BELOW THE BOTTOM OF THE MANHOLE.
2. BACKFILL AROUND THE LOWER MANHOLE SECTIONS AND LYSIMETER PIPE SHALL CONSIST OF GRANULAR BEDDING MATERIAL. A 3 FOOT COLUMN OF GRANULAR BEDDING AROUND THE MANHOLE SHALL EXTEND TO A LEVEL GREATER THAN OR EQUAL TO 5-FEET BELOW FINAL GRADE. THE FINAL 5 FEET OF BACKFILL SHALL BE CLAY PLACED IN 1.0 ± 0.1 FOOT THICK LOOSE LIFTS COMPACTED TO ≥90% OF A STANDARD PROCTOR.
3. GRANULAR BEDDING MATERIAL SHALL BE USED TO BACKFILL THE PIPE TRENCH TO A MINIMUM OF 0.5-FOOT ABOVE THE PIPE. THE REMAINING TRENCH BACKFILL MAY CONSIST OF GRANULAR BEDDING MATERIAL OR NATIVE SOIL PLACED IN 1.0 ± 0.2 FOOT THICK LOOSE LIFTS COMPACTED TO ≥90% OF THE STANDARD PROCTOR. IF GRANULAR BEDDING IS USED AS TRENCH BACKFILL, THE FINAL 1.0 ±0.2-FOOT THICK LIFT SHALL CONSIST OF NATIVE SOILS.
4. SEAL PIPE PENETRATION ON MANHOLE SECTION ON THE INSIDE AND OUTSIDE WITH A RUBBER BOOT AND SS STRAP AND/OR NON-SHRINK GROUT. SEAL OUTSIDE OF AT LEAST THE LOWEST SUMP SECTION AND BASE WITH BLACK MASTIC PRIOR TO INSTALLATION TO WATERPROOF. SEAL ALL MANHOLE SECTION'S JOINTS.
5. INLET AND BASE ELEVATIONS TO BE DETERMINED FOR EACH LYSIMETER AND PRESENTED IN A SEPARATE DRAWING(S).
6. SEE ALL MATERIALS GRADATIONS IN THE CQA PLAN.

MANHOLE AND PIPING DETAIL

NOT TO SCALE

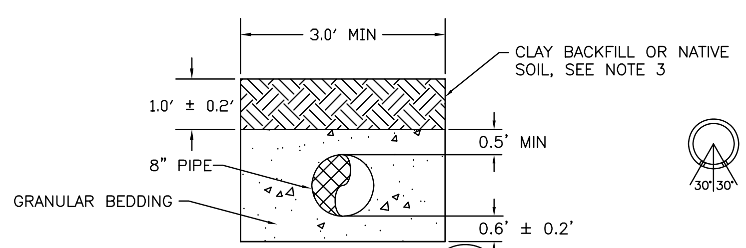


NOTE:

1. SEE SAND AND GRAVEL GRADATIONS IN THE CQA PLAN. THE SAND AND GRAVEL THICKNESSES ARE EACH 0.9 TO 1.0 FEET AND NO COMPACTION IS REQUIRED FOR EITHER LAYER.

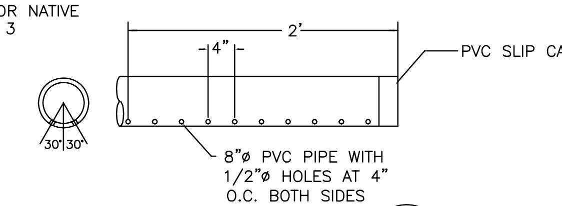
COLLECTION LYSIMETER SUMP DETAIL

NOT TO SCALE



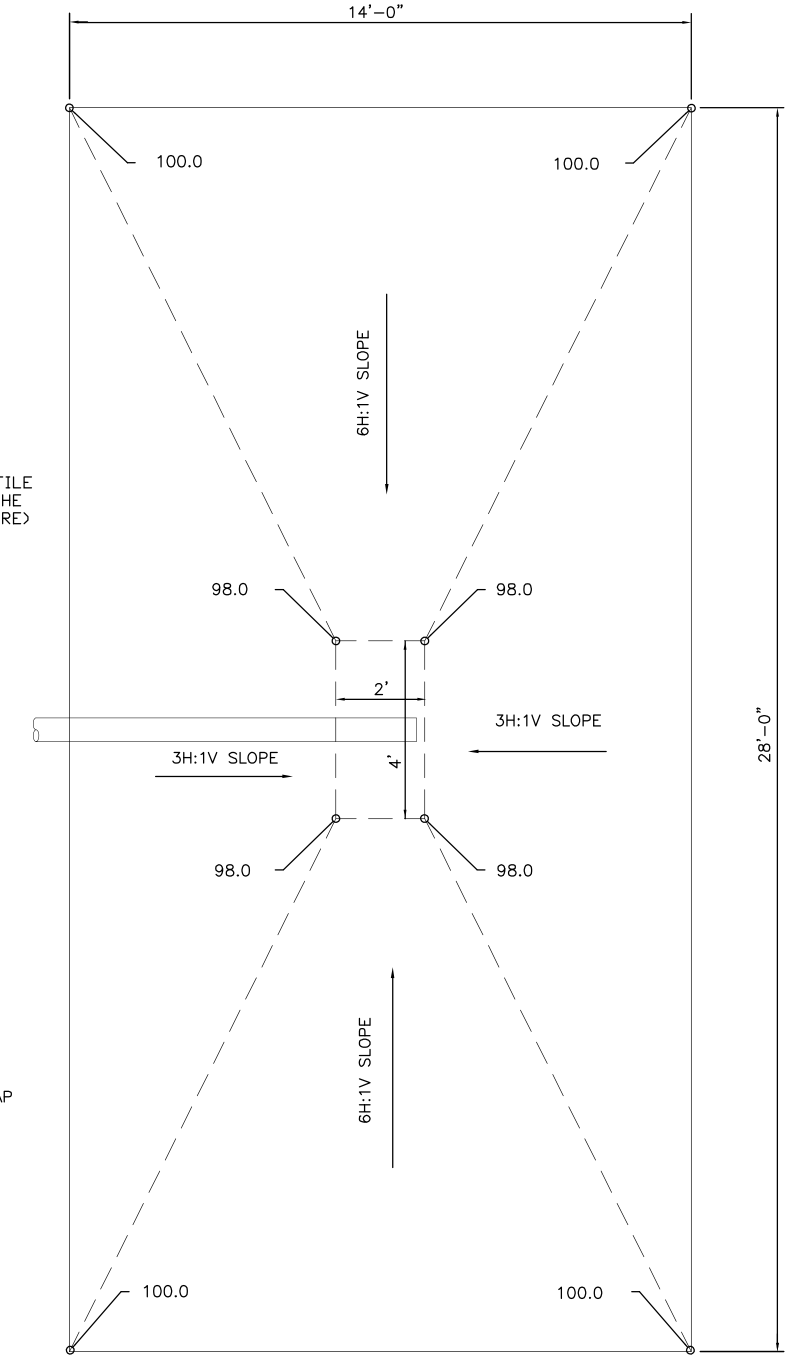
SECTION A

NOT TO SCALE



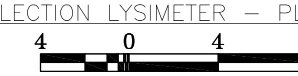
PERFORATION DETAILS 2

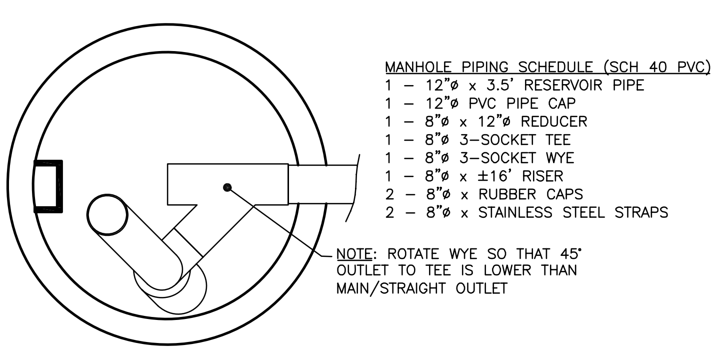
NOT TO SCALE



NOTE: LISTED ELEVATIONS ARE FOR REFERENCE ONLY AND REPRESENT TOP OF FOUNDATION. CONSTRUCTION ELEVATIONS ARE BASED ON TOP OF CLAY LAYER ELEVATIONS AND WILL BE DETERMINED PRIOR TO CONSTRUCTION OF THE LYSIMETER(S). GRADE TOLERANCE SHALL BE GRADE TO 0.2-FOOT BELOW GRADE.

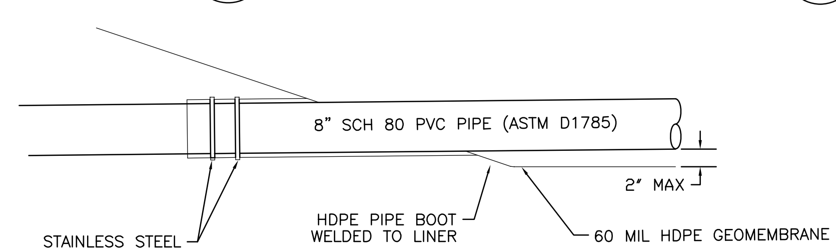
COLLECTION LYSIMETER – PLAN VIEW





MANHOLE PIPING DETAIL

NOT TO SCALE



LINER PENETRATION DETAIL 1

NOT TO SCALE

NOTE: SEE ALSO GWQDP APPENDIX C, CQA PLAN FOR COLLECTION LYSIMETERS.

DATE	BY	DESCRIPTION OF CHANGE
6/9/09	BLD	REVISED TO MAKE CONSISTENT WITH CQA/QC PLAN FOR LYSIMETER CONSTRUCTION
1/4/08	DFB	ISSUED FOR PERMITTING

ENERGYSOLUTIONS

CLIVE FACILITY
CLASS A SOUTH/11e.(2) DISPOSAL CELL
COLLECTION LYSIMETERS DETAILS
CLIVE, UTAH

DRAFTED BY D.SQUIRES
REVIEWED BY G.DUTSON
APPROVED BY D. BOOTH
SCALE AS NOTED
DATE 01/04/08
DRAWING NO. 07021 V8

ATTACHMENT 3

LLRW and 11e.(2) Construction Quality Assurance/Quality Control (CQA/QC) Manual

TABLE 1 – CQA/QC ACTIVITIES

Work Elements:

TABLE 2 – MATERIAL PROPERTIES FOR PORTLAND CEMENT CLSM

TABLE 3 – MATERIAL PROPERTIES FOR FLY ASH CLSM

FIGURE 1 – LARW Settlement Monuments, May 1, 2006
FIGURE 2 – Class A Settlement Monuments, rev. 2, July 30, 2008
FIGURE 3 – Mixed Waste Settlement Monuments, rev. 2, October 10, 2008
FIGURE 4 – Class A South/11e.(2) Settlement Monuments, rev. 32, October 10, 2008June 8, 2009

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
SCOPE: This work element applies to all construction activities in the Class A, Class A North, and Class A South/11e.(2) embankments.		
QC DOCUMENTATION APPROVAL: QC documentation shall be approved/rejected by the QC Officer and submitted to the Construction QA Officer. The Construction QA Officer shall approve/reject the documentation.	Sign the reports indicating documentation is adequate, correct, and has been accepted by QC. Provide QA with copies of the documentation and obtain their signature on the documentation indicating QA acceptance. Ensure that corrective actions required by QA personnel are accomplished.	Review the documentation generated by QC. Report deficiencies to the QC officer and the Construction QA Officer. Verify that corrective action has been taken (where required) and recorded on the QC documentation. Countersign reports indicating documentation is adequate, correct, and has been accepted by QA. Record findings on the "Daily Quality Assurance Report".
QC DOCUMENTATION FILES: Original QC documents shall be maintained at the site. A copy of the original shall be forwarded to Energy*Solutions*' main office.	After the QC documentation has been accepted by QA, submit a copy of the original to the main office for filing. Maintain the originals of all QC documentation in the site engineering file.	Periodically review the site engineering files to ensure the correct documentation is being retained by QC personnel.
QA DOCUMENTATION FILES: Original QA documents shall be maintained at the site. A copy of the original shall be forwarded to Energy*Solutions*' main office.	None	Submit a copy of the original to the main office for filing. Maintain the originals of all QA documentation in the site QA file.

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
SCOPE: This work element applies to the Class A, Class A North, and Class A South/11e.(2) embankments.		
RUNON CONTROL DURING PROJECT: The perimeter berms shall be constructed to a minimum of 3 feet above the ground elevations (GL) shown in the engineering drawings. The first lift of material shall have an uncompacted thickness of no greater than 12 inches. Elevations for the berms between the specified ground elevations shall be linearly interpreted between the shown elevations. The berms shall be a minimum of 10 feet at the top and shall be compacted to 90 percent of a standard Proctor.	Verify that the required berms have been constructed to the specified dimension. Record any findings on the "Daily Construction Report". Spot check the density of the first lift and subsequent lifts of the berm to ensure that it meets specifications. Record density tests on the "Field Density Test" form.	Verify that berms have been inspected by QC personnel.
RUNOFF CONTROL DURING PROJECT: Berms shall be constructed around the outside edge of the clay liner to a height of 3 feet. This height is measured as the elevation above the design elevation of the clay liner; or as the elevation above the design elevation of debris-free zone soils placed on top of the clay liner, whichever is higher. Berms shall be a minimum of 3 feet wide at the top. The first lift of material shall have an uncompacted thickness of no greater than 12 inches. The berm will be constructed on top of the clay liner such that the berm is not in contact with native ground. A distance of 10 feet shall be maintained between the toe of the berm and the toe of the waste. The berms shall be compacted to 90 percent of a standard Proctor.	Verify that the required berms have been constructed to the specified dimension. Record any findings on the "Daily Construction Report". Spot check the density of the first lift and subsequent lifts of the berm to ensure that it meets specifications. Record density tests on the "Field Density Test" form.	Verify that the berms have been inspected by QC personnel.
Contact water shall be controlled inside the runoff control berm system. Contact water is defined as any storm water that falls within the runoff berm system in the active, unfinished portions of the embankment. Access ramps that cross runoff berms shall be constructed to prevent such runoff from leaving the lined portion of the embankment.	Inspect the access ramps that cross runoff berms on a weekly basis for the presence of runoff control channels and document the inspection on the "Daily Construction Report".	Verify that the weekly access ramp inspections have been performed and documented.

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
Fences or other barriers will be installed at the active cell boundary, (the run-off berm, Class A South/11e.(2) clay barrier, and near the radon barrier/waste interface) The barriers will be "chicken-wire", snow-fence, chain-link fence, or herculite (or other materials similar to herculite) secured to "T" posts.	Verify fences are installed around the active cell boundary and near the radon barrier/waste interface and document the inspection on the "Daily Construction Report".	Verify that fences are in place and have been inspected by QC personnel.
Storm runoff for up to a 10-year, 24-hour event that runs off from those portions of the embankment that have been completed to final cover design shall be managed and controlled to prevent such runoff from contacting contaminated waste material in the active unfinished portions of the embankment.		
MONTHLY BERM INSPECTION: The berms and fences are to be inspected monthly. Inspect for obvious damage to berms and fences. Ensure berm height where roads cross berms.	Inspect the berm on a monthly basis and document the inspection and any corrective actions taken (if required) on the "Daily Construction Report". Marker posts indicating the required berm height should be placed at both side of a road at the point where the road crosses the berm. This is to aid in identifying damage to the berm due to road traffic. Repair any noted damage of berm or wind dispersal fences and fill low spots to meet the design height.	Verify that the monthly berm inspections have been performed and properly documented. Verify proper installation of marker posts and wind dispersal fences or other barriers.
BERM MAINTENANCE: The runon and runoff berms shall be surveyed and improved, as required, by July 1 of each year.	Survey the berms at 100 foot intervals and key points. Repair any noted damage and fill low spots to meet the design height.	Verify that the berms are surveyed and improved, as required.
MOVING OR BREACHING A BERM: When moving or breaching a berm, the work must be authorized by the QC officer prior to commencing work. A temporary breach of a berm may be accomplished without a temporary berm, provided the work may be completed and the berm replaced the same day. A temporary berm will have the same	Review the work to be performed. Document the approval to move or breach a berm on the "Breach of Berm" Form.	Verify that the approval to move or breach a berm has been properly documented.

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
specifications as a permanent berm.		
NUCLEAR DENSITY/MOISTURE GAUGE CALIBRATION: To ensure proper calibration, a sand-cone density test shall be performed jointly with five percent of the nuclear density test. The frequency of sand-cone tests shall be reduced to two percent of the nuclear density tests for the clay liner or radon barrier to minimize the damage to these low permeability layers from the sand-cone test. Holes in the clay liner and radon barrier created by the nuclear density gauge shall be filled with dry bentonite. To ensure proper calibration, an oven-drying test shall be performed jointly with five percent of the nuclear moisture tests.	Perform sand-cone density tests and oven-drying tests to calibrate the nuclear moisture/density gauge. Review the results with the Construction QA Officer. When performing the sand-cone density test or the oven-drying test to calibrate the nuclear moisture/density gauge, the data obtained from the sand-cone density test or the oven-drying test takes precedence over the data obtained from the nuclear moisture/density gauge.	Review the results with the QC officer. Verify that the data obtained from the sand-cone density tests and oven-drying tests (when performed) are used in the calculations for ultimate acceptance of the tested media.
SAMPLING LOCATIONS FOR LOTS: For sample location chosen by random numbers, two random numbers shall be employed. The first number (X) shall be between 0 and the largest east-west distance of the lot. The second number (Y) shall be between 0 and the largest north-south distance of the lot. The test location will be located at X feet east and Y feet south of the north-west corner of the lot. For a linear lot (e.g. the intersection of lifts), a single random number shall be generated. For borrow sources which consist of multiple lots which will be sampled by a single test pit, the test pit shall be located by two random numbers as outlined above and will be the same for all lots.	Generate random numbers for each lot by using a calculator or computer with a random number generator. Locate the test location within five feet of the location specified by the random numbers. If the sample location is outside the lot, generate two new random numbers.	Verify that the test methods are being chosen by random number.
TEST METHODS: All tests shall be performed in accordance with the test methods specified in Appendix B.	Use the test methods in Appendix B to perform the require testing.	Verify that the test methods being use to conduct the tests are the methods specified in Appendix B.
QA AUDITING: Energy*Solutions* shall contract with	Schedule times with the QA auditor to observe the	Cooperate with QA auditor in the review of QC

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
an independent firm to perform an annual audit of the CQA/QC. The auditor shall: a) audit at least 15% of the CQA\QC documentation; and b) observe QC procedures for field density/moisture tests, classification tests, Proctors, permeability tests, and surveying. A copy of the auditors report shall be submitted to the DRC.	specified testing. Cooperate with QA auditor in the review of QC documentation.	documentation.
WEEKLY CONSTRUCTION SCHEDULE: During clay liner and embankment cover construction projects, including test pads, a weekly construction schedule will be provided to DRC. This specification also applies to permitted facilities under construction within Section 32. The schedule does not constitute a binding commitment; but is a reasonable estimate of when listed construction activities will occur. No submittal is required if there are no clay liner, cover, or other permitted facilities under construction.	Support the Director of Engineering in preparing the schedule for submittal.	

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
SCOPE: This work element applies to the Class A, Class A North, and Class A South/11e.(2) embankments.		
CLEARING AND GRUBBING: Remove vegetation, debris, organic, or deleterious material from areas to be excavated for construction of cells. Grubbing depth will depend on the type of vegetation, debris, organic, or deleterious material on the site. If the area is free of these materials then no clearing and grubbing will be necessary.	Inspect the area once clearing and grubbing has been completed. Record observations and corrective actions (where required) on the "Daily Construction Report".	Verify that the clearing and grubbing has been inspected by QC.
EXCAVATION: Excavation shall be made to the lines, grades, and dimensions prescribed in the approved plans. Any over excavation shall be backfilled with select materials and compacted to 95 percent of Standard Proctor. The uncompacted lift thickness shall not exceed 9 inches.	Observe the cell excavation. Record observations and corrective actions taken (where required) on the "Daily Construction Report". In areas of over excavation, conduct in-place density tests at a rate of one test per lot and record the results on the "Field Density Test" form. A lot is defined as a maximum of 10,000 square feet of a lift of a specified type of material. Test locations shall be chosen on the basis of random numbers. a. Approve lots which meet the specified compaction. b. Rework and retest lots not meeting the specified compaction. Proctors shall be performed at a rate of one test per 100,000 square feet for each material type. At least one proctor shall be performed for each material type. Record the location of the sample on the "Sampling Log".	Observe, at a minimum, five percent of the tests performed by QC personnel to ensure that the tests and observations are being performed correctly. Verify that the tests are being performed at the correct frequency and that the documentation is being completed.
SCARIFICATION AND COMPACTION: The foundation shall consist of either: a. scarifying the in-situ clays to at least six inches and compacting it to at least 95 percent of a standard proctor or; b. inspecting the in-situ sands and if cracking of the surface is	Observe the foundation. Record observations and corrective actions on the "Daily QC Report". Conduct in-place density tests at a rate of one test per lot and record the results on the "Field Density Test"	Observe, at a minimum, five percent of the tests performed by the QC personnel to ensure that the tests and observations are being performed correctly. Verify that the tests are being performed at the correct frequency and that the documentation is being

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observed, then scarify the in-situ sands to at least six inches and compact it to at least 95 percent of a standard proctor, or, if no cracking is observed, then compact the in-situ sands to at least 95 percent of a standard proctor without prior scarification.	form. A lot is defined as a maximum of 10,000 square feet of a 6 inch lift of a specified type of material. Test locations shall be chosen on the basis of random numbers. a. Approve lots which meet the specified compaction. b. Rework and retest lots not meeting the specified compaction. Proctors shall be performed at a rate of one test per 100,000 square feet for each material type. At least one proctor shall be performed for each material type. Record the location of the sample on the "Sampling Log".	completed.
FINAL GRADING: The foundation for the clay liner shall be fairly smooth and free from clods, rocks, soft spots, wet areas, etc. Foundation elevations shall be at grade or below grade.	Survey the foundation on a 50 ft grid and at key points. Final survey measurements will be documented and provided to the QC officer and Construction QA Officer. a. Indicate where the foundation meets design line and grade. b. Rework and resurvey areas not meeting the specified grade.	Review the final survey data. Verify the frequency of the survey points.
UNSUITABLE MATERIAL: Remove unsuitable material as required. Unsuitable material is non-soil material or soil which cannot be reworked to meet the compaction criteria.	Define areas of unsuitable material and advise the contractor that such areas must be removed. Observe the areas once the unsuitable material has been removed. Report corrective actions (where required) on the "Daily Construction Report".	Verify that the removal of unsuitable material has been properly documented.
FOUNDATION APPROVAL: Foundation to be approved by Construction QA Officer.	Obtain the "Notice of Acceptance" from the Construction QA Officer before construction of the clay liner begins.	Provide a "Notice of Acceptance" to the QC officer indicating that the foundation meet the required specifications.

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SCOPE: This work element applies to the Class A, Class A North, and Class A South/11e.(2) embankments. It also applies to the Clay Barrier located in the Class A South/11e.(2) embankment.		
CLEARING AND GRUBBING: Remove vegetation, debris, organic, or deleterious material from areas to be used for borrow. Grubbing depth will depend on the type of vegetation, debris, organic, or deleterious material on the site. If the area is free of these materials then no clearing and grubbing will be necessary.	Inspect the area once clearing and grubbing has been completed. Record observations and corrective actions (where required) on the "Daily Construction Report".	Verify that the clearing and grubbing has been inspected by QC.
MATERIAL: Satisfactory material shall be defined as CL and ML soils based on the Unified Soil Classification with at least 85 percent passing the No. 200 sieve (silt and clay), a plasticity index (PI) between 10 and 25, and a liquid limit (LL) between 30 and 50. The clay shall also have a dry clod size less than or equal to 1 inch.	Perform laboratory classification tests at a rate of 1 test per lot prior to use of material in the clay liner. A lot is defined as a maximum of 3,000 cubic yards (compacted) of specified material type. Record the location of the classification sample on the "Sampling Log". a. Approve lots (which meet the specified classification) for use in the clay liner. b. Lots not meeting the specified classification can not be used.	Verify the frequency of laboratory tests and compliance of test results.
PROTECTION: The clay borrow material shall be handled in such a manner as to prevent contamination with radioactive waste material or other deleterious material. The in-place clay may contain up to 5 percent additional rocks and sand above the content found in the classification test.	Visually check clay liner materials for contamination by foreign materials. Remove clays which have been contaminated above the specified requirements. Document corrective actions (where required) on the "Daily Construction Report".	Verify that the clay liner is being inspected for contaminates and that corrective actions (if required) are properly documented.
PROCESSING: These procedures may be used to provide suitable material for construction of the clay liner. 1. Apply deflocculant at a rate determined by the production engineer	Measure the mixing areas and verify that the application rate of the deflocculant is equal to or greater than the rate determined by the production engineer. Record the size of the mixing areas and the amount of deflocculant applied on the "Embankment Construction Lift Approval Form".	Verify that the size of the mixing areas and the amount of deflocculant applied have been properly documented.
2. Mix the deflocculant thoroughly into the soils by	Observe the mixed clay and advise the contractor of	Verify that the clay is being inspected by QC.

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tilling or similar action.	areas which are adequately mixed.	

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SCOPE: This work element applies to the Class A, Class A North, and Class A South/11e.(2) embankments.		
NOTICE OF TEST PAD CONSTRUCTION: The test pad plan shall be approved by the DRC prior to the test pad construction. The DRC shall be notified 48 hours in advance of the start-up of test pad construction.	Obtain documentation confirming that the test pad plan has been approved by the DRC. Verify that the DRC has been notified, as required.	Verify that the test pad plan has been approved by the DRC. Verify that the DRC has been notified as required.
TEST PAD: An approximately 60 feet by 75 feet large test pad will be constructed using the procedure proposed for construction of the clay liner.	Observe the construction of test pads. Measure test pads to ensure that they are constructed to the size indicated. Record the test pad size on the "Embankment Construction Lift Approval Form".	Observe the construction of the test pads. Verify that the test pad has been measured and is properly documented.
A small test pad with minimum dimensions of 5 feet by 5 feet will be constructed. The purpose of this small test pad is to establish equipment and procedures for construction of clay liner in locations where large equipment is not practical (e.g. repairs).	The large test pad shall be divided into three lots per lift (approximately 1,500 square feet per lot). Each lift of the small test pad shall equal a lot.	
A new test pad shall be constructed each time there is a change in specifications, construction procedures, types of equipment, unified soil classification, or QC testing equipment or procedure.		
Test pads are to be constructed and tested in accordance with the following specifications:		
1. Place the clay in at least three lifts with the first lift uncompacted thickness not exceeding twelve inches. Remaining lifts shall have a loose material thickness not exceeding nine inches for each lift. The clay material will be inspected for dry clod size during placement of each lift of clay liner.	Measure the lift thickness at a rate of 1 test per lot. Record thicknesses on the "Embankment Construction Lift Approval Form". Inspect the loose clay material during the unloading and spreading process for each uncompacted lift to ensure any dry clods that are present are less than or equal to one (1) inch. Record inspection of the clod size on the "Embankment Construction Lift Approval	Verify that the number of lifts and lift thicknesses have been documented. Verify that the clod size inspection has been performed and documented for each uncompacted lift thickness.

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	Form".	
2. The clay is to be placed and compacted by equipment proposed for use during construction of the clay liner.	Verify with the contractor that the same or similar type equipment and compaction efforts will be used in the cell for construction of the clay liner. Record type of equipment used, and number of passes on the "Embankment Construction Lift Approval Form".	Verify equipment used and the number of passes made in preparing the test pad are those to be used during the construction of the clay liner.
3. The lifts of clay shall be bonded by: a) providing a rough upper surface on the underlying layer of clay liner. The surface should have changes in grade of approximately one inch or more at a rate of two per linear foot; **- OR -** b) by compacting with a sheepsfoot with feet approximately two inches longer than the lift thickness.	Verify that there are adequate changes in grade by placing a straight edge at least two feet long on the surface. Count the number of points approximately one inch or more below the straight edge. **- OR -** Verify that the feet on the sheepsfoot compactor are approximately two inches longer than the lift thickness.	Verify the frequency of measurements and compliance of test results.
4. The clay is to be compacted to at least 95 percent of a standard Proctor with a moisture content of optimum to 5 percent over optimum. Compaction of the large test pad is to be accomplished by at least four passes of suitable compaction equipment.	Conduct in-place moisture-density tests at a rate of one test per lot. The test location shall be chosen on the basis of random numbers. Record the test result on the "Field Density Test" form. a. Approve lots which meet the specified moisture and compaction. b. Rework and retest lots not meeting the specified moisture or compaction. c. Any additional work under b. shall be included in the test pad construction method.	Verify the frequency of tests and compliance of test results.
5. The clay is to be constructed to provide a permeability less than or equal to 1 x 10^{-6} cm/sec. Permeability testing on the bottom lift will be performed at the surface. Permeability on the second lift will be performed ≥ 2" below the surface. Permeability on the third lift will be performed ≥ 4" below the surface.	Conduct in-place permeability tests at a rate of one test per lot per lift. The permeability test shall be run in close proximity to the moisture-density test. Record the test result on the "Field Permeability Test" form. a. Approve lots which meet the specified permeability. b. Rework and retest lots not meeting the specified permeability c. Any additional work under b. shall be included in the test pad construction method.	Verify the frequency of tests and compliance of test results.

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6. At least one PI, LL, and gradation test shall be conducted for each test pad.	Conduct PI, LL, and gradation tests at a rate of one of each type of test per test pad.	Verify that the PI, LL, and gradation tests have been conducted and documented.
7. The procedures used to construct the test pad shall be reviewed and approved by the certifying engineer. The test must be approved by a Professional Engineer.	Provide the certifying engineer with copies of the documentation for the test pad for review and approval.	Verify that proper approval has been obtained for the test pad and that the necessary construction procedure documents are in place for use during clay liner construction.
8. The procedures used to construct the test pad shall be reviewed and approved by the DRC prior to using the new test pad construction method.	Obtain documentation confirming the DRC approval of the test pad.	Verify that proper approval has been obtained for the test pad and that the necessary construction procedure documents are in place for use during clay liner construction.

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SCOPE: This work element applies to the Class A, Class A North, and Class A South/11e.(2) embankments.		
LIFT IDENTIFICATION: Each lift shall be given a discrete designation for testing and surveying purposes.	Assign a lift identification number to each lift. Use the lift identification number to identify all paper work for that lift.	Verify that a lift identification number has been assigned to each lift. Verify that the lift identification number is used on all paper work for that lift.
PLACEMENT: The clay liner will be prepared, placed, and compacted using the same type of equipment and mixing and compacting procedures that were approved in the test pad.	Observe the clay liner placement. Record the equipment used to place the clay liner and any corrective actions (where required) on the "Embankment Construction Lift Approval Form".	Verify the equipment used to construct the clay liner has been documented and that it is the same type of equipment used to construct the test pad.
LIFT BONDING: The lifts of clay shall be bonded by: 1) providing a rough upper surface on the underlying layer of clay liner. The surface should have changes in grade of approximately one inch or more at a rate of two per linear foot; **- OR -** 2) by compacting with a sheepsfoot with feet approximately two inches longer than the lift thickness.	Verify that there are adequate changes in grade by placing a straight edge at least two feet long on the surface. Count the number of points approximately one inch or more below the straight edge. **- OR -** Verify that the feet on the sheepsfoot compactor are approximately two inches longer than the lift thickness.	Verify the frequency of measurements and compliance of test results.
LIFT THICKNESS: The first lift of material shall have an uncompacted thickness of no greater than 12 inches. For the remaining lifts, the loose lift thickness shall not exceed the lesser of the lift thickness used to construct the test pad or nine inches. Thickness for the lift will be established by installing grade poles on at least a 70-foot grid and at all control points. The grade poles must not be installed deeper than 1 inch into the underlying clay liner. The grade poles must be marked at the appropriate depth to establish the grade. After the grade for the lift has been checked and approved by QC personnel, the grade poles shall be removed. The clay material will be inspected for dry clod size during placement of each lift of clay liner.	Verify that the required grading tolerance is achieved as follows: a. Ensure that the required frequency for placement of grade poles has been met. b. Compare soil level with the marked level on the grade poles. c. Use a string line where necessary between poles to check for high or low spots. d. Define high out of specification areas and advise the contractor to rework those areas. e. Review areas reworked and approve areas meeting criteria. f. Continue "b" through "d" above until all areas meet criteria.	Observe, at a minimum, five percent of the measurements performed by the QC personnel to ensure that the measurements are being performed correctly. Verify that the measurements are being performed at the correct frequency and that the documentation is being completed. Verify that the clod size inspection has been performed and documented for each uncompacted lift thickness.

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	g. Indicate areas meeting criteria on the "Embankment Construction Lift Approval Form". **- OR -** Dig a hole and measure the loose lift thickness at a rate of one per lot. A lot is defined as 10,000 square feet of a single lift and record on the "Lift Approval Form". The location of the measurement shall be chosen on the basis of random numbers. a. Approve lots which meet the specified lift thickness. b. If the thickness is greater than the specified thickness, measure the thickness at four points (north, east, south, and west) within ten feet of the first measurement. Average the five measurements together. c. Approve lifts with an average less than or equal to the specified lift thickness. d. Rework and retest lots with an average lift thickness greater than the specified lift thickness. Inspect the loose clay material during the unloading and spreading process for each uncompacted lift to ensure any dry clods that are present are less than or equal to one (1) inch. Record inspection of the clod size on the "Embankment Construction Lift Approval Form".	
KEYING-IN: Segments of cell clay liner constructed at times more than 30 days apart from each other shall be keyed-in to each other at vertical steps no greater than nine inches and at least twice as wide as they are high.	Verify that the new liner has been properly keyed-in to the existing liner. Record deficiencies on the "Embankment Construction Lift Approval Form".	Verify that the keying-in of the liner has been documented.
COMPACTION: Clay liner material will be compacted to at least 95 percent of standard Proctor with a moisture content between optimum and 5 percent over optimum.	Conduct in-place moisture-density tests at a rate of one test per lot and record the results on the "Field Density Test" form. A lot is defined as 200 cubic yards (compacted) of a single lift. The test location shall be chosen on the basis of random numbers. a. Approve lots which meet the specified moisture and	Observe, at a minimum, five percent of the tests performed by the QC personnel to ensure that the tests and observations are being performed correctly. Verify that the tests are being performed at the correct frequency and that the documentation is being completed.

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	compaction. b. Rework and retest lots not meeting the specified moisture or compaction. Proctors shall be performed at a rate of one test per borrow lot. A borrow lot is defined as 3,000 cubic yards (compacted) or less of a specific material type. Record the location of the Proctor sample on the "Sampling Log".	
PERMEABILITY: Clay liner will have an in-place permeability less than or equal to 1 x 10^{-6} cm/sec.	Conduct in-place permeability tests at a rate of one test per lot and record the results on the "Field Permeability Test" form. A lot is defined as 2,000 cubic yards (compacted) of clay liner. The permeability test shall be run in close proximity to a moisture density test location. a. Approve lots which meet the specified permeability. b. Rework and retest lots not meeting the specified permeability. c. Restore all test areas to assure no leaks.	Observe, at a minimum, five percent of the tests performed by the QC personnel to ensure that the tests and observations are being performed correctly. Verify that the tests are being performed at the correct frequency and that the documentation is being completed.
LINER DRYING PREVENTION: To prevent the clay liner from drying, water will be applied to the clay surface on an as needed basis or the liner will be covered with six inches of loose clay or 12 inches of loose waste. Newly constructed liner will be covered with six inches of loose clay or 12 inches of loose waste within 15 days of liner completion. Desiccation cracks larger than one-fourth inch wide and one-inch deep in the clay liner will be reported to the DRC and will be documented as a non-conformance item when discovered.	Observe the liner surface for drying. Advise the contractor of any deficiencies. Record corrective actions taken (where required) on the "Daily Construction Report".	Verify that the liner is being inspected.
SNOW REMOVAL: When clay liner material is to be placed and the work area is covered with snow, the snow must be removed.	Observe that snow is removed. Advise the contractor of any deficiencies. Construction may not continue without taking corrective action to remove the snow. Record these corrective actions (where required) in the	Verify that snow removal is being documented.

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	"Daily Construction Report".	
COLD WEATHER PLACEMENT OF CLAY LINER: For purposes of this CQA/QC Manual, “frozen” is defined as a soil temperature of less than or equal to 27ºF. Clay liner shall not be placed above frozen material. In addition, no frozen material shall be processed or placed. If the air temperature has dropped below 32ºF since the last lift of clay liner was approved, one of the following three scenarios apply: (1) If less than 30 days have passed since the date of lift approval and the last lift of clay liner has been covered since the approval date with at least 9 inches of loose clay or 6 inches of compacted clay, then the cover clay may be worked with no additional testing of the lower approved lift. (2) If less than 30 days have passed since the date of lift approval and the last lift of clay liner has not been covered with at least 9 inches of loose clay or 6 inches of compacted clay, then: (a) Perform spring start-up testing as discussed below; or (b) Monitor the liner/foundation temperature approximately 1 inch beneath the surface. If the temperature 1 inch beneath the surface is greater than 27ºF, re-roll the surface with one pass of the same type of construction equipment (i.e., a compactor for intermediate lifts or a smooth drum roller for the final surface) and continue with liner construction. If the temperature 1 inch beneath the surface is less than or equal to 27ºF, re-work and re-test the affected area after the clay temperature has risen above 27ºF. (3) If more than 30 days have passed since the date of lift approval, perform spring start-up testing.	As needed, observe the area where clay liner is to be placed. If frozen material is observed, cease placement of clay liner. If frozen material is suspected, measure soil temperature. Record the stopping of placement in the "Daily Construction Report.” Review ambient air temperature records as measured at the site meteorological station. Document status of clay liner cover placement on the “Daily Construction Report.” Monitor liner/foundation temperature when triggered under 2.(b). Clay temperature shall be measured between 6:00 am and 8:00 am on the day that clay liner will be placed. Temperature measurements shall include a location that is most likely to be coldest; i.e., if there is a portion of the liner that is shaded or at a low point. Temperature monitoring frequency shall be at least one point per 100,000 square feet or one point per contiguous project area, whichever is smaller. If the initial clay temperature measurement is less than or equal to 27ºF, the affected area may be resampled before 8:30 am the same day as follows: a. Measure the liner/foundation temperature at a frequency of one measurement per lot (defined as no more than 10,000 square feet). b. Lots where the temperature is greater than 27ºF do not require rework; except that the lot where the initial temperature less than or equal to 27ºF was measured shall be reworked regardless of resampling results.	Verify that clay liner is tested during cold weather conditions.

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SPRING START-UP: See "Cold Weather Placement of Clay Liner" above for situations that trigger this specification. For spring start-up testing, the surface lift is treated as protective cover, regardless of whether it was an approved lift of clay liner at one time or not. Excavate 9 inches below the clay surface and re-test for density and permeability. Excavation for testing purposes may consist of removing the protective cover lift; or may be performed by 'potholing' only at the testing locations. Areas that have been 'potholed' for permeability testing shall be repaired by applying the same level of effort as prescribed by the approved test pad for liner construction. Spring start-up testing shall be conducted on 11e.(2) embankment lift areas S-11, R-12, L-12, H-12, and D-12 prior to and in the same construction season as initial waste placement for each area.	Perform density and permeability testing at the frequencies outlined for liner construction above. This testing may be performed outside of the approved lift area so long as the area tested is representative of the clay in the approved lift area (i.e., was constructed at the same time and with the same method). Moisture testing is not required for spring start-up. a. Approve lots that meet specification. The protective cover lift may then be worked in place and tested to become the next lift of clay liner. b. For lots that do not meet specification, test the surface at successively deeper 9 inch increments until a passing lift is found; remove all failing lifts; re-work all failing areas; and re-test. Document that repairs are completed to the same level of effort as required by the approved test pad for clay liner construction.	
CONTAMINATION OF CLAY LINER: The clay liner material shall not become contaminated with radioactive soils or debris during construction. The in-place clay may contain up to 5 percent additional rocks and sand above the content found in the classification test.	Visually check clay liner for contamination by foreign materials. Remove clays which have been contaminated above the specified requirements.	Verify that removal of contaminated material has been properly documented.
FINAL GRADING: Final grading shall be from grade to above grade. Survey on a 50 ft grid and key points to verify the minimum design liner thickness requirement is met.	Survey the foundation on a 50 ft grid and at key points. Final survey measurements will be documented and provided to the QC officer and Construction QA Officer. a. Indicate where the clay liner meets design line and grade. b. Rework and resurvey areas not meeting the specified grade.	Review the final survey data. Verify the frequency of the survey points.

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HEAVY EQUIPMENT ON CLAY LINER: Heavy equipment travel will be minimized on top of the finished clay liner. Heavy equipment will not be operated on saturated clay liner.	Observe the work procedures of the contractor. Advise the contractor of problems with equipment on the clay liner. Record corrective actions taken (where required) on the "Daily Construction Report".	Verify that the contractors work procedures are being inspected.
DRC APPROVAL: The DRC shall approve documentation associated with completed clay liner. Documentation shall include all QC and QA records associated with clay liner construction, as well as photographs of the completed liner surface. In addition, 48 hour notification shall be provided to the DRC prior to placement of soil material over the clay liner (waste or soil protective cover). However, DRC approval of clay liner documentation is not required prior to placement of waste material over the clay liner.	Notify the Construction QA Officer that the clay liner is prepared and ready for inspection by the DRC. Obtain written authorization on the "Liner Inspection Form" from the Construction QA Officer that the clay liner has been inspected. Obtain documentation confirming the DRC approval of the clay liner documentation.	Provide written approval of the clay liner prior to the placement of material over clay liner (waste or soil protective cover). Notify the DRC that the clay liner is prepared and ready for inspection at least 48 hours prior to covering with soil material.
QUALITY ASSURANCE SAMPLING: Assurance samples for clay liner materials tests are to be obtained at the following minimum frequency: 1. In-place moisture-density tests (ASTM D6938): 1 per 50,000 cubic yards (compacted). 2. Moisture/density relationship testing (ASTM D698): 1 per 50,000 cubic yards (compacted). 3. Classification tests (ASTM D2487, D1140, and D4318): 1 per 50,000 cubic yards (compacted). A minimum of one of each of the above tests is required for each year that clay liner is placed.	Coordinate with QA personnel in obtaining the quality assurance samples. Record the samples on the "Sample Log" and moisture-density test on the "Density Testing Log". Promptly report result of QC testing to Construction QA Officer so that a comparison of QA and QC testing results can be made.	Conduct or coordinate quality assurance sampling and testing in accordance with the designated frequencies. Obtain test results of QC samples so that a comparison of QA and QC test results can be made. The Construction QA Officer, in consultation with the QC officer, shall be responsible for determining the adequacy of correlation and documentation of the rationale used to determine adequacy. If the correlation is not adequate, new QC and QA samples shall be taken immediately. The Construction QA Officer, in consultation with the QC officer, shall then evaluate the accuracy of the QC sampling and testing and, if necessary, provide for improved sampling and testing procedures and closer inspection and control. Record findings of the quality assurance sampling in the "Daily QA Report".

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SCOPE: This work element applies to the Class A, Class A North, and Class A South/11e.(2) embankments.		
APPLICABILITY: This work element is applicable to waste placed with the CAT 826 compactor. With prior DRC approval, this work element may be implemented by equipment demonstrated to perform equivalent to the CAT 826 compactor.	Document equipment used for compaction on the Lift Approval Form.	
DEFINITIONS: Machine Pass is defined as movement of the compactor across an area of the lift in any direction, which also meets compaction criteria calculated by an algorithm in the compactor's system. For example, movement of the compactor from south to north across the lift, which also meets compaction criteria calculated by an algorithm in the compactor's system, constitutes one machine pass; the return trip from north to south, which also meets compaction criteria calculated by an algorithm in the compactor's system, constitutes a second pass. Wheel Pass is defined as movement of any of the compactor's drums across an area of the lift, which also meets compaction criteria calculated by an algorithm in the compactor's system. Since there are forward and rear drums on the CAT 826 compactor, each machine pass constitutes two wheel passes. The CAES compaction tracking system reports wheel passes.		
LINER PROTECTION: The compactor shall not be operated on the surface of finished clay liner or on the surface of the debris free zone directly over the clay liner. The compactor may not be used to compact the first lift of waste above the debris free zone. When	When disposal and compaction is being performed on or adjacent to the first lift above the debris free zone, observe compactor operation for protection of the liner and debris free zone. Document observations on the Daily Construction Report.	

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operating on a slope that terminates on the surface of the first lift of waste above the debris free zone, the compactor shall be operated in a manner to prevent impact to the debris free zone.		
LIFT IDENTIFICATION: Each lift shall be given a discrete designation.	Assign a lift identification number to each lift. Use the lift identification number to identify all paper work for that lift. Summarize all lifts on the lift summary form or master sheet.	Verify that a lift identification number has been assigned to each lift. Verify that the lift identification number is used on all paper work for that lift.
LIFT ACCEPTANCE: At the time of acceptance, the date and time of lift approval shall be recorded.	Record the date and time of lift approval on the lift approval form.	Verify that the date and time of lift approval is recorded on the lift approval form.
No waste material will be disposed on a lift until the prior lift is approved, except for management of in-cell bulk disposal	Verify that the previous waste lift has been approved prior to waste disposal.	
LIFT THICKNESS: The waste material will be placed in lifts with a compacted average thickness not exceeding 24 inches.	Survey the mean elevation of the top of each lift by surveying at least five points and taking the average. Where practical, survey the corners and at least one spot in the middle. Survey measurements will be documented and forwarded to the Construction QA Officer. Lift thickness may also be verified via GPS. a. Approve lifts with an average less than or equal to the specified lift thickness. b. Remove excess material from the thicker areas of the lift if the average lift thickness is greater than 24 inches, and re-compact lift in the areas where wastes are removed. OR Download the CAES system report of beginning and ending lift elevations. For lifts that are not sloped, survey data may be used for beginning lift elevation. Lift thickness shall be reported using CAES in accordance with operating procedure ENG 3.8. When calculating the average lift thickness on a side slope, no	Perform a monthly assessment of the survey documentation performed by the QC personnel to ensure that the measurements and observations are being performed correctly. Verify that the surveys are being performed at the correct frequency and that the documentation is being completed. Verify that the survey data has been received from the QC personnel.

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	point shall be more than 2.1'. If CAES is used to document lift thickness on the side slope, there shall be no white pixels shown in the lift.	
LIFT AREA: Identify the dimensions and the location of the northwest corner of the lift. There is no minimum lift area for this work element.	Locate the northwest corner of each lift, and document the location and lift dimensions.	
CLASSIFICATIONS: Soil classification testing is not required for waste placed using this work element.		
TERRACING OF LIFTS: As new lifts are placed next to old lifts, at least one foot, measured horizontally, shall be removed from the outer edge of the old lift (except for CLSM lifts).	Inspect the intersections of old and new lifts. Verify that the outer one foot of the old lifts are being removed (except for CLSM lifts). Record any problems on the "Daily Construction Report".	Verify that the required inspections are being performed.
COMPACTION WITH CAES: When using the CAES system, each lift and lift interface shall be compacted by at least 4 machine passes with the CAT 826 compactor. The lift surface shall be firm and unyielding to the compactor's weight. A minimum of 80% of the grid points reported for the lift by CAES shall exhibit adequate compaction. Adequate compaction as well as meeting the minimum number of wheel passes is reported by CAES when the pixel turns green. —a. Additional compaction may be required if, after the minimum number of passes is complete, the minimum percentage of grid points do not exhibit adequate compaction, as reported by the CAES system.	Document the CAES system report of compaction for each lift area. Compactive effort is reported by CAES on a roughly 3.3' x 3.3' grid; with each on-screen pixel representing one square meter. Ensure that the CAES reports a minimum of 4 machine passes (i.e., 8 wheel passes) for at least 80% of the grid points in the lift, as detailed in operating procedure ENG 3.8. Record this information on the Lift Approval Form. Perform a QC inspection of the compacted lift by observing the CAES control screen for evidence of uniform and adequate compaction. This condition is indicated by having a majority of the screen light green, with only isolated pixels in other colors. Print the screen as a color image and include with the lift approval form. Record QC inspection results on the Lift Approval Form.	Perform a monthly assessment of the compaction documents generated by the QC technician.
COMPACTION WITHOUT CAES: If the CAES system is not available to be used for compaction under this work element, the following requirements apply. 1. Verbal notice shall be provided to DRC within 24	Document that the minimum number of passes is completed for each lift area. Passes shall be counted by the QC technician or by using a GPS unit communicating with the GPS unit on the compactor.	Perform a monthly assessment of the compaction documents generated by the QC technician.

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hours of beginning to approve lifts without CAES. This notice may be provided via email. 2. Written notice shall be provided to DRC no later than 3 calendar days (72 hours) after beginning to approve lifts without CAES. The written notice shall explain why CAES is down; an estimate of when CAES will be back online; a map of the areas being compacted without CAES; and a map of pre-final cover settlement monitoring points over the area being compacted without CAES. 3. Compaction without CAES is limited to 10 calendar days per occurrence. Each lift and lift interface shall be compacted by at least 6 machine passes with the CAT 826 compactor. The lift surface shall be firm and unyielding to the compactor's weight. Additional compaction may be required if, after the minimum number of passes is complete, any of the following are observed: a. The lift surface exhibits ruts or compression (excluding depressions caused by the tines of the compactor wheel) in excess of four inches; b. The waste material exhibits pumping behavior, or has other indications of excess moisture content; or c. The lift does not appear to be uniformly compacted.	Perform a visual inspection of the compacted lift surface. If rutting or other indications of inadequate compaction are present, direct the equipment operator to complete additional passes until the situation is corrected. If additional passes are unable to correct the situation, moisture adjustment or other corrective actions may be needed and the lift shall not be approved until these actions are completed. Survey lift elevation and thickness in accordance with the specification "Lift Thickness" above, with the further requirement that the greater of the following number of points shall be surveyed per lift: a. At least 5 points; or b. One point per 2,000 square feet of lift area. Record number of passes and visual inspection results on the Lift Approval Form.	
DEBRIS PLACEMENT WITH THE COMPACTOR: For purposes of this work element, debris shall be defined as provided in the work element "Waste Placement", below.	Determine the volume of debris. Volume determination shall be established by either: a) inspecting the debris on the lift and calculating the quantity of debris, or b) using the manifested waste volume for shipments placed on the lift.	
Debris placed in accordance with this work element shall be limited to no more than 50% by volume of the compacted volume of the lift. The debris shall be	Inspect debris once it is spread out on the lift and prior to placement of fill material. Ensure that debris is spread out uniformly across the lift and in a manner to	Observe in the field that the debris calculations and estimates are being performed and properly documented. Review documentation to verify that the

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uniformly distributed across the lift. Lifts containing materials susceptible to wind dispersal shall be covered so that these materials are secured by the end of the shift the materials were placed into the lift.	minimize void spaces and does not exceed volume requirements. Document the debris inspection on the Lift Approval Form. Record the debris fill calculations and estimates on the Lift Approval Form.	visual observations of debris shipments are being properly performed by QC personnel or that the manifested volume of waste is used to calculate the volume of fill material required.
DEBRIS SIZE: All debris placed in accordance with this work element shall be less than 10 inches in at least one dimension and no longer than 12 feet in any dimension.	Inspect debris placed in soil lifts to ensure that it meets the debris size requirements.	

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SCOPE: This work element applies to the Class A, Class A North, and Class A South/11e.(2) embankments.		
LIFT IDENTIFICATION: Each lift shall be given a discrete designation for testing and surveying purposes.	Assign a lift identification number to each lift. Use the lift identification number to identify all paper work for that lift. Summarize all lifts on the lift summary form.	Verify that a lift identification number has been assigned to each lift. Verify that the lift identification number is used on all paper work for that lift.
LIFT ACCEPTANCE: At the time of acceptance, the date and time of lift approval shall be recorded.	The QC technician shall record the date and time of lift approval on the lift approval form.	Verify that the date and time of lift approval is recorded on the lift approval form.
No waste material will be disposed on a lift until the prior lift is approved, except for management of in-cell bulk disposal	Verify that the previous waste lift has been approved prior to waste disposal.	
LIFT THICKNESS: The radioactive disposal material will be placed in lifts with a compacted average thickness not exceeding 12 inches (except CLSM lifts).	Survey the mean elevation of the top of each lift by surveying at least five points and taking the average. Where practical, survey the corners and at least one spot in the middle. Survey measurements will be documented and forwarded to the Construction QA Officer. a. Approve lifts with an average less than or equal to the specified lift thickness. b. Remove excess material and retest lots with an average lift thickness greater than the specified lift thickness.	Observe, at a minimum, five percent of the surveys performed by the QC personnel to ensure that the measurements and observations are being performed correctly. Verify that the surveys are being performed at the correct frequency and that the documentation is being completed. Verify that the survey data has been received from the QC personnel.
LIFT AREA: The lift area shall be at least 10,000 square feet except CLSM, Containerized Waste Facility, and Mixed Waste lifts. Identify the dimensions and the location of the northwest corner of the lift.	Locate the northwest corner of each active lift, and determine the dimension. a. Allow placement to continue on any lift that meets the lift area requirement. b. Stop placement on any lift which does not meet the lift area requirements. c. The Construction QA Officer may grant a waiver, for up to five percent of the lifts, if it is deemed impracticable to place at the specified lift area (e.g. a narrow lift on the outside edge of the cell). Insufficient material from a specific generator does	Verify that the lift area meets the lift area requirements.

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	not constitute grounds for a waiver.	
COMPACTION: Each lift shall be compacted to 90 percent of a standard Proctor, except lifts with greater than ten (10%) compressible debris, which shall be compacted to a minimum of 95 percent of a standard Proctor. The moisture content of all lifts shall be equal to at least 2 percent and no greater than up to 3 percentage points above the optimum moisture (except for CLSM lifts).	Except for CLSM lifts, conduct in-place moisture-density tests at a rate of one test per lot and record the results on the "Field Density Test" form. A lot is defined as 1,000 cubic yards (compacted) of a single lift. At least one test will be performed per lift. At least one test will be performed per soil type in the lift. The test location shall be chosen on the basis of random numbers. Approve lots when: a. Material is observed to be properly compacted throughout the lot; b. Moisture/density tests performed meet moisture and compaction specifications.	Observe, at a minimum, five percent of the tests performed by the QC personnel to ensure that the tests and observations are being performed correctly. Verify that field moisture/density tests are being performed at the correct frequency and that the documentation is being completed.
	Outliers shall be resolved according to the following: a. For lot sections where the material is observed to not be properly compacted throughout the entire lot: 1) Identify the section requiring further compaction and rework the material until it is observed to be adequately compacted; 2) Perform moisture/density testing as outlined above. b. For lots where the dry density reading from a nuclear gauge moisture/density test is less than or equal to the required percentage of the standard Proctor: 1) Identify the section(s) of the lot (including dimensions) requiring further compaction, and re-work the material. Re-test at the location previously tested. Test one more location in the re-worked lot section. Identify the test location using the lot section dimensions and random numbers. - If the test results from both tests meet moisture/density requirements, approve the lot; - If either test fails, repeat the above process	Ensure that resolution of any outliers is properly accomplished and documented.

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	until all tests meet moisture and compacting requirements. **- OR -** 2) If the lot is observed by the QC Technician to be adequately compacted, investigate the reason for the low density reading. If it is determined that the test results were <u>improperly influenced</u> (e.g. debris directly beneath the gauge), take two more density tests within 5 feet of the original test. **NOTE: <u>All tests are to be recorded.</u>** - If the results from both tests are above the required compaction requirements, record both tests and approve the lot. If either test fails to meet moisture/density specifications – and the test results were not improperly influenced as described above - follow instructions for a.1 above.	
	Proctors shall be performed at a rate of one test per 15,000 cubic yards (compacted) or less of a specific material type.	Observe, at a minimum, five percent of the tests performed by the QC personnel to ensure that the tests and observations are being performed correctly. Verify that proctor tests are being performed at the correct frequency for each specific material type and that the documentation is being completed properly.
CLASSIFICATIONS: One soil classification test shall be performed at six month intervals for each large soil waste generator.	Perform a soil classification test (ASTM D2487) every six months for each large soil waste generator. A large soil waste generator is defined as a generator disposing of at least 30,000 cubic yards (compacted) of compactable soil in a given calendar year. Record the location of the classification sample on the "Sampling Log".	Verify the frequency of laboratory tests.
TERRACING OF LIFTS: As new lifts are placed next to old lifts, at least three feet, measured horizontally, shall be removed from the outer edge of	Inspect the intersections of old and new lifts. Verify that the outer three feet of the old lifts are being removed (except for CLSM lifts). Record any problems	Verify that the required inspections are being performed.

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the old lift (except for CLSM lifts).	on the "Daily Construction Report".	
INTERSECTION OF LIFTS: In addition to the density testing of the lift, an average of one density test per three lifts shall be performed at the old/new-lift interfaces. For lifts intersecting with CLSM lifts, the interface density testing is performed on the non-CLSM lift within 2 feet of the CLSM interface.	Conduct in-place moisture-density tests at an average rate of one test per three lifts and record the results on the "Field Density Test" form. For each lift random numbers between 0 and 1 shall be generated. If the random number is 0.65 or greater, then a moisture-density test is required on the lift interface between the new lift and old lift. On lifts requiring an interface test, the test location shall be chosen on the basis of a random number. For intersections with CLSM, perform a density test on the non-CLSM portions of the intersection within 2 feet of the CLSM interface. a. Approve lots which meet the specified compaction. b. Rework and retest lots not meeting the specified compaction.	Observe, at a minimum, five percent of the tests performed by the QC personnel to ensure that the tests are being performed correctly. Verify that tests are performed at the correct frequency and the documentation has been completed.

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DEBRIS PLACEMENT		
DEBRIS DEFINITION: For the purposes of this CQA/QC project plan, debris is defined as any radioactive waste for disposal other than compactable soils. Compactable soil is defined as: (a) having a graded material that will pass through a four inch grizzly; (b) as having a bulk density greater than seventy pounds per cubic foot dry weight in accordance with ASTM D-698; and (c) having soil-like properties (i.e., standard tests in accordance with waste placement procedures can be performed. Additionally, debris shall be classified as either incompressible debris (i.e. concrete, stone, or solid metal) or compressible debris (all other debris types). A large object is defined as any debris that does not have at least one dimension less than 10-inches or that has any dimension in excess of 12-feet. A large component is defined as a large object that weighs more than 100,000 pounds.	No action required.	No action required.
DEBRIS PLACEMENT METHODS: Debris may be placed in the embankment using two different methods: 1) placement of the debris in a lift with compactable soil at a limited ratio of debris to soil, or 2) placement of the debris in a lift and in-filling the debris with Controlled Low Strength Material (CLSM).		
For placement of large components, the maximum allowable load on the clay liner surface must be less than 3000 psf.	Perform a Large Component Engineering Review. Ensure that the bearing pressure at the clay liner surface meets specification for the load associated with placement of any large component.	
When CLSM is required as structural fill in the Large Component Engineering Review in order to meet the load specification, the first 4 feet of CLSM shall be placed around the large component within 30 calendar days of large component disposal.	Document the following on the Lift Approval Form: 1. Date of large component disposal and date of CLSM pour.	

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DEBRIS FREE ZONE: The Debris Free Zones are defined as the first one foot of the waste embankment above the clay liner, and the last one foot of the waste embankment below the radon barrier. The materials that make up the Debris Free Zones shall be native soils that are free of debris material.	Visually inspect the soil material used for the Debris Free Zone and verify that it is free of debris. Record results on the "Lift Approval Form".	Review documentation to ensure that inspections have been performed.
DEBRIS QUANTITY IN SOIL WASTE LIFTS: Debris that is placed in the embankment with compactable soil shall be limited to a portion of the total volume of the waste lot. Furthermore, the debris shall be uniformly distributed across the lot.	For shipments containing debris material, determine the volume of debris for the shipments. Volume determination shall be established by either a) inspecting the debris in the shipment and calculating the quantity of debris, or b) using the manifested waste volume.	Observe in the field that the debris calculations and estimates are being performed and properly documented. Review documentation to verify that the visual observations of debris shipments are being properly performed by QC personnel or that the manifested volume of waste is used to calculate the volume of fill material required.
Lifts containing materials susceptible to wind dispersal shall be covered with soil-like waste or fill material so that materials susceptible to wind dispersal are secured by the end of each working day.	Visually inspect lifts containing materials susceptible to wind dispersal are covered with soil-like waste or fill material by the end of each working day.	
A lot is defined as an area for the placement of waste from a single generator. The volume of a lot is limited to one thousand (1000) cubic yards for testing purposes. A lift is defined as one or more lots which are compacted and tested together to meet lift placement requirements. Debris lift fill will be controlled by the volume of uncompacted fill added to the lift.	Inspect debris once it is spread out on the lot and prior to placement of fill material. Ensure that debris is spread out uniformly across the lot and in a manner to minimize void spaces and does not exceed volume requirements. Document the debris inspection on the "Lift Approval Form." Record the debris fill calculations and estimates on the "Lift Approval Form".	
For compressible debris, the volume of the debris in a lot shall be limited to less than or equal to thirty percent (30%) by volume of the calculated compacted volume of the lot.		
Incompressible debris (concrete, stone, or solid metal) may be placed in a lot up to twenty-five percent by volume of the uncompacted lot. When combining the two types of debris in one lot, the above volume limit applies and the maximum volume of all debris shall be		

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less than or equal to 25 percent. At least one moisture/density test shall be performed per soil type in the lift.		
DEBRIS SIZE: All debris placed in soil waste lifts shall be less than ten (10) inches in at least one dimension, and no longer than twelve (12) feet in any dimension.	Inspect debris placed in soil lifts to ensure that it meets the debris size requirements.	Review documentation associated with debris lifts to verify that debris inspections are being performed.
RESIN LIFTS: Unless disposed in the Containerized Waste Facility, resins shall be disposed as follows or in accordance with the specification "CLSM Pours with Resin-Filled Containers" below. For resin lifts, resins will be less than one inch thick, at any location on the surface of the lift, prior to tilling. Ion Exchange Resin (IER) must be blended with native clay that meets the CL classification in a minimum ratio of 1:9 (one part IER to nine parts CL clay) on a volumetric basis. This native clay shall be tested by ASTM method D-2487 at a rate of one test every 250 cubic yards. Blending of IER must take place where native soil has been placed and approved by the Construction Quality Control Officer (CQCO) as a marker layer over the previous lift. The CQCO may approve the 6-inch fill cover for the 10% debris lifts as the bottom marker layer provided verification of the following: 10% debris is placed in previous lifts; and cover fill is native soil that is distinguishable from the previous lift and resin clay. Exposed synthetic soils can be compacted, tested and approved prior to placement of at least 2-inches of native soil cover. A minimum of 2-inches of native soil cover must be placed by the end of each workday.	For resin lifts, inspect the spread resin prior to tilling to ensure: a) resin is less than one inch thick at any location on the surface of the lift; b) resin is spread throughout the resin lift area; c) there are no areas larger than 25 ft^2 without resin; d) there are no depressions or wheel ruts deeper than one inch. e) verify native clay meets CL classification and is blended at a 9 to 1 ratio. f) Verify a minimum of 2-inches of native soil cover must be placed by the end of each workday. Require additional spreading for any resin lift not meeting these specifications. Record the debris inspection on the Lift Approval Form. Notify DRC during normal working hours of placement of blended materials at least 24 hours prior to covering beyond this 2" clay layer in order to allow inspection and sampling of placed blended materials.	Review documentation associated with resin lifts to verify blending and disposal requirements are being performed.

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The minimum 2-inch native soil cover may be used to blend the resin in the next lift.		
CLSM POURS:		
CLSM PYRAMID: 1) Stacked CLSM lifts shall form a pyramid with a maximum 3H:1V outside edge slope. Thus, with a six foot CLSM lift and six inch (6”) cap, the next stacked CLSM lift must be constructed to minimum of 19.5 feet inside the edge of the lower lift. 2) The pyramid base dimensions and maximum 3H:1V side slope requirements will control the location of all subsequent stacked CLSM lifts throughout the full height of the embankment. 3) Adjacent pyramids shall not be placed above any portion of previous CLSM pyramids.	Determine the location of the northwest corner and the dimensions of each lift and document on the EC-1904 form. Use the lift location and dimensions to ensure compliance with the CLSM pyramid specification. Document the dimensions of the previous CLSM lift on the EC-1904 form diagram. In locating a new pyramid, document on the EC-1904 Form: a) The pyramid base is placed on the two-foot debris free zone; or, b) The pyramid base has not been placed above a previously placed pyramid	Verify compliance with the CLSM pyramid specification and proper documentation of the QC requirements.
CLSM Lift Preparation: The average height of each pour shall be limited to six feet. Large objects taller than six feet shall be poured with the subsequent CLSM pours (in layers) until completion. Debris disposed with CLSM will be placed to minimize the entrapment of air in the CLSM pour.	Perform an inspection of the preparation of debris for placement with CLSM. Ensure that the average formed height of the CLSM lift is less than six feet and that any large objects are localized into specific areas. Also, ensure that debris is placed in a manner to minimize the possible entrapment of air during the CLSM pour and to allow maximum in-filling of the debris. Document the inspection on the CLSM Inspection Form.	Review inspection documentation to ensure that inspections are performed and properly documented.
DRC NOTIFICATION FOR CLSM POURS: The DRC shall be notified at least 48 hours in advance of any CLSM pour. A CLSM pour will be defined as a formed area approved and documented by Engineering for CLSM designated on a waste lift.	Verify that the DRC has been notified at least 48 hours in advance of any CLSM pour. Document DRC notification on the “Daily Construction Report”.	Verify that the DRC has been notified at least 48 hours in advance of any CLSM pour.
PORTLAND CEMENT OR FLY ASH CLSM DESIGN SPECIFICATIONS:		
Notwithstanding the following specifications, Macro		

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Vaults as approved by the Division of Solid and Hazardous Waste in the Mixed Waste Landfill Cell are considered large objects that do not require CLSM. Macro Vaults shall not be proof rolled.		
CLSM shall have the following characteristics: a) The design mix is approved by the production engineer prior to use in the cell area and meets the material specifications provided in Table 2 or Table 3 of this Attachment II-A. b) The CLSM passes a Slump Test (procedure provided in Appendix B of this manual), Flow Consistency Test (ASTM D6103) or Efflux test (procedure provided in Appendix B of this manual), as applicable. Passing criteria for each test is specified in Table 2 "Material Specifications for Portland Cement CLSM" or Table 3 "Material Specifications for Fly Ash CLSM" of this Attachment II-A. c) The CLSM shall have a wet unit weight in all cases of at least 100 lbs/ft^3 as determined by ASTM D6023 (Unit Weight, Yield, Cement Content, and Air Content (Gravimetric) of CLSM).	Two types of tests will be performed to ensure that the CLSM meets the design specifications: initial screening tests and lot acceptance tests. The results of these tests and corrective actions, if any, shall be documented on the CLSM Testing Form. a. Initial screening tests shall be performed on the first load of CLSM for each day that CLSM is poured. This screening test shall be performed from the "front end" of the load. The initial screening test includes either a Flow Consistency Test (ASTM D6103) or Efflux test (procedure given in Appendix A), as well as a unit weight test (ASTM D6023). The results from this initial screening test shall indicate whether or not any adjustments need to be made at the batch plant to ensure loads meet design specifications. b. If adjustments are made to the load to produce a product that passes the testing requirements, perform initial screening testing on the subsequent two loads to verify that the batch plant adjustments are sufficient c. CLSM pouring shall only be authorized to proceed upon verification that the initial load (and subsequent two loads if the initial load failed) meets mix specifications. d. Acceptance tests shall be performed at a rate of one test per lot, with a minimum of one acceptance test performed for each CLSM pour. A lot is defined as 100 cubic yards of CLSM. Sampling for acceptance tests shall be	Observe, at a minimum, five percent of the tests performed by QC personnel on the CLSM to ensure that the tests and observations are being performed correctly. Verify that the required testing has been performed and properly documented.

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	performed in accordance with ASTM D5971 (Sampling Freshly Mixed CLSM). These acceptance tests shall be performed from a composite of two samples from near the middle of the load. a. Accept loads that meet specification. b. For loads with unsatisfactory results, accept the first part of the load and reject the remainder, or modify the load and/or pour techniques and retest.	
d) The CLSM shall have a minimum 28-day strength of 150 pounds per square inch (psi) as determined by ASTM D4832. A minimum of 3 cylinders shall be cast for compressive strength testing.	Cast a minimum of 3 cylinders per 2000 cubic yards of CLSM placed. Perform compressive strength testing in accordance with ASTM D4832 at 28 days to ensure the minimum strength requirements are met. If the CLSM cap does not meet specification, evaluate why it failed and implement corrective actions to prevent recurrence.	Ensure compressive strength testing is being performed at the correct frequency.
e) A load ticket shall be furnished for each truck of CLSM to be poured.	Obtain the load ticket for each truck load of CLSM and ensure the load meets the mix specifications provided in Table 2 “Material Specifications for Portland Cement CLSM” or Table 3 “Material Specifications for Fly Ash CLSM” of this Attachment II-A. Reject any loads not meeting the mix specifications. Include the load ticket with the Lift Approval Form for the CLSM lift. During each CLSM pour, a QC Technician shall be present at or near the pour at all times and shall visually observe pour activities.	Verify that the load tickets have been obtained by QC personnel for each truck load of CLSM and that the load ticket has been checked against Table 2 “Material Specifications for Portland Cement CLSM” or Table 3 “Material Specifications for Fly Ash CLSM”.
CLSM PLACEMENT OF UNCONTAINERIZED DEBRIS: Debris shall be placed to minimize the entrapment of air in the CLSM pour. To accomplish this, any plastic caps, wrappings, or other obstructions placed on pipes, valves, and other debris objects shall be cut or removed prior to pouring CLSM. The uncontainerized debris shall be spread horizontally across the lift. Any compressible debris in the lift shall be secured to ensure proper disposal and cover with	Visually inspect the debris pour to ensure that the CLSM can flow throughout all uncontainerized debris in the waste matrix. Inspect pipes, valves, and other debris object and ensure that sufficient access exists for CLSM to enter the debris interior and fill voids. Verify that all compressible debris is properly secured. Ensure that wood materials are spread throughout the lift and not stacked or nested together.	Verify the large debris inspections have been performed and documented on the CLSM Inspection and Testing Form.

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CLSM. Any wood materials shall be spread throughout the lift to prevent localized stacking or concentration of wood materials.		
CLSM POURS WITH DEBRIS-FILLED CONTAINERS: In-filling of debris inside containers with CLSM shall be maximized. A minimum of two holes shall be punched into the bottom of one of the walls of each box container to allow for flow throughout the container. Containers filled with primarily wood materials shall not be disposed with CLSM, and must be emptied and spread out prior to placement.		
Lids shall be removed from all box containers prior to pouring CLSM (unless a specific waste stream or shipments are exempted by UDRC for safety or ALARA considerations). Drum containers do not require removal of the lid. However, a drum container lid shall be pierced with a hole size of at least 2" X 4" to allow flow of CLSM into the container. If any container includes compressible debris, the material shall be secured to remain inside the container. Drum containers that contain compressible debris shall have the lid removed or a six-inch CLSM cap shall be placed over the filled container.	Visually inspect compressible debris inside containers to ensure the debris is secured. Ensure lids are removed from all box containers. If the lid shall remain on the drum container (or other waste container specifically exempted by UDRC), ensure that the lid has been pierced with the proper size and number of holes. Record results on the CLSM Inspection Form. If the lid remains on the drum container, ensure that the required number and size of holes exist in the lid. A flowability test is not required on containers filled with soil or fine-grained materials.	Review inspection results to ensure that compressible debris is being properly secured and that adequate holes exist for containers where lids remain on the container.
CLSM POURS WITH SOIL-FILLED CONTAINERS: Containers that are filled with soil-like materials may be placed with CLSM. The lid may remain on the container. However, holes must be placed in the lid as required for compressible debris-filled containers above.		
CLSM POURS WITH RESIN-FILLED CONTAINERS: Containers that include or are filled with ion-exchange resin materials may be placed with	Verify that ion-exchange resin containers are constructed of steel or poly. Document this inspection on the CLSM Inspection Form.	

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CLSM. Only watertight steel or poly containers are permitted for resin disposal in CLSM. Cardboard, wood, and soft plastic "supersack" containers are expressly prohibited from use as the sole container for resin disposal in CLSM.		
Each container shall be inspected for headspace void and have any headspace void filled with an inert material. Provide a minimum of 24 hours notice to DRC prior to filling headspace void and sealing containers. CLSM and other concrete products are expressly prohibited for use filling this headspace void. After filling the headspace void, the lid shall be replaced on the container and latched, banded, or otherwise secured. The container shall be watertight to minimized potential CLSM contact with ion-exchange resins. Paint or mark the word "RESIN" on all 4 sides and the lid of each container when void filling and sealing operations are complete.	Verify that DRC has been notified at least 24 hours prior to the following activities. Inspect each container of ion-exchange resins for headspace void. Document the material used to fill any headspace voids. Document that the lid has been replaced and secured on the container. Document that the container is inherently watertight (i.e., a drum with the ring secured around the lid) or has been rendered watertight (i.e., a steel box with a flexible gasket in place before the lid is secured or that has been otherwise sealed). Document that the container has been painted or marked as required.	
The total waste resin volume shall be limited to no more than 25 percent of the total volume of the CLSM pour. Other wastes meeting the criteria for CLSM disposal as outlined in this CQA/QC Plan may be used to make up the remainder of the volume of the pour.	Prior to the CLSM pour, calculate the ratio of resins to other material in the pour as follows: (1) Document the container type and volume for each container of resins in the pour; (2) Document the total pour volume based on the formed area x height; (3) Resin volume divided by total volume x 100 = resin percentage. Container volume may be calculated from the nominal capacity or from manifested volume of resins in the container.	
Containers of ion-exchange resins shall not be placed directly adjacent to each other within the CLSM pour. Containers of ion-exchange resins shall not be placed directly above containers of ion-exchange resins in previous lifts within the CLSM pyramid.	Survey and document the location of each resin-filled container on the CLSM Inspection Form. Verify that each resin-filled container is not placed directly above resin-filled containers in previous lifts within the CLSM pyramid.	
CLSM pours with resin-filled containers are subject to all CLSM pyramid controls under the specification		

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"CLSM Pyramid" above.		
FINAL CLSM POUR SURFACE: The final CLSM surface will be a horizontal plane with no exposed debris that impedes contact with the surface area during proof rolling. (with the exception of large objects that require multiple pours to completely dispose with CLSM).	Visually inspect the final CLSM pour surface to ensure the area is acceptable for proof rolling.	Review the documentation to ensure proof-roll testing is being performed and properly documented.
PROOF-ROLL TESTING: A proof roll test shall be performed on all CLSM lifts a minimum of 3 calendar days following completion of the CLSM pour and prior to placement of any additional waste lifts on top of the completed pour. The test shall consist of a loaded truck (rock truck, cement truck, or other vehicle of equal or greater surface load) driving across the entire footprint of the completed CLSM pour.	Inspect the entire cured CLSM pour surface. Following inspection, direct the truck (rock truck, cement truck, or other vehicle of equal or greater surface load) across the entire CLSM pour surface. Inspect the surface during rolling for any cracking or depressions resulting from the proof-rolling. Identify any surface cracks or depressions with a vertical displacement of ½-inch or greater, or cracks greater than ½-inch in depth. Mark these areas for repair or re-work. Document observations on the Lift Approval Form. Approve all lift areas not marked for repair or rework. For any areas with surface cracking or depressions with a vertical displacement of ½-inch or greater, or cracks greater than ½-inch in depth, one of the following methods shall be followed to remedy the failed area(s): a. The area may be compacted and then re-poured. Following three days from the re-pour, perform another proof-roll test to evaluate if the repair was adequate; or b. Remove the CLSM and debris from the marked area and replace it with debris and CLSM. Following three days from the re-pour, perform another proof-roll test of the area to evaluate if the repair was adequate. Repeat this process until satisfactory results	Review the documentation to ensure rework, if required, has been performed and documented

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	are achieved; or c. Place a six-inch CLSM cap over the pour lift area after the area in question has been compacted. The six-inch cap shall extend a minimum of three feet (3') past the damaged areas created during proof rolling in each direction. Following a minimum of three calendar days, perform a proof roll test of the six-inch cap area to evaluate if the cap was adequate. This process may also be repeated (i.e., placement of additional cap to a 12-inch cap) until satisfactory results are achieved.	
SIX-INCH CAP: All containers filled with compressible debris that do not have the lids removed shall have a six inch CLSM cap poured over the top of the containers prior to proof rolling. In addition, any CLSM pours that have areas which did not pass the proof-rolling test may have a CLSM cap placed over those areas. Areas poured with a CLSM cap shall still require a proof-rolling test (as described above) to verify adequacy of the cap. The six inch cap shall extend a minimum of three feet in each direction past the edge of the container area that requires a cap.	Visually inspect the CLSM pour area and identify the highest elevations of debris that requires a six-inch cap. Survey and document these designated elevations on the CLSM Inspection Form. Following completion of the six-inch cap, perform a final survey of the entire lift as required for determining lift thicknesses above. Ensure that the thickness of the cap is six inches above all debris requiring a CLSM cap and that the cap extends three feet in each direction past the edge of the area that requires the cap. Document the inspection and completion of the CLSM cap on the Lift Approval Form.	Review the documentation associated with the CLSM cap.
The minimum compressive strength of the CLSM cap shall be 500 psi. Table 2 and Table 3 specifications do not apply to the CLSM cap.	Perform compressive strength testing of the CLSM used for caps at the rate of 1 test per CLSM lift. Test specimens/samples shall be collected in accordance with ASTM D5971 (Sampling Freshly Mixed CLSM). The samples shall then be tested in accordance with ASTM D4832 (Preparation and Testing of CLSM Test Cylinders). If the CLSM cap does not meet specification, evaluate why it failed and implement	Verify that compressive strength testing is performed at a rate of 1 per CLSM lift. Ensure that the compressive strength of the cap is greater than or equal to 500 psi.

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	corrective actions to prevent recurrence.	
IN-CELL BULK DISPOSAL: For both LLRW and 11e.(2) waste: Any waste material taken to the disposal cell but not spread out (for lifts placed with compactable soil) or set into a CLSM lift area for forming (for debris to be placed using CLSM) shall be considered in-cell bulk disposal. In-cell bulk disposal may be temporarily managed in piles up to twenty-five feet high on the embankment. For 11e.(2) waste: In-cell bulk disposal cannot be placed on slopes steeper than approximately 5H:1V. The volume of in-cell bulk disposal shall not exceed 8.418 x 10^4 m^3 or 1.10 x 10^5 yd^3 (2.97 x 10^6 ft^3). ~~All 11e.(2) in-cell bulk placement material shall be placed to final specifications by August 1 of each year.~~	On a monthly basis, calculate and document the volume of in-cell bulk disposal and waste stored on the LLRW storage pads. Stop waste unloading before the volume of waste stored exceeds the volume specified in the trust agreement.	Review documentation of in-cell bulk disposal and ensure that volumes do not exceed the trust agreement.
Open-air storage of PCB/Radioactive waste and Dry Active Waste (DAW) is prohibited. DAW is defined in condition I.E.10.(d) of the Ground Water Quality Discharge Permit. In-cell bulk disposal of PCB and DAW shall be managed to prevent open-air storage as follows: 1. Maintained in a water-tight container; or 2. Covered within 24 hours of the end of the shift that the waste was unloaded with a nominal 6” of soil or soil-like waste material that is free of PCB and DAW; or 3. Covered within 24 hours of the end of the shift that the waste was unloaded with a commercial fixative to prevent wind dispersal and leachate generation, applied in accordance with the manufacturer’s instructions; or 4. The following PCB wastes do not require cover to prevent wind dispersal: a. Drained equipment; b. Large objects with inaccessible PCB	Obtain reports from waste disposal personnel as to the location and status of PCB and DAW in-cell bulk disposal at the beginning of each shift. When material requiring cover has been placed into in-cell bulk disposal during the preceding shift, track placement of the specified cover material. Document completion of cover within the required timeframe on the Daily Construction Report.	

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contamination; or c. PCB bulk product waste (as defined in 40 CFR 761.62(b)(1)(i)) with a bulk density greater than 70 pounds per cubic foot. When cover is required, maintain documentation of the date and shift that PCB and DAW were placed in in-cell bulk disposal and of the date and shift that cover was applied. The volume of in-cell bulk disposal plus the volume of waste stored at the LLRW container storage pads (e.g. LLRW bulk storage pad, LLRW container storage pad, etc.) shall not exceed the volume allowed in the trust agreement.		
COLD WEATHER PLACEMENT		
FROZEN MATERIAL: No frozen material shall be disposed directly on or within 24 inches of the clay liner. Frozen material is defined as material which cannot meet the compaction requirements because of frozen water mixed within the material.	During cold weather, inspect waste to be disposed directly on the clay liner. Do not allow waste containing frozen material to be disposed on the clay liner. Record corrections on the "Daily Construction Report".	Verify that inspections for frozen material are being conducted during cold weather and that any corrective actions (if required) are properly documented.
PLACEMENT OF WASTE DURING COLD WEATHER: Waste material shall only be placed when the required moisture and compaction can be met.	1. For soil lifts: a) On November 1, decrease density and moisture lot size to 750 cubic yards (compacted). b) On December 1, and continuing to March 1, decrease density and moisture lot size to 500 cubic yards (compacted). c) Stop placement of waste on a lift when two consecutive tests fail compaction requirements due to frozen material. The first "unapproved" lift is classified as in-cell bulk disposal. d) When temperatures are high enough to place the in-cell bulk disposal material, place the material in accordance with lift thickness and compaction	1. For soil lifts: Verify that the testing frequency is increased at the beginning of November, and December. Verify that work stops on a lift after the failure of two consecutive compaction test and that the lift is surveyed before the placement of in-cell bulk disposal.

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	requirements specified for waste lifts above. a) If more than 2 feet of waste was stored as in-cell bulk disposal, excavate to a maximum of 12 inches above the last approved waste lift. Test and approve this in accordance with lift thickness and compaction requirements given above. b) If less than 2 feet of in-cell bulk waste was disposed over the last approved lift, excavate to the top of the last approved lift and re-test this lift in accordance with lift thickness and compaction requirements specified above.	
For CLSM pours:	2. For CLSM pours:	2. For CLSM pours:
a) Do not pour CLSM on a frozen soil base.	a) If the CLSM is to be poured on a soil base, perform a soil density test on adjacent material prior to the pour to determine if the underlying soil is frozen. If the soil is found to be frozen do not allow placement of material.	a) Review documentation of soil base testing verify that CLSM is not to be poured on a frozen soil base. During freezing conditions, verify that QC personnel have performed initial sampling and testing of the CLSM to ensure flowability ensured that the CLSM has been covered with concrete blankets or tented and heated, where required. Verify that QC personnel have periodically checked the temperature of the CLSM and recorded the results on the "CLSM Inspection and Testing Form".
b) If the ambient air temperature is forecast to drop below 5^{o}F anytime during the CLSM pour, CLSM shall not be poured. When the ambient or expected air temperature will fall below 35^{o}F anytime during the CLSM pour, the CLSM shall be sampled and an initial screening test performed as outlined under CLSM Design Specifications above. This initial sample may	b) When the ambient or expected air temperature will fall below 35^{o}F anytime during the CLSM pour, perform an initial screening test of the CLSM immediately before pouring to ensure that it meets the flowability criteria. This screening test includes either a Flow Consistency Test (ASTM D6103) or Efflux test (procedure given in Appendix A), as well as a unit	b) Review documentation of screening tests to ensure that CLSM met flowability specifications during cold weather.

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be used to prompt an adjustment of the load water content or temperature, modify the pour techniques, motivate rescheduling of the pour event, etc., but should not be considered acceptance sampling and testing. Acceptance sampling and testing should be obtained in accordance with ASTM D5971 (Sampling Freshly Mixed CLSM).	weight test (ASTM D6023). The result from this initial screening test shall indicate whether or not any adjustments need to be made at the batch plant to ensure loads meet design specifications. 1) If adjustments are made to the load to produce a product that passes the testing requirements, perform initial screening testing on the subsequent two loads to verify that batch plant adjustments are sufficient. 2) CLSM pouring shall only be authorized to proceed upon verification that the initial load (and subsequent two loads if the initial load failed) meets mix specifications. Perform acceptance sampling and testing from near the center of the load. a. Accept loads which meet specification. b. For loads with unsatisfactory results, accept the first part of the load and reject the remainder, or modify the load and/or pour techniques and retest. Record the results on the "CLSM Inspection and Testing” forms.	
c. Unless the ambient air temperature is at least 35°F and rising, measures must be taken to ensure the CLSM temperature does not fall below 40°F. To ensure this occurs and therefore the CLSM can adequately cure prior to exposure to freezing temperatures, the following should occur: Limit the pour to a surface area of no more than 4,800 ft^2. Heat the CLSM prior to pouring (as possible). Cover, or tent and heat, the CLSM directly following pouring (i.e. - pour one truck load, cover or tent the in-place material, then pour the next truck load). Following completion of the pour, cover the CLSM with concrete blankets, or tent and heat the CLSM. Likewise, if following placement, the ambient air temperature decreases below 35°F, or is	c) When the ambient air temperature decreases to below 35°F, ensure the CLSM temperature does not fall below 40°F. Measure and record the temperature of each CLSM load prior to introduction to the cell. Ensure the freshly poured CLSM is covered or tented and heated in a timely manner. Measure and record the temperature of the in-place CLSM every two hours during pouring, at the end of the work shift and at the beginning of the next work shift. Temperature results of pour temperatures shall be recorded on the "CLSM Inspection and Testing” forms. If, following placement, the ambient air temperature decreases below 35°F, or is anticipated to decrease below 35°F anytime in the 24 hours following placement of the CLSM, verify that	c) Review documentation of CLSM temperature measurements and actions taken for cold weather pouring to verify that CLSM temperatures meet specifications.

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anticipated to decrease below 35°F anytime in the 24 hours following placement, the CLSM must be covered with concrete blankets, or tented and heated.	concrete blankets or tenting and heating has been employed to ensure the CLSM is maintained greater than 40°F. Record the results of the inspection on the "CLSM Inspection and Testing" forms.	
SNOW REMOVAL: When waste material is to be placed and the work area is covered with snow, the snow must be removed.	Observe that snow is removed. Advise the contractor of deficiencies. Construction may not continue without corrective action. Record corrective action (where required) in the "Daily Construction Report".	Verify that snow removal is being performed and documented.
FINAL GRADING: Top of waste elevations shall be at grade or below grade.	Survey the top lift of waste on a 50 ft grid and at key points. Final survey measurements will be documented and provided to the QC and Construction QA Officers. a. Indicate where the waste meets design line and grade. b. Rework and resurvey areas not meeting the specified grade.	Review the final survey data. Verify the frequency of the survey points.

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SCOPE: This work element applies to the Class A and Class A North embankments. This work element also applies to the Class A South portion of the Class A South/11e.(2) embankment.		
NOTICE OF TEST PAD CONSTRUCTION: The test pad plan shall be approved by the DRC prior to the test pad construction. The DRC shall be notified 48 hours in advance of the start-up of test pad construction.	Obtain documentation confirming that the test pad plan has been approved by the DRC. Notify the DRC 48-hours in advance of test pad construction.	Verify that the test pad plan has been approved by the DRC. Verify that the DRC has been notified as required.
CONTAINERIZED WASTE PLACEMENT TEST PAD: A test pad with a minimum area of 400 ft^2 will be constructed using the procedure (container or large component type, container configuration, backfill material properties, placement and compaction methods) proposed for construction of the waste lifts. The test pad shall be representative of anticipated field placement conditions and of dimensions suitable to the equipment to be used for production. The minimum area of the test pad may be reduced with DRC concurrence with the test pad plan. Prior to implementation, within the Containerized Waste Facility, of a containerized waste configuration that has not been previously approved, a waste placement test pad shall be constructed utilizing the proposed containerized waste configuration. Test pads are to be constructed and tested in accordance with the following specifications:	Observe the construction of test pads. Measure test pads to ensure that they are constructed to the size indicated. Record the test pad size on the "Daily Construction Report".	Daily, observe the construction of the test pads. The Quality Assurance review for test pad specifications shall cover each specification in this work element. Review 100% of the QC documentation to verify that the tests were performed and documented correctly.
1. Construct the proposed configuration of containerized waste in the test pad area.	Document the constructed configuration of containers in the test pad on the “Daily Construction Report.”	Perform a minimum of one (1) QA visual inspection of the resulting waste form per test pad.
2. At least one Proctor (or relative density) and classification test shall be conducted on the backfill	Conduct the required proctor (or relative density) and classification (PL, LL, and gradation) tests.	

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material for each test pad.		
3. Backfill shall be placed over and between the waste packages in a manner that encourages flow into void spaces. The backfill is to be placed and compacted by equipment and methods proposed for use during construction of the waste lifts. Other equivalent equipment may be used for placement or compaction of backfill with approval from the Director of Engineering and DRC.	Record type of equipment used, and number of passes on the "Daily Construction Report". Verify DRC approval has been received for equivalent equipment when used.	
4. The backfill surrounding the containers shall achieve an average density of at least 85% standard proctor or 55-percent relative density for drum configurations, or an average density of at least 80-percent standard proctor or 50-percent relative density around B-12 or B-25 boxes, HICs, cask liners, large components, or container overpack configurations. The completed test pad shall have no greater than 1% external void space by volume of the entire test pad.	Conduct direct or indirect in-place moisture-density tests at a rate of at least four tests per test pad. The test location shall be chosen to verify backfill compaction throughout the test pad. Record the test result on the "Field Density Test" form. Inspect the constructed test pad for void spaces surrounding the containers. Observe destructive testing of the test pad and measure external void spaces found in the backfill in accordance with the "Containerized Waste Facility Waste Placement Test Pad Destructive Testing" method in Appendix B. a. Approve test pads which meet the specified compaction, and minimize void space conditions. b. Rework and retest test pads not meeting the specified moisture or compaction or minimize void space conditions. Document all rework that was performed. c. Where rework and retesting is impractical, reject the test pad procedure.	
5. The procedures used to construct the test pad (container type, container configuration/orientation, backfill material properties, placement and compaction methods) shall be reviewed and approved by the Director of Engineering. The test must be approved by a Professional Engineer.	Provide the Director of Engineering with copies of the documentation for the test pad for review and approval.	

WORK ELEMENT – CONTAINERIZED WASTE FACILITY WASTE PLACEMENT TEST PAD

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6. The procedures used to construct the test pad shall be reviewed and approved by the DRC prior to using the new test pad construction method.	Obtain documentation confirming DRC approval of the test pad.	Verify that proper approval has been obtained for the test pad and that the necessary construction procedure documents are in place for use during backfill construction.

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SCOPE: This work element applies to the Class A and Class A North embankments. This work element also applies to the Class A South portion of the Class A South/11e.(2) embankment.		
LIFT IDENTIFICATION: Each lift shall be given a discrete designation for testing and surveying purposes.	Assign a lift identification number to each lift. Use the lift identification number to identify all paperwork for that lift. Summarize all lifts on the lift summary form.	The Quality Assurance review for waste placement specifications shall cover each specification in this work element. Review a minimum of 50.0% of the QC documentation to verify that the tests were performed and documented correctly.
LIFT ACCEPTANCE: At the time of acceptance, the date and time of lift approval shall be recorded.	The QC technician shall record the date and time of lift approval on the CWF Lift Approval Form	
DEFINITIONS: For the purpose of this CQA/QC project plan, the following terms are defined: Backfill is defined as poorly graded type SP or well graded type SW sand with a minimum of 95% passing the #4 sieve, a minimum of 35% passing the #30 sieve, and less than 5% passing the #200 sieve. The maximum moisture content for backfill shall be less than or equal to 4.1% at the time of backfill placement. This specification may be modified following successful completion and DRC approval of a test pad. Backfill cover is defined as a minimum of one foot of soil placed over containerized waste packages after backfilling is complete. In the case of standard liners and large liners, the placement sequence is: (1) backfill between the waste forms; (2) intermediate sand; (3) backfill cover. Containerized waste is defined as any containers of Certified Containerized Waste in accordance with applicable requirements of the Waste Characterization Plan. Certified Containerized Waste is defined as	No action required.	No action required.

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monolithic units in the form of the following filled containers. 1. Any DOT "Strong, Tight" Containers up to 5 feet tall 2. Standard Liners are High Integrity Containers (HICs) or other packages between 5 and 6.65 feet tall (up to 215 cubic feet external volume) 3. Large Liners are HICs or other packages between 6.65 and 9 feet tall (between 215 and 331 cubic feet external volume) 4. Other Large Components and oversized DOT containers (larger than 331 cubic feet) Containerized Waste Facility (CWF) pyramid is limited to a maximum of two lifts of containerized waste. Containers up to 5 feet tall are limited to a single lift at the pyramid base. Containers greater than 5 feet tall are limited to two lifts. The volume of the embankment above and surrounding the pyramid shall be filled with bulk waste lifts placed in accordance with the Bulk Waste Placement Work Element of this plan. Intermediate sand is defined as a minimum of 2 feet of sand meeting gradation specifications for backfill, placed above the top of caissons used for placement of cylindrical containers greater than 5 feet tall. In the case of containers placed using removable steel forms, intermediate sand shall be placed to an elevation at least 9 feet above the base of the container for standard liners and 11.5 feet above the base of the container for large liners. Lift is defined as containerized waste packages, backfill between packages, intermediate sand (when applicable), and the backfill cover layer. A containerized waste placement lift may contain one layer of containers or more than one stacked layer of containers, depending on the container type and height.		

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Removable Steel Form is a circular steel form used to ensure the spacing of standard or large liners. Removable steel forms are placed in an approved disposal configuration (hexagonal for example) prior to placement of liners. Removable steel forms can be used in either the first lift or second lift in place of caissons. All removable steel forms shall be pulled after liner placement and before backfill.		
CONTAINERIZED WASTE PLACEMENT: 1) All containers shall be placed in accordance with an approved container placement method. Containers shall be placed in a configuration that has been approved through the successful completion of a waste placement test pad. Figures 7 and 8 illustrate approved waste placement configurations. A minimum 6-inch layer of loose sand shall be placed prior to placement of containers. Containers shall be worked into this loose sand to minimize any voids underneath the containers. Containers shall be placed with a minimum distance as specified by individual container type below. Backfill shall be placed over and between the containers in accordance with the approved container placement method for the type of container being placed. The containerized waste placement backfill soil properties shall be tested once per 2,500 square feet of placement area or once per lift.	1) Verify through observation and document that the appropriate container placement method and spacing is followed for the type of container stacking in each lift. Perform at least one moisture content and classification (PL, LL, and gradation) test per 2,500 square feet of placement area, or change in backfill material type, or change in borrow source. Conduct an inspection of the container placement configuration prior to commencement of backfill placement. This inspection shall document that an approved configuration has been utilized for the container types present. Observe placement and compaction of the backfill to ensure that type of equipment, equipment load (if applicable), and number of passes meet the specifications approved by the containerized waste placement test pad. Record type of equipment used, equipment load (if applicable), and number of passes on the CWF Lift Approval Form.	1) Review the QC documentation to confirm that the appropriate container placement and backfilling method has been used and properly documented.
2) Standard Liners shall be placed as follows. Spacing and backfill of standard liners may be facilitated by the use of concrete caissons or removable steel forms; use of caissons or removable steel forms is not required. Caissons or other forms shall not exceed 7 feet tall. When	2) Verify through observation and document on the CWF Lift Approval Form that standard liners are placed with the appropriate container placement method and spacing.	

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used, removable steel forms shall be removed prior to backfill. Caissons shall not be removed without prior DRC notification. Backfill shall be placed to a minimum height of 7 feet above the container base elevation by dropping from the bucket of a front-end loader or equivalent around and above the container (whether in a caisson or not). Backfill shall achieve a minimum density of at least 80% of a standard Proctor, as demonstrated by the approved test pad(s). The backfill layer shall be covered by an intermediate sand layer to a minimum depth of 2 feet above the top of the caisson (9 feet above the container base elevation). Intermediate sand shall achieve a minimum density of 85% of a standard Proctor. The backfill cover layer is then placed above the intermediate sand layer. Caissons shall be placed in a hexagonal or other approved (through a test pad) configuration, such as rectangular, that meets the following criteria. Caissons with an outer diameter of 100 inches shall be placed a minimum of 4 inches apart. If no caisson is used, or if a caisson or other form of smaller outer diameter is used, the container shall be placed as if the 100-inch diameter caisson were there for spacing purposes; i.e., within a minimum area of 108-inch diameter centered around the container, no other caisson or container shall intrude.	Conduct in-place density tests at the surface of the intermediate sand layer at a rate of one test per lot and record the results on the "Field Density Test" form. A lot is defined as 10,000 square feet of a single lift. At least two tests will be performed per lift. The test location shall be chosen on the basis of random numbers. Approve lots when: a. Material is observed to be properly compacted throughout the lot; b. Density tests performed meet compaction specifications. Verify the mean elevation of the top of each intermediate sand lift by installing grade poles, or other methods approved by the Site Engineer. For each lift larger than 50’ x 50’, survey the corners and at least one spot in the middle. For lifts less than 50’ x 50’, a minimum of four grade poles, one in each direction, shall be used. Lifts larger than 50’ x 50’ may be segmented to areas 50’ x 50’ or less and elevation verified with the use of grade poles. The use of grade poles to verify the compacted thickness of the intermediate sand material shall be verified as part of the test pad for intermediate sand. Thickness measurements of the compacted intermediate sand will be documented and forwarded to the Construction QC Officer. a. Approve lifts with an average compacted intermediate sand thickness greater than or equal to the specified compacted intermediate sand thickness. b. Add intermediate sand and retest lots with an average compacted intermediate sand lift thickness less than the specified compacted intermediate sand lift thickness.	
3) Unusually shaped containers shall be placed and backfilled in a manner that allows void spaces to be filled. In no case shall unusually shaped containers be placed such that a significant amount of external void	3) Verify through observation and document that the unusual containers are placed such that all significant voids can be filled.	

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space cannot be filled. A significant amount of external void space for unusually shaped containers is 5 percent of the volume of the unusually shaped containers in the lift, unless otherwise approved by the Division.		
4) Large components and oversized DOT containers shall be placed and backfilled such that void spaces are filled and the bearing capacity of the embankment is not exceeded.	4) Verify through observation and document that the large components and oversized DOT containers are placed in accordance with an approved large component placement method.	
5) Large Liners shall be placed as follows. Spacing and backfill of large liners may be facilitated by the use of concrete caissons or removable steel forms; use of caissons or removable steel forms is not required. Caissons or other forms shall not exceed 9.5 feet tall. When used, removable steel forms shall be removed prior to backfill. Caissons shall not be removed without prior DRC notification. Backfill shall be placed to a minimum height of 9.5 feet above the container base elevation by dropping from the bucket of a front-end loader or equivalent around and above the container (whether in a caisson or not). Backfill shall achieve a minimum density of at least 80% of a standard Proctor, as demonstrated by the approved test pad(s). The backfill layer shall be covered by an intermediate sand layer to a minimum depth of 2 feet above the top of the caisson (11.5 feet above the container base elevation). Intermediate sand shall achieve a minimum density of at least 85% of a standard Proctor. The backfill cover layer is then placed above the intermediate sand layer. Caissons shall be placed in a hexagonal or other approved (through a test pad) configuration, such as rectangular, that meets the following criteria. Caissons with an outer diameter of 114 inches shall be placed a minimum of 5 inches apart and no more than 11 inches apart (at the nearest point between two adjacent caissons). If no caisson is used, or if a caisson or other form of smaller outer diameter is	5) Verify through observation and document that large liners are placed with an approved container placement method and spacing. Conduct in-place density tests at the surface of the intermediate sand layer at a rate of one test per lot and record the results on the "Field Density Test" form. A lot is defined as 10,000 square feet of a single lift. At least two tests will be performed per lift. The test location shall be chosen on the basis of random numbers. Approve lots when: a. Material is observed to be properly compacted throughout the lot; b. Density tests performed meet compaction specifications. Verify the mean elevation of the top of each intermediate sand lift by installing grade poles, or other methods approved by the Site Engineer. For each lift larger than 50’ x 50’, survey the corners and at least one spot located near the center. For lifts less than 50’ x 50’, a minimum of four grade poles, one in each direction, shall be used. Lifts larger than 50’ x 50’ may be segmented to areas 50’ x 50’ or less and elevation verified with the use of grade poles. The use of grade poles to verify the compacted thickness of the intermediate sand material shall be verified as part of the test pad for intermediate sand.	

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used, the container shall be placed as if the 114-inch diameter caisson were there for spacing purposes; i.e., within a minimum area of 124-inch diameter centered around the container, no other caisson or container shall intrude and adjacent caissons shall be within a maximum area of 136-inch diameter.	Thickness measurements of the compacted intermediate sand will be documented and forwarded to the Construction QC Officer. a. Approve lifts with an average compacted intermediate sand thickness greater than or equal to the specified compacted intermediate sand thickness. b. Add intermediate sand and retest lots with an average compacted intermediate sand lift thickness less than the specified compacted intermediate sand lift thickness.	
6) Large Liners shall meet the following void space criteria: void spaces within the waste and between the waste and its packaging shall be reduced to the extent practicable, but in no case shall less than 90 percent of the capacity of the container be filled.	6) For large liners, document that the void space criteria is met.	
7) Drums shall be placed horizontally at least 1 inch apart in a single layer. There shall be no continuous contact between drums. Forklifts may be used for drum placement provided that protective measures are taken to prevent damage to the drums. The forklift tines shall not come into direct contact with the drums. Sand shall be compacted to an average standard proctor density of 85% with a minimum of a single pass of a hoe mounted vibratory compactor or its equivalent, prior to placement of the next layer of drums. For purposes of this specification, the "Standard I-13 Liner" and "NUHIC-55 liners" may be placed as a drum.	7) Document that drums have been placed as required. Document equipment used and number of passes.	
8) When backfilling between standard or large caissons placed in a hexagonal pattern, the following controls apply as demonstrated in the "Test Pad Report for the Containerized Waste Facility Tri-Arc Test Pad Plan, Revised Plan" dated September 18, 2007. The loader or other equipment shall have a bucket of at least 25 cubic foot capacity and the bucket shall be totally filled. Dump the backfill sand from a height of approximately 2 feet	8) Document that the bucket used to place backfill sand meets or exceeds the minimum capacity. Observe sand dumping operations for compliance with the specification. Document on the Daily Construction Report.	

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above the top of the caisson (measured from the lower lip of the bucket to the top of the caisson).		
9) If placing ion-exchange resins in containers other than standard liners or large liners, ensure that each 50' x 50' lift area contains no more than 25% resins by volume. Increase spacing of resin containers as needed to maintain this criteria.	9) Calculate the ratio of resins to other material (soil, non-resin wastes) in the lift based on manifested resin volume and actual lift dimensions. Nominal container capacity may be used instead of manifested volume. Resin volume divided by total volume x 100 = resin percentage. Document on the CWF Lift Approval Form.	
PYRAMID CONTROLS: Refer also to Figure 7. Containerized Waste Facility (CWF) Pyramid: 1) Containerized waste lifts shall form a pyramid with a maximum 3H:1V outside edge slope. The slope shall be measured to the top of the backfill cover above containers in the lift. 2) Drums and boxes less than 5 feet tall are limited to a single lift on the lower layer of the CWF pyramid. Standard and large liners are limited to two lifts. 3) The pyramid base dimensions and maximum 3H:1V side slope requirements will control the location of the second lift of containers. 4) Adjacent pyramids shall not be placed above a previous CWF pyramid. 5) CLSM pyramids for bulk waste shall not be placed above a previous CWF pyramid. 6) CLSM may be used for fill (for any larger debris and oversized DOT containers) within the initial lift of the container pyramid. 7) The first liner placed in a second lift using this method shall be offset from liners in the lower lift. 8) Large Liners placed in the upper lift of the Containerized Waste Facility shall be placed at least 75 feet from the outer perimeter of the lower lift.	Determine the location of the northwest corner and the dimensions of each lift and document on the CWF Lift Approval Form. Use the lift location and dimensions to ensure compliance with the containerized waste facility pyramid specification. As each lift of backfill cover is placed, survey and document that the corners of the lift meet the 3H:1V slope. If applicable, document the dimensions of the previous containerized waste facility lift on the CWF Lift Approval Form. In locating a new pyramid, document on the CWF Lift Approval Form: a) The pyramid base is placed on the debris-free zone; or b) The pyramid base does not encroach the vertical limits of a previous pyramid. Prior to positioning the first liner in a second lift, document the location of containers in the first lift. Ensure that the first liner placed in the second lift is offset so that it is not directly above any single liner in the lower lift. Document that large liners placed in the upper lift meet the setback criteria.	Verify compliance with the containerized waste facility pyramid specification and proper documentation of the QC requirements.
CLSM USE AS FILL: CLSM use as fill within the initial lift of the container pyramid shall comply with specifications "DRC Notification for CLSM Pours" and "Portland Cement or Fly Ash CLSM Design Specifications" under Work Element – Waste Placement above. CLSM may be used for fill with up to two, 5-drum	Document DRC notification and CLSM mix inspections and approval in accordance with the referenced specifications.	

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pallets stacked inside a standard or large caisson. CLSM may also be used for fill with other waste containers that fit inside a standard or large caisson. The entire caisson height may be filled in a single CLSM pour.		
BACKFILL COVER: After backfilling of voids between containers is complete and intermediate sand is placed (as needed), each lift of containerized waste shall be covered by at least one foot of compacted backfill cover material.	1. For containerized waste lifts: Verify the mean elevation of the top of each backfill cover lift by installing grade poles, or other methods approved by the Site Engineer. For each lift larger than 50' x 50', survey the corners and at least one spot in the middle. For lifts less than 50' x 50', a minimum of four grade poles, one in each direction, shall be used. Lifts larger than 50' x 50' may be segmented to areas 50' x 50' or less and elevation verified with the use of grade poles. The use of grade poles to verify the compacted thickness of the backfill cover material shall be verified as part of the test pad for backfill cover. Thickness measurements of the compacted backfill cover will be documented and forwarded to the Construction QC Officer. a. Approve lifts with an average compacted backfill cover thickness greater than or equal to the specified compacted backfill cover thickness. b. Add backfill and retest lots with an average compacted backfill cover lift thickness less than the specified compacted backfill cover lift thickness.	Review the QC documentation.
Backfill cover for each lift shall achieve a density of at least 95 percent of a standard Proctor.	Conduct in-place density tests at the surface of the backfill cover at a rate of one test per lot and record the results on the "Field Density Test" form. A lot is defined as 10,000 square feet of a single lift. At least two tests will be performed per lift. The test location shall be chosen on the basis of random numbers. Approve lots when: a. Material is observed to be properly compacted throughout the lot; b. Density tests performed meet compaction	

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	specifications. Perform a laboratory classification test on the backfill cover material at a rate of one test per 3,000 cubic yards (compacted), or change in backfill cover material type, or change in borrow source. The sample for this test will be taken from the backfill cover stockpile.	
SET BACK OF WASTE: Maintain a distance of at least 10 feet between the inside toe of the runoff berm and the outside toe of the waste containers.	Initial waste set back approval shall measure the set back distance around the edge of the runoff berm at 100 foot intervals. Record the inspection of the setback on the "Daily Construction Report". Inspect the waste setback on a monthly basis. Record findings on the "Daily Construction Report". Require removal of any waste necessary to maintain the required set back.	Review the QC documentation to confirm that the monthly inspections have been performed and properly documented.
SNOW REMOVAL: When waste material is to be placed and the work area is covered with snow, the snow must be removed.	Observe that snow is removed. Advise the contractor of deficiencies. Construction may not continue without corrective action. Record corrective action (where required) in the "Daily Construction Report".	Review the QC documentation to verify that snow removal is being performed and documented.
Cold Weather Placement of Backfill: The following requirements apply to placement of flowable sand backfill when the ambient air temperature is below 32 degrees Fahrenheit: a. Backfill with frozen clods shall not be accepted for placement. b. The backfill stockpile shall be worked using heavy equipment prior to use. c. The minimum average spread diameter for the flowability tests shall be 8.75". d. If backfill is observed to have frozen clods or does not meet the flowability specification, the backfill stockpile may be re-worked. Each inspection and test shall be repeated for re-worked material.	When the ambient air temperature falls below 32 degrees Fahrenheit: a. Inspect the backfill stockpile to be used that day for any visible frozen clods. b. Observe working of the backfill stockpile. c. Perform a flowability test (ASTM D6103) on material from the backfill stockpile: 1) Collect a minimum of three representative samples from the backfill stockpile. 2) Test each sample using ASTM D6103. d. Record these actions and test results on the "Daily Construction Report."	Verify that the backfill stockpile is inspected, worked, and tested during cold weather conditions.

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FINAL GRADING: Top of waste elevations shall be at grade or below grade.	Survey the top lift of waste on a 50 ft grid and at key points. Final survey measurements will be documented and provided to the Director of Engineering and Construction QA Officer. a. Indicate where the waste meets design line and grade. b. Rework and resurvey areas not meeting the specified grade.	Review the final survey data. Verify the frequency of the survey points.

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SCOPE: This work element applies to the Class A and Class A North embankments. This work element also applies to the Class A South portion of the Class A South/11e.(2) embankment.		
DEFINITION: Interim rad cover is non-waste soil used to comply with the "uncovered radioactive waste" limit at Radioactive Material License UT 2300249, Condition 11. This material was formerly referred to as "temporary cover" or "interim temporary cover". Waste in closed containers may be stored on interim rad cover. If bulk waste is placed or stockpiled on interim rad cover, the affected area shall no longer be considered to have interim rad cover on it.		
INTERIM RAD COVER MATERIAL: Interim rad cover shall be native soil that is free of debris material. This work element shall have an effective date one year following DRC approval of its inclusion in the LLRW and 11e.(2) CQA/QC Manual.	Visually inspect interim rad cover soil and document on the Daily Construction Report.	
INTERIM RAD COVER PLACEMENT: Interim rad cover shall be a minimum of 6 inches thick in order for an area to be removed from the "uncovered radioactive waste" inventory. Thickness shall be evaluated through use of grade poles or survey. Contaminated equipment may be used to place interim rad cover.	Survey at least the perimeter of the area covered and document. Document thickness of cover on the Daily Construction Report.	Periodically observe lift approval documentation.
A commercial fixative product (i.e., polymer), magnesium chloride, or non-contact water may be applied, in accordance with the manufacturer's instructions, to the surface of the interim rad cover to aid in dust control and erosion prevention. Erosion control blankets, mats, or fiber mulch may also be used, in accordance with the manufacturer's instructions, for erosion prevention. DRC shall be notified at least 48 hours prior to deployment of erosion control blankets,		

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mats, or fiber mulch.		
OPERATIONAL CONTROLS: Interim rad cover shall be fenced, roped, or otherwise marked to identify as distinct from active waste placement areas. Traffic across interim rad cover shall be minimized. Haul roads are prohibited on interim rad cover.		
INSPECTIONS: Monthly, inspect interim rad cover for the presence of erosion gullies. If the inspection indicates that waste material is exposed due to erosion, the interim rad cover shall be repaired in that area within 7 calendar days.	Perform monthly inspections and document on the Daily Construction Report.	
SURVEYS: Quarterly, perform an elevation survey on interim rad cover that is within 2 feet of the design top of debris waste elevation. Surveys shall be performed at the temporary and final settlement monument locations provided in Figures 2 and 6, within an 18-inch radius of the design monument location.	Perform quarterly surveys and document.	
REMOVAL: Interim rad cover may be removed. Soils used as interim rad cover may be used as fill for debris wastes. If used, erosion control blankets, mats, or fiber mulch may be left in place or removed, but either way must be placed and compacted as waste.		

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SCOPE: This work element applies to the Clay Barrier constructed in the Class A South/11e.(2) embankment.		
CLAY BARRIER CONSTRUCTION: Clay Barrier shall be constructed concurrently with the adjoining waste lifts and to the dimensions indicated on drawing 07021-V1. At no time will the top of the clay barrier project more than 6 ft above the surface on either side of the barrier.	Observe the construction of the clay barrier and document compliance of the dimensions and height limits. Record the observations on the Daily Construction Report.	
RUNOFF CONTROL: Clay Barrier will be constructed in advance of waste lifts adjacent to the barrier such that a minimum of 1 ft of freeboard is maintained at all times on both sides of the barrier. Adjacent approved LLRW waste lifts will be graded away from the barrier at a minimum slope of 2% for a distance of at least 100 ft from the west edge of the barrier. Adjacent approved 11e.(2) waste lifts will be graded away from the barrier at a minimum slope of 2% for a minimum distance of 12 ft from the east edge of the barrier. Runoff from 11e.(2) waste is permitted to flow into the LLRW areas.	During times that clay barrier and adjacent lifts are under active construction, inspect the cell for compliance with this specification daily. Record observations on the Daily Construction Report. During times that clay barrier and adjacent lifts are not being actively worked, inspect the cell for compliance with this specification at least once per week. Record observations on the Daily Construction Report.	
CLAY BARRIER MATERIAL: Clay material for the Clay Barrier will meet the requirements of Work Element –Clay Liner Borrow Material.	Refer to Work Element – Clay Borrow Material for Quality Control Requirements.	Refer to Work Element – Clay Borrow Material for Quality Assurance Requirements.
CLAY LINER - CLAY BARRIER INTERFACE: The clay liner protective cover shall be removed. Clay Barrier shall be placed at the clay liner surface as defined by the as built record. Any over-excavation of the clay liner shall be considered clay liner damage and shall be repaired in compliance with the appropriate test pad procedure. The surface of the clay barrier will be roughened prior to placement of the first lift of Clay Barrier material, in accordance with the lift bonding specification of this work element.	Observe protective cover removal. Record observations and corrective actions taken (where required) on the "Daily Construction Report". Document the elevation of the exposed clay liner surface as compared to the as built record on the "Lift Approval Form". Document lift bonding.	Verify that the interface preparation has been documented.

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LIFT THICKNESS: Barrier material shall be placed in lifts with a compacted lift thickness not exceeding 9 inches. Thickness for the lift will be established by installing grade poles at an interval of not more than 70 ft and at all control points. The grade poles must be marked at the appropriate depth to establish the grade. After the grade for the lift has been checked and approved by QC personnel, the grade poles shall be removed.	Verify that the required grading tolerance is achieved as follows: a. Ensure that the required frequency for placement of grade poles has been met. b. Compare soil level with the marked level on the grade poles. c. Use a string line where necessary between poles to check for high or low spots. d. Define high out of specification areas and advise the contractor to rework those areas. e. Review areas reworked and approve areas meeting criteria. f. Continue "b" through "d" above until all areas meet criteria. g. Indicate areas meeting criteria on the “Embankment Construction Lift Approval Form”.	Observe, at a minimum, five percent of the measurements performed by the QC personnel to ensure that the measurements are being performed correctly. Verify that the measurements are being performed at the correct frequency and that the documentation is being completed.
UNSUITABLE MATERIAL: Remove unsuitable material, if any is encountered. Unsuitable material is defined as frozen material, rocks, debris, waste material or material not meeting the CL or CL-ML classification.	Define areas of unsuitable material and direct its removal. Observe the areas once the unsuitable material has been removed. Report corrective action on the "Daily Construction Report." Notify the Project Engineer and QA of any unsuitable material.	
COMPACTION: Barrier shall be compacted to a minimum of 95 percent of a standard proctor and with a moisture content between ±5 percentage points of the optimum moisture. Lifts shall be compacted with a pad-foot type compactor/roller.	Conduct in-place density tests (ASTM D 6938) at a rate of one test per lot and/or per lift, and record the results on the "Field Density Test" form. A lot is defined as a maximum of 200 linear feet of placed barrier material. Test locations shall be chosen on the basis of random numbers. Approve lots that meet the specified compaction. Lots that fail shall be reworked and retested until required specifications have been met. Proctors will be performed at a rate of one test per	Observe, at a minimum, five percent of the measurements performed by the QC personnel to ensure that the measurements are being performed correctly. Verify that the measurements are being performed at the correct frequency and that the documentation is being completed.

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	3,000 cubic yards of borrow material or less of a specific material type.	
PERMEABILITY: Clay barrier will have an in-place permeability less than or equal to 1 x 10^{-6} cm/sec.	Conduct in-place permeability tests at a rate of one test per lot and record the results on the "Field Permeability Test" form. A lot is defined as 1,000 cubic yards (compacted) of clay barrier or at minimum of one test per every 3 lifts. The permeability test shall be run in close proximity to a moisture density test location. a. Approve lots which meet the specified permeability. b. Rework and retest lots not meeting the specified permeability. c. Restore all test areas to assure no leaks.	Observe, at a minimum, five percent of the tests performed by the QC personnel to ensure that the tests and observations are being performed correctly. Verify that the tests are being performed at the correct frequency and that the documentation is being completed.
LIFT BONDING: No smooth surfaces shall exist between lifts. The surface resulting from compaction by the pad foot compactor shall be acceptable. If necessary, roughen the surface to have changes in grade of approximately one inch or more at a rate of two per linear foot prior to placing the next lift.	Verify that the surface of the previously compacted barrier lift has been roughened as required. Record observations on the "Daily Construction Report."	Verify that QC personnel are performing lift bonding inspections.
KEYING-IN: Segments of clay barrier constructed at times more than 30 days apart from each other shall be keyed-in to each other at vertical steps no greater than nine inches and at least twice as wide as they are high.	Verify that the new barrier has been properly keyed-in to the existing barrier. Record deficiencies on the "Embankment Construction Lift Approval Form". Rework and inspect if needed.	Verify that the keying-in of the clay barrier has been documented.
CLAY BARRIER DRYING PREVENTION: To prevent the clay barrier from drying, water will be applied to the clay surface on an as needed basis or the clay barrier will be covered with 6 inches of loose clay. Approved clay barrier lifts shall be covered with 6 inches of loose clay within 30 days of completion. Desiccation cracks larger than one-fourth inch wide and one-inch deep in the clay barrier will be reported to the DRC and will be documented as a non-	Observe the clay barrier surface for drying. Advise project manager of any deficiencies. Record corrective actions taken (where required) on the "Daily Construction Report".	Verify that the clay barrier is being inspected.

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conformance item when discovered.		
COLD WEATHER PLACEMENT OF CLAY BARRIER: For purposes of this CQA/QC Manual, "frozen" is defined as a soil temperature of less than or equal to 27ºF. Clay barrier shall not be placed above frozen material. In addition, no frozen material shall be processed or placed. If the air temperature has dropped below 32ºF since the last lift of clay barrier was approved, one of the following three scenarios apply: (1) If less than 30 days have passed since the date of lift approval and the last lift of clay barrier has been covered since the approval date with at least 9 inches of loose clay or 6 inches of compacted clay, then the cover clay may be worked with no additional testing of the lower approved lift. (2) If less than 30 days have passed since the date of lift approval and the last lift of clay barrier has not been covered with at least 9 inches of loose clay or 6 inches of compacted clay, then: (a) Perform spring start-up testing as discussed below; or (b) Monitor the clay barrier temperature approximately 1 inch beneath the surface. If the temperature 1 inch beneath the surface is greater than 27ºF, re-roll the surface with one pass of the same type of construction equipment (i.e., a compactor for intermediate lifts or a smooth drum roller for the final surface) and continue with clay barrier construction. If the temperature 1 inch beneath the surface is less than or equal to 27ºF, re-work and re-test the affected area after the clay temperature has risen above 27ºF. (3) If more than 30 days have passed since the date of lift approval, perform spring start-up testing.	As needed, observe the area where clay barrier is to be placed. If frozen material is observed, cease placement of clay barrier. If frozen material is suspected, measure soil temperature. Record the stopping of placement in the "Daily Construction Report." Review ambient air temperature records as measured at the site meteorological station. Document status of clay barrier cover placement on the "Daily Construction Report." Monitor clay barrier temperature when triggered under 2.(b). Clay temperature shall be measured between 6:00 am and 8:00 am on the day that clay barrier will be placed. Temperature measurements shall include a location that is most likely to be coldest; i.e., if there is a portion of the clay barrier that is shaded or at a low point. Temperature monitoring frequency shall be at least one point per 2,000 square feet or one point per contiguous project area, whichever is smaller. If the initial clay barrier temperature measurement is less than or equal to 27ºF, the affected area may be resampled before 8:30 am the same day as follows: a. Measure the clay barrier temperature at a frequency of one measurement per lot (defined as no more than 500 square feet). b. Lots where the temperature is greater than 27ºF do not require rework; except that the lot where the initial temperature less than or equal to 27ºF was measured shall be reworked regardless of resampling results.	Verify that clay barrier is tested during cold weather conditions.

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SPRING START-UP: See "Cold Weather Placement of Clay Barrier" above for situations that trigger this specification. For spring start-up testing, the surface lift is treated as protective cover, regardless of whether it was an approved lift of clay barrier at one time or not. Excavate 9 inches below the clay surface and re-test for density and permeability. Excavation for testing purposes may consist of removing the protective cover lift; or may be performed by 'potholing' only at the testing locations. Areas that have been 'potholed' for permeability testing shall be repaired by applying the same level of effort as prescribed by the approved test pad for clay barrier construction.	Perform density and permeability testing at the frequencies outlined for clay barrier construction above. This testing may be performed outside of the approved lift area so long as the area tested is representative of the clay in the approved lift area (i.e., was constructed at the same time and with the same method). Moisture testing is not required for spring start-up. a. Approve lots that meet specification. The protective cover lift may be worked in place and tested to become the next lift of clay barrier. b. For lots that do not meet specification, test the surface at successively deeper 9 inch increments until a passing lift is found; remove all failing lifts; re-work all failing areas; and re-test. Document that repairs are completed to the same level of effort as required for clay barrier construction.	Observe, at a minimum, five percent of the tests performed by the QC personnel to ensure that the tests and observations are being performed correctly. Verify that the tests are being performed at the correct frequency and that the documentation is being completed.
FINAL GRADING: The barrier shall be completed to the top of waste grade through the temporary cover.	Survey the clay barrier surface jointly with the top of waste or temporary cover survey. Final survey measurements shall be documented. a. Indicate where the clay barrier meets design lines and grades. b. Rework and resurvey areas not meeting the specified grade until the area is approved.	

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SCOPE: This work element applies to the Class A, Class A North, and Class A South/11e.(2) embankments.		
TEMPORARY COVER MATERIAL: Temporary cover shall be native soils that are free of debris material.	Visually inspect temporary cover soil and verify that it is free of debris. Record results on the Lift Approval Form.	
TEMPORARY COVER PLACEMENT: Temporary cover shall be placed within 9 years of the date of initial waste placement on each lift area, and within 90 days of any survey that determines top of debris waste elevations and grades for each lot. Top of debris waste elevations and grades are defined as those found on the approved engineering design drawings authorized under the license. DRC shall be notified in writing at least 48 hours in advance of the start-up of temporary cover placement. A side slope exemption is limited to the 90 calendar day requirement for temporary cover placement, which does not apply to side slope areas immediately adjacent to top slope lifts that have not reached the top of debris waste elevations. Once the adjacent top slope area has reached the top of debris waste elevation all top slope and adjacent side slope areas shall have temporary cover placed within 90 calendar days. Temporary cover shall perform as the Debris Free Zone specified under Work Element – Waste Placement, above. Temporary cover shall be a minimum of 1 foot thick. Temporary cover may be over-built in order to achieve this thickness. Temporary cover shall be placed in accordance with the lift thickness and compaction requirements specified under Work Element – Waste Placement, above. Contaminated equipment may be used to place temporary cover. The edge of the temporary cover shall be marked with fencing, rope, snow fence, or equivalent marking to	Provide DRC notification. Document lift area, location, thickness, and compaction on the Lift Approval Form.	Periodically observe lift approval documentation.

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prevent heavy equipment travel on the temporary cover surface. Haul routes may traverse temporary cover, provided that the haul route does not travel over any pre-final cover settlement monuments and that the haul route is marked with fencing, rope, snow fence, or equivalent markings.		
A commercial fixative product, magnesium chloride, or clean water may be applied to the surface of the temporary cover to aid in dust control and erosion prevention. Contaminated water shall not be used for dust suppression on temporary cover. Erosion control blankets, mats, or fiber mulch may also be used, in accordance with the manufacturer's instructions, for erosion prevention. DRC shall be notified at least 48 hours prior to deployment of erosion control blankets, mats, or fiber mulch. If used, such erosion control materials shall be removed prior to radon barrier construction.	Provide DRC notification. Document application and removal of erosion control materials on the Daily Construction Report.	
PRE-FINAL COVER SETTLEMENT MONUMENTS: Pre-final cover settlement monuments shall consist of approximately 18-inch long #5 or greater rebar that is welded to a metal plate. The metal plate shall be approximately 18 inches square with a thickness of 3/16 inch to 1/4 inch. The metal plate shall be placed on the top of waste surface and then secured by the temporary cover as it is placed. Each monument shall be labeled, flagged, and documented on a reference drawing.	Inspect pre-final cover settlement monuments for compliance with the specification prior to installation.	Perform a surveillance of monument installation activities.
PRE-FINAL COVER SETTLEMENT MONUMENT PLACEMENT: Pre-final cover settlement monuments shall be placed as close as practical to the locations of final cover settlement monuments identified in Figures 2, 4, and 6. In addition, pre-final cover settlement monuments shall be placed at the locations identified as "additional final temporary cover monuments" on Figures	Perform and document a post-construction survey of the pre-final cover settlement monuments.	Verify that surveys have been performed.

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2, 4, and 6.		
SURVEY REQUIREMENTS: Surveys shall be performed with GPS or approved equivalent equipment. Tolerance shall be no more than ± 0.1 foot.	Calibrate and operate survey equipment in accordance with the manufacturer's recommendations.	
SURVEY INTERVAL: The pre-final cover settlement monuments shall be surveyed within 30 days of temporary cover installation. New monuments shall be surveyed again during the months of January, March, May, July, September, and November. After at least one year of data has been obtained for a monument, it shall be surveyed semi-annually during the months of May and November until final cover construction begins. Weather conditions at the time of the survey and a discussion of the potential for frost to be present shall be documented in the survey report.	Perform and document the required surveys. Provide survey data to the Director of Engineering.	Verify that monument surveys are completed as required.
INSPECTIONS: Monthly, inspect temporary cover for the presence of erosion gullies. If the inspection indicates that waste material is exposed due to erosion, the temporary cover shall be repaired in that area within 7 calendar days.	Perform and document monthly inspections.	
Semi-annually, maintain the temporary cover surface. Maintenance shall consist of filling in any erosion gullies and, if necessary, re-grading to prevent ponding on the temporary cover.	Document semi-annual maintenance activities. Document any areas requiring filling or re-grading.	
REPORTING: Survey data for pre-final cover settlement monuments shall be compiled and analyzed to evaluate total and differential settlement. This data and analysis shall be submitted to DRC with the annual as-built report.		
Review and analysis of settlement monitoring data will include the following:		

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• A drawing identifying the location of each point. • Graphical or tabular presentation of the incremental settlement for each point (how much each point has moved since the last set of readings), • Graphical or tabular presentation of the total settlement for each point, • Graphical or tabular presentation of the time rate of settlement for each point (to include both the overall rate from the first data for the point, and the incremental rates for each period), • Graphical or tabular presentation of the differential settlement for each point with respect to the nearest adjacent points, and • A discussion about the general nature of the observed settlement, and any areas of the landfill that are behaving in an anomalous manner.		
TRANSITION TO FINAL COVER: If distortion is less than 0.007 foot/foot for all of the grid points in a given area, and each grid point has at least one year's monitoring data; then final cover construction may proceed. Once an area is approved, final cover construction shall be completed within 3 years of this determination.	The Director of Engineering shall evaluate pre-final cover settlement data for each area of cover construction to determine distortion between all adjacent points in that area. If the criteria are met, a written report shall be prepared and forwarded to DRC at least 7 calendar days prior to removing the pre-final cover settlement monuments.	
If an area is not approved for final cover construction by the beginning of the 10^{th} year of the 12-year open cell period, an analysis of projected future distortions shall be performed and submitted to DRC. If the analysis indicates that the future distortions between any two adjacent points will be more than 0.01 foot/foot, then surcharging over the area(s) in question will be required to stabilize settlement prior to final cover construction.	The Director of Engineering shall perform the analysis of projected future distortions. The analysis shall be submitted no later than the start of the 10^{th} year since waste placement began in the oldest lift area subject to analysis.	
Immediately prior to placement of the first lift of radon barrier, the pre-final cover settlement monuments shall be removed and the temporary cover surface restored.	Inspect and document that all pre-final cover settlement monuments have been removed prior to final cover construction.	Verify that pre-final cover settlement monuments have been removed and that the temporary cover surface meets design top of waste grades and elevations.

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Additional clean debris-free soil material shall be placed; or excess temporary cover material shall be cut, as needed to return the area for final cover construction to the original top of waste design grades and elevations. When placing clean debris-free soil material for this purpose, the soil shall be placed in lifts with a compacted average thickness not exceeding 12” and compacted to 90% of a standard Proctor. If an area has settled more than 12”, bulk waste may be placed in accordance with the applicable work elements and specifications of this manual, so long as the debris-free zone specification is met at the design top of waste elevations.	Survey and document the temporary cover surface to confirm that the top of waste design grades and elevations are achieved. Document lift thickness and compaction for any debris-free soil material placed to bring the temporary cover surface to the design top of waste grades and elevations.	

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SCOPE: This work element applies to the Class A, Class A North, and Class A South/11e.(2) embankments.		
CLEARING AND GRUBBING: Remove vegetation, debris, organic, or deleterious material from areas to be used for borrow. Grubbing depth will depend on the type of vegetation, debris, organic, or deleterious material on the site. If the area is free of these materials then no clearing and grubbing will be necessary.	Inspect the area once clearing and grubbing has been completed. Record observations and corrective action (where required) on the "Daily Construction Report".	Verify that the clearing and grubbing has been inspected by QC.
MATERIAL--NATURAL CLAY MIXTURE: Satisfactory material shall be defined as CL and ML soils based on the Unified Soil Classification with at least 85 percent passing the No. 200 sieve (silt and clay), a plasticity index (PI) between 10 and 25, and a liquid limit (LL) between 30 and 50. The clay shall also have a dry clod size less than or equal to 1 inch.	Perform laboratory classification tests at a rate of 1 test per lot prior to use of material in the radon barrier. A lot is defined as a maximum of 3,000 cubic yards (compacted) of specified material type. Record the location of the classification sample on the "Sampling Log". a. Approve lots (which meet the specified classification) for use in the radon barrier. b. Lots not meeting the specified classification can not be used.	Verify the frequency of laboratory tests and compliance of test results.
PROTECTION: The borrow material will be handled in such manner as to prevent contamination with radioactive waste material or other deleterious material. The in-place material may contain up to 5 percent additional rocks and sand above the content found in the classification test.	Visually check radon barrier materials for contamination by foreign materials. Remove clays that have been contaminated above the specified requirements. Document corrective actions (where required) on the "Daily Construction Report".	Verify that the radon barrier is being inspected for contaminates and that corrective actions (if required) are properly documented.
PROCESSING: These procedures may be used to provide suitable material for construction of the radon barrier.		
1. Apply deflocculant at a rate determined by the production engineer.	Measure the mixing areas and verify that the application rate of the deflocculant is equal to or greater than the rate determined by the production engineer. Record the size of the mixing areas and the amount of deflocculant applied on the "Embankment	Verify that the size of the mixing areas and the amount of deflocculant applied have been properly documented.

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	Construction Lift Approval Form".	
2. Mix the deflocculant thoroughly into the soils by tilling, or similar action.	Observe the mixed clay and advise the contractor of areas which are adequately mixed.	Verify that the clay is being inspected by QC.

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SCOPE: This work element applies to the Class A, Class A North, and Class A South/11e.(2) embankments.		
NOTICE OF TEST PAD CONSTRUCTION: The test pad plan shall be approved by the DRC prior to test pad construction. The DRC shall be notified 48 hours in advance of the start-up of test pad construction.	Obtain documentation confirming that the test pad plan has been approved by the DRC. Verify that the DRC has been notified as required.	Verify that the test pad plan has been approved by the DRC. Verify that the DRC has been notified as required.
TEST PAD: An approximately 60 feet by 75 feet large test pad will be constructed using the procedure proposed for construction of the radon barrier when using heavy equipment for compaction. An approximately 5 feet by 5 feet small test pad will be constructed using the procedure proposed for construction of the radon barrier when using hand compaction equipment. A new test pad shall be constructed each time there is a significant change in specifications, construction procedures, types of equipment, unified soil classification, QC testing equipment or procedure. A new test pad must be constructed each time there is a change in the grade or source of bentonite. Test pads are to be constructed and tested in accordance with the following specifications:	Observe the construction of test pads. Measure test pads to ensure that they are constructed to the size indicated. Record the test pad size on the "Embankment Construction Lift Approval Form". The large test pad shall be divided into three lots per lift (approximately 1,500 square feet per lift). Each lift of the small test pad shall equal a lot.	Observe the construction of the test pads. Verify that the test pad has been measured and is properly documented.
1. Place the clay in at least three lifts with the first lift uncompacted thickness not exceeding twelve inches. Remaining lifts shall have a loose material thickness not exceeding nine inches for each lift. The clay material will be inspected for dry clod size during placement of each lift of radon barrier.	Measure the lift thickness at a rate of 1 test per lot. Record thickness on the "Embankment Construction Lift Approval Form". Inspect the loose clay material during the unloading and spreading process for each uncompacted lift to ensure any dry clods that are present are less than or equal to one (1) inch. Record inspection of the dry clod size on the "Embankment Construction Lift	Verify that the number of lifts and lift thicknesses have been documented. Verify that the clod size inspection has been performed and documented for each uncompacted lift thickness.

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	Approval Form".	
2. The clay is to be placed and compacted by equipment proposed for use during construction of the radon barrier.	Verify with the contractor that the same or similar type equipment and compaction efforts will be used in the cell for construction of the radon barrier. Record type of equipment used, and number of passes on the "Embankment Construction Lift Approval Form".	Verify equipment used and the number of passes made in preparing the test pad are those to be used during the construction of the radon barrier.
3. The lifts of clay shall be bonded by: a) Providing a rough upper surface on the underlying layer of radon barrier. The surface should have changes in grade of approximately one inch or more at a rate of two per linear foot; **- OR –** b) By compacting with a sheepsfoot with feet approximately two inches longer than the lift thickness.	Verify that there are adequate changes in grade by placing a straight edge at least two feet long on the surface. Count the number of points approximately one inch or more below the straight edge. **- OR -** Verify that the feet on the sheepsfoot compactor are approximately two inches longer than the lift thickness.	Verify the frequency of measurements and compliance of test results.
4. The clay is to be compacted to at least 95 percent of a standard Proctor with a moisture content of optimum to 5 percent over optimum. Compaction of the large test pad is to be accomplished by at least four passes of suitable compaction equipment.	Conduct in-place moisture-density tests at a rate of one test per lot per lift. The test location shall be chosen on the basis of random numbers. Record the test result on the "Field Density Test" form. a. Approve lots which meet the specified moisture and compaction. b. Rework and retest lots not meeting the specified moisture or compaction. c. Any additional work under b. shall be included in the test pad construction method	Verify the frequency of tests and compliance of test results.
5. The clay is to be constructed to provide a permeability of less than or equal to the specified permeability as shown on the approved engineering drawings. Permeability testing on the bottom lift will be performed at the surface. Permeability on the second lift will be performed ≥ 2" below the surface. Permeability on the third lift will be performed ≥ 4" below the surface.	Conduct in-place permeability tests at a rate of one test per lot per lift. The permeability test shall be run in close proximity to the moisture-density test. Record the test result on the "Field Permeability Test" form. a. Approve lots that meet the specified permeability. b. Rework and retest lots not meeting the specified permeability c. Any additional work under b. shall be included in	Verify the frequency of tests and compliance of test results.

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	the test pad construction method	
6. At least one PI, LL, and gradation tests shall be conducted for each test pad.	Conduct PI, LL, and gradation tests at a rate of one of each type of test per test pad.	Verify that the PI, LL, and gradation tests have been conducted and documented.
7. The procedures used to construct the test pad shall be reviewed and approved by the certifying engineer. The test must be approved by a Professional Engineer.	Provide the certifying engineer with copies of the documentation for the test pad for review and approval.	Verify that proper approval has been obtained for the test pad and that the necessary construction procedure documents are in place for use during radon barrier construction.
8. The procedures used to construct the test pad shall be reviewed and approved by the DRC prior to using the new test pad construction method.	Obtain documentation confirming the DRC approval of the test pad.	Verify that proper approval has been obtained for the test pad and that the necessary construction procedure documents are in place for use during radon barrier construction.

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SCOPE: This work element applies to the Class A, Class A North, and Class A South/11e.(2) embankments.		
NOTICE OF COVER CONSTRUCTION: The DRC shall be notified of the cessation of waste placement and the start-up of cover construction for each phase of the "cut and cover" operation.	Verify that the DRC has been notified of the anticipated cessation of waste placement and the start-up of cover construction, prior to the placement of radon barrier.	Verify that the DRC has been notified of the anticipated cessation of waste placement and the start-up of cover construction, prior to the placement of radon barrier.
PROJECT AREA: Radon barrier projects shall have a minimum total area of 300,000 square feet, unless otherwise approved in advance, in writing by DRC. Radon barrier projects may continue over more than one construction season, so long as the specifications for cold weather placement and spring start-up are met. A radon barrier project may consist of any number of lift areas.	Document the radon barrier project area dimensions.	
LIFT IDENTIFICATION: Each lift shall be given a discrete designation for testing and surveying purposes.	Assign a lift identification number to each lift. Use the lift identification number to identify all paper work for that lift.	Verify that a lift identification number has been assigned to each lift. Verify that the lift identification number is used on all paper work for that lift.
PLACEMENT: The radon barrier will be prepared, placed and compacted using the same type of equipment and mixing and compacting procedures that were approved in the test pad.	Observe the radon barrier placement. Record the equipment used to place the radon barrier, along with any corrective actions (where required) on the "Daily Construction Report".	Verify the equipment used to construct the radon barrier has been documented and that it is the same type of equipment used to construct the test pad.
LIFT BONDING: The lifts of clay shall be bonded by: 1) Providing a rough upper surface on the underlying layer of radon barrier. The surface should have changes in grade of approximately one inch or more at a rate of two per linear foot; **- OR -** 2) By compacting with a sheepsfoot with feet approximately two inches longer than the lift thickness.	Verify that there are adequate changes in grade by placing a straight edge at least two feet long on the surface. Count the number of points approximately one inch or more below the straight edge. **- OR -** Verify that the feet on the sheepsfoot compactor are approximately two inches longer than the lift thickness.	Verify the frequency of measurements and compliance of test results.

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LIFT THICKNESS: The first lift of material shall have an uncompacted thickness of no greater than 12 inches. For the remaining lifts, the loose lift thickness shall not exceed the lesser of the lift thickness used to construct the test pad or nine inches. Thickness for the lift will be established by installing grade poles on at least a 70-foot grid and at all control points. The grade poles must not be installed deeper than 1 inch into the underlying clay liner. The grade poles must be marked at the appropriate depth to establish the grade. After the grade for the lift has been checked and approved by QC personnel, the grade poles shall be removed. The clay material will be inspected for dry clod size during placement of each lift of radon barrier.	Verify that the required grading tolerance is achieved as follows: a. Ensure that the required frequency for placement of grade poles has been met. b. Compare soil level with the marked level on the grade poles. c. Use a string line where necessary between poles to check for high or low spots. d. Define out of specification areas and advise the contractor to rework those areas. e. Review areas reworked and approve areas meeting criteria. f. Continue "b" through "d" above until all areas meet criteria. g. Indicate areas meeting criteria in the "Embankment Construction Lift Approval Form". **- OR -** Dig a hole and measure the loose lift thickness at a rate of one per lot. A lot is defined as 10,000 square feet of a single lift and record on the "Lift Approval Form". The location of the measurement shall be chosen on the basis of random numbers. a. Approve lots which meet the specified lift thickness. b. If the thickness is greater than the specified thickness, measure the thickness at four points (north, east, south, and west) within ten feet of the first measurement. Average the five measurements together. c. Approve lifts with an average less than or equal to the specified lift thickness. d. Rework and retest lots with an average lift thickness greater than the specified lift thickness. Inspect the loose clay material during the unloading and spreading process for each uncompacted lift to ensure any dry clods that are present are less than or equal to one (1) inch. Record inspection of the clod size on the "Embankment Construction Lift Approval	Observe, at a minimum, five percent of the measurements performed by the QC personnel to ensure that the measurements are being performed correctly. Verify that the measurements are being performed at the correct frequency and that the documentation is being completed. Verify that the clod size inspection has been performed and documented for each uncompacted lift.

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	Form".	
KEYING-IN: Segments of cell radon barrier constructed at times more than 30 days apart than each other shall be keyed-in to each other at vertical steps no greater than nine inches and at least twice as wide as they are high.	Verify that the new liner has been properly keyed-in to the existing liner. Record deficiencies on the "Embankment Construction Lift Approval Form".	Verify that the keying-in of the liner has been documented.
COMPACTION: Radon barrier material will be compacted to at least 95 percent of standard Proctor with a moisture content between optimum and 5 percent over optimum.	Conduct in-place moisture-density tests at a rate of one test per lot and record the results on the "Field Density Test" form. A lot is defined as 200 cubic yards (compacted) of a single lift. The test location shall be chosen on the basis of random numbers. a. Approve lots which meet the specified moisture and compaction. b. Rework and retest lots not meeting the specified moisture or compaction. Proctors shall be performed at a rate of one test per borrow lot. A borrow lot is defined as 3,000 cubic yards (compacted) or less of a specific material type. Record the location of the Proctor sample on the "Sampling Log".	Observe, at a minimum, five percent of the tests performed by the QC personnel to ensure that the tests and observations are being performed correctly. Verify that the tests are being performed at the correct frequency and that the documentation is being completed.
PERMEABILITY: The radon barrier shall have an in-place permeability of less than or equal to 1×10^{-6} cm/sec for the bottom layer. The radon barrier shall have an in-place permeability of less than or equal to 5×10^{-8} cm/sec for the final top foot.	Conduct in-place permeability tests at a rate of one test per lot and record the results on the "Field Permeability Test" form. A lot is defined as 2,000 cubic yards (compacted) of 1×10^{-6} cm/sec or 200 cubic yards (compacted) of 5×10^{-8} cm/sec radon barrier. The permeability test shall be run in close proximity to a moisture-density test location. a. Approve lots that meet the specified permeability. b. Rework and retest lots not meeting the specified permeability. ~~c)~~c. Restore all test areas with the approved construction method.	Observe, at a minimum, five percent of the tests performed by the QC personnel to ensure that the tests and observations are being performed correctly. Verify that the tests are being performed at the correct frequency and that the documentation is being completed.

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LAYER THICKNESS: For the LLRW embankment, the bottom (1 x 10^{-6} cm/sec permeability) layer shall be at least 1.0 feet thick. For the 11e.(2) embankment top slopes, the bottom (1 x 10^{-6} cm/sec permeability) layer shall be at least 3.0 feet thick. For the 11e.(2) embankment side slopes, the bottom (1 x 10^{-6} cm/sec permeability) layer shall be at least 2.5 feet thick. For the LLRW and 11e.(2) embankments, the top (5 x 10^{-8} cm/sec permeability) layer shall be at least 1.0 feet thick.		
LINER TRANSITIONS BETWEEN RADON BARRIER WITH DIFFERENT SPECIFIED PERMEABILITIES: The radon barrier with the higher permeability (i.e. the bottom radon barrier) shall be final graded from grade to 0.4 feet below grade design grade. Survey on a 50 ft grid and key points.	Survey the radon barrier surface on a 50 ft grid and at key points. Final survey measurements will be documented and provided to the QC Officer and Construction QA Officer. a. Indicate where the radon barrier meets design line and grade. b. Rework and resurvey areas not meeting the specified grade.	Review the final survey data. Verify the frequency of the survey points.
RADON BARRIER DRYING PREVENTION: To prevent the radon barrier from drying, water will be applied to the clay surface on an as needed basis or the radon barrier will be covered with 6 inches of loose clay. Finished radon barrier shall be covered with 12 inches of filter zone, sacrificial soil layer, or 6 inches of loose clay within 30 days of completion. Unfinished radon barrier shall be covered with 6 inches of loose clay within 30 days of the last activity for the lift. Desiccation cracks larger than one-fourth inch wide and one-inch deep in the radon barrier will be reported to the DRC and will be documented as a non-conformance item when discovered.	Observe the liner surface for drying. Advise contractor of any deficiencies. Record corrective actions taken (where required) on the "Daily Construction Report".	Verify that the liner is being inspected.
SNOW REMOVAL: When radon barrier material is to be placed and the work area is covered with snow,	Observe that snow is removed. Advise the contractor of deficiencies. Construction may not continue without	Verify that snow removal is being documented.

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the snow must be removed.	taking corrective actions to remove the snow. Record corrective actions (where required) in the "Daily Construction Report".	
COLD WEATHER PLACEMENT OF RADON BARRIER: For purposes of this CQA/QC Manual, “frozen” is defined as a soil temperature of less than or equal to 27ºF. Radon barrier shall not be placed above frozen material. In addition, no frozen material shall be processed or placed.	As needed, observe the area where radon barrier is to be placed. If frozen material is observed, cease placement of radon barrier. If frozen material is suspected, measure soil temperature. Record the stopping of placement in the "Daily Construction Report.”	Verify that radon barrier is tested during cold weather conditions.
If the air temperature has dropped below 32ºF since the last lift of radon barrier was approved, one of the following three scenarios apply: (1) If less than 30 days have passed since the date of lift approval and the last lift of radon barrier has been covered since the approval date with at least 9 inches of loose clay or 6 inches of compacted clay, then the cover clay may be worked with no additional testing of the lower approved lift. (2) If less than 30 days have passed since the date of lift approval and the last lift of radon barrier has not been covered with at least 9 inches of loose clay or 6 inches of compacted clay, then: (a) Perform spring start-up testing as discussed below; or (b) Monitor the radon barrier temperature approximately 1 inch beneath the surface. If the temperature 1 inch beneath the surface is greater than 27ºF, re-roll the surface with one pass of the same type of construction equipment (i.e., a compactor for intermediate lifts or a smooth drum roller for the final surface) and continue with radon barrier construction. If the temperature 1 inch beneath the surface is less than or equal to 27ºF, re-work and re-test the affected area after the clay temperature has risen above 27ºF. (3) If more than 30 days have passed since the date of	Review ambient air temperature records as measured at the site meteorological station. Document status of radon barrier cover placement on the “Daily Construction Report.” Monitor radon barrier temperature when triggered under 2.(b). Clay temperature shall be measured between 6:00 am and 8:00 am on the day that radon barrier will be placed. Temperature measurements shall include a location that is most likely to be coldest; i.e., if there is a portion of the radon barrier that is shaded or at a low point. Temperature monitoring frequency shall be at least one point per 100,000 square feet or one point per contiguous project area, whichever is smaller. If the initial radon barrier temperature measurement is less than or equal to 27ºF, the affected area may be resampled before 8:30 am the same day as follows: a. Measure the radon barrier temperature at a frequency of one measurement per lot (defined as no more than 10,000 square feet). b. Lots where the temperature is greater than 27ºF do not require rework; except that the lot where the initial temperature less than or equal to 27ºF was measured shall be reworked regardless of resampling results.	

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lift approval, perform spring start-up testing.		
In addition, the final lift of 5 X 10^{-8} cm/sec radon barrier requires that the Type B filter zone and sacrificial soil be placed over the radon barrier prior to the end of the work day when ambient temperatures will drop below 32 degrees Fahrenheit. If this protective cover is not applied prior to freezing conditions, an additional density test and permeability test shall be performed directly prior to covering the radon barrier final surface with filter zone and sacrificial soil. This process must be repeated whenever any final surface material is not covered with the filter zone and sacrificial soil prior to overnight freezing conditions.	Perform an additional density test and permeability test on 5 x 10^{-8} cm/sec final surface that has been exposed to overnight freezing conditions prior to placement of the Type B filter zone and sacrificial soil material. If passing test results are achieved, but it is not possible to cover all of the exposed radon barrier material with filter zone and sacrificial soil prior to the end of the workday, testing must be repeated for the exposed materials. This testing may be performed outside of the approved lift area so long as the area tested is representative of the clay in the approved lift area (i.e., was constructed at the same time and with the same method).	
SPRING START-UP: See "Cold Weather Placement of Radon Barrier" above for situations that trigger this specification. For spring start-up testing, the surface lift is treated as protective cover, regardless of whether it was an approved lift of radon barrier at one time or not. Excavate 9 inches below the clay surface and re-test for density and permeability. Excavation for testing purposes may consist of removing the protective cover lift; or may be performed by 'potholing' only at the testing locations. Areas that have been 'potholed' for permeability testing shall be repaired by applying the same level of effort as prescribed by the approved test pad for radon barrier construction.	Perform density and permeability testing at the frequencies outlined for radon barrier construction above. This testing may be performed outside of the approved lift area so long as the area tested is representative of the clay in the approved lift area (i.e., was constructed at the same time and with the same method). Moisture testing is not required for spring start-up. a. Approve lots that meet specification. The protective cover lift may be worked in place and tested to become the next lift of radon barrier. b. For lots that do not meet specification, test the surface at successively deeper 9 inch increments until a passing lift is found; remove all failing lifts; re-work all failing areas; and re-test. Document that repairs are completed to the same level of effort as required by the approved test pad for radon barrier construction.	

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CONTAMINATION OF RADON BARRIER: The radon barrier material shall not become contaminated with radioactive soils or debris during construction. The in-place clay may contain up to 5 percent additional rocks and sand above the content found in the classification test.	Visually check radon barrier for contamination by foreign materials. Remove clays which have been contaminated above the specified requirements.	Verify that removal of contaminated material has been properly documented.
FINAL GRADING: Final grading shall be from grade to 0.2 feet above grade. Survey on a 50 ft grid and key points. Upon completion, the surface shall be rolled with a smooth drum roller.	Survey the foundation on a 50 ft grid and at key points. Final survey measurements will be documented and provided to the QC officer and Construction QA Officer. a. Indicate where the radon barrier meets design line and grade. b. Rework and resurvey areas not meeting the specified grade.	Review the final survey data. Verify the frequency of the survey points.
EROSION CONTROL FOR EXPOSED SOIL: If DRC-approved final grade 5 x 10-8 cm/sec radon barrier soil surfaces are not covered by filter zone within 30 days of lift approval, the following erosion control repair measures shall apply. Semi-annually, inspect exposed radon barrier soil surfaces for evidence of erosion. Rivulet or gullied areas wider than 6 inches or deeper than 6 inches require maintenance to fill the rivulet or gully and restore the area to design grade. Soils imported as fill shall meet the requirements of "Radon Barrier Borrow Material", above. Maintenance shall be performed within 30 calendar days when needed. Erosion control blankets, mats, or fiber mulch may be used, in accordance with the manufacturer's instructions, for erosion prevention. DRC shall be notified at least 48 hours prior to deployment of erosion control blankets, mats, or fiber mulch. If used, such erosion control materials shall be removed prior	Perform monthly inspections. Document the inspection as well as associated maintenance activities on the Daily Construction Report.	

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to filter zone construction.		
RADIOLOGICAL SAMPLING FOR EXPOSED SOIL: If DRC-approved final grade 5 x 10-8 cm/sec radon barrier soil surfaces are not covered by filter zone within 30 days of final approval, the area shall be either: (a) sampled and radiologically released in accordance with the Environmental Monitoring Plan; or (b) have a minimum of 6 inches of clay removed and replaced prior to filter zone placement. Under option (b), no environmental sampling is required.	Coordinate sampling and analysis with environmental personnel. Attach a copy of the release report to the lift approval documentation.	
HEAVY EQUIPMENT ON RADON BARRIER: Heavy equipment travel will be minimized on top of the finished radon barrier. Heavy equipment will not be operated on saturated radon barrier.	Observe the work procedures of the contractor. Advise contractor of problems with equipment on the radon barrier. Record corrective actions taken (where required) on the "Daily Construction Report".	Verify that the contractor's work procedures are being inspected.
QUALITY ASSURANCE SAMPLING: Assurance samples for radon barrier materials tests are to be obtained at the following minimum frequency: 1. In-place moisture-density tests (ASTM D6938): 1 per 50,000 cubic yards. 2. Moisture/density relationship testing (ASTM D698): 1 per 50,000 cubic yards. 3. Classification tests (ASTM D2487, D1140, and D4318): 1 per 50,000 cubic yards. A minimum of one of each of the above tests is required for each year that radon barrier is placed.	Coordinate with QA personnel in obtaining the quality assurance samples. Record the samples on the "Sample Log" and moisture-density test on the "Density Testing Log". Promptly report result of QC testing to Construction QA Officer so that a comparison of QA and QC testing results can be made.	Conduct or coordinate quality assurance sampling and testing in accordance with the designated frequencies. Obtain test results of QC samples so that a comparison of QA and QC test results can be made. The Construction QA Officer, in consultation with the QC officer, shall be responsible for determining the adequacy of correlation and documentation of the rationale used to determine adequacy. If the correlation is not adequate, new QC and QA samples shall be taken immediately. The construction QA Officer, in consultation with the QC officer, shall then evaluate the accuracy of the QC sampling and testing and, if necessary, provide for improved sampling and testing procedures and closer inspection and control. Record findings of quality assurance sampling in the "Daily QA Report".
DRC APPROVAL: The DRC shall approve documentation associated with completed radon barrier. Documentation shall include all QC and QA records associated with construction, as well as	Notify the Construction QA Officer that the radon barrier is ready for inspection by the DRC. Obtain written authorization on the "Liner Inspection Form" from the Construction QA Officer that the radon	Provide written approval of the radon barrier. Notify DRC that the radon barrier is ready for inspection.

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photographs of the completed surface. In addition, 48 hour notification shall be provided to the DRC prior to placement of filter zone material over the finished radon barrier. Energy*Solutions* may proceed with filter zone placement 48 hours after DRC notification if the DRC has not inspected and has not notified the Director of Engineering of its intent to inspect the radon barrier surface.	barrier has been inspected. Obtain documentation confirming the DRC approval of the radon barrier documentation.	

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
SCOPE: This work element applies to the Class A, Class A North, and Class A South/11e.(2) embankments.		
QUALITY OF ROCK: The rock shall have a "Rock Quality" score of at least 50 based on the following tests: Specific Gravity (ASTM C-128), Absorption (ASTM C-127), Sodium Soundness (ASTM C-88), and L.A. Abrasion (ASTM C-131 or ASTM C-535). The procedures for scoring "Rock Quality" are found in Appendix C.	As described in NUREG-1623, appendix F, perform at least one petrographic examination for each rock source in accordance with ASTM C-295. If a combination of limestone, sandstone, and igneous rock is found for a source, percentages of each type of material shall be determined for scoring. Perform Na soundness, LA abrasion, absorption, and specific gravity testing at a rate of one set of tests per 10,000 cubic yards of rock. Record the location of all collected samples in the "Sampling Log". a. Approve rock for use in the filter zone which meet the specifications for rock quality. b. Rock not meeting the specifications for rock quality can not be used.	Verify the frequency of laboratory tests and compliance of test results.
TYPE B FILTER ZONE PERMEABILITY: The type B filter zone rock on the Class A and Class A North embankments will have a minimum permeability of 3.5 cm per second. The filter zone rock on the 11e.(2) embankment will have a minimum hydraulic conductivity of 42 cm/sec.	Perform permeability testing at a rate of one test per 10,000 cubic yards placed. Record the location of all samples in the "Sampling Log". a. Approve rock for use in the filter zone which meet the specified gradation. b. Rock not meeting the specified gradation can not be used.	Verify the frequency of laboratory tests and compliance of test results.
GRADATION: LLRW embankment rock gradation shall be as specified on the currently approved engineering drawing series 9821, ~~and~~ 04080, and 07021. 11e.(2) embankment rock gradation shall be as specified on the currently approved engineering drawing series 07021~~9420-4~~.	For Type B filter zone rock, if material is to be stockpiled, perform gradation testing at a rate of one test per 2,500 cubic yard stockpile. If Type B filter zone rock material is transferred directly to the cell from the production plant, perform at least one test per source per day material is placed, or at least one test per 2,500 cubic yards. For Type A filter zone rock, perform gradation testing at a rate of one test per 10,000 cubic yards. In addition, perform a minimum of	Verify the frequency of laboratory tests and compliance of test results.

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	one test per change in soil type by ASTM D 2488. Record the location of all samples in the "Sampling Log". a. Approve rock for use in the filter zone which meet the specified gradation. b. Rock not meeting the specified gradation can not be used.	
PLACEMENT: Filter zone material will be placed over the radon barrier. The thickness of the filter zone layer for the LLRW embankments shall be as specified on the currently approved engineering drawing series 9821, and 04080, and 07021. The thickness of the filter zone layer for the 11e.(2) embankment shall be as specified on the currently approved engineering drawing series 070219420-4, 9420-5, and 9420-6. Filter zone material shall be handled in such a manner as to prevent contamination from waste material and segregation of finer materials.	Observe the placement of the filter zone material. Ensure that soil fines are not concentrated in localized areas. If soil fines are concentrated in localized areas, the contractor shall be directed to evenly distribute the fines or to remove them. Record corrective actions (where required) in the "Daily Construction Report".	Verify that QC personnel observe the placement of the filter zone material such that soil fines are not concentrated in localized areas.
SNOW REMOVAL: When filter zone material is to be placed and the work area is covered with snow, the snow must be removed.	Observe that snow is removed. Advise the contractor of any deficiencies. Construction may not continue without taking corrective actions to remove the snow. Record corrective actions (where required) in the "Daily Construction Report".	Verify that snow removal is being documented.
FINAL GRADING: Thickness for the lift will be established by installing grade poles on at least a 50' grid and at all control points. The grade poles shall consist of PVC pipe (approximately ½-inch diameter) with surveyors ribbon (or other distinguishable markings) attached to the appropriate lift thickness. The poles shall be held in place by placing the filter rock adjacent to the base of the grade pole to secure it in a vertical position (long axis of the grade pole perpendicular to the radon barrier surface). With the grade pole marked at the appropriate thickness and	Verify that the grade poles are marked at the appropriate depth to establish grade for the layer that will be placed. Observe the installation of some of the grade poles to ensure that the installation method has been followed and verify that the grade poles have not penetrated or damaged the surface of the radon barrier. Verify the required grade is achieved at all control points throughout the placed filter rock in the project area. Rework and re-verify areas not meeting the specified grade. Ensure all grade poles have been	Review documentation for final grading.

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
secured at the appropriate locations, the filter rock may be placed throughout the project area. The base of the grade poles shall rest on the surface of the radon barrier and therefore will not damage the radon barrier surface. After the grade has been checked and approved by QC personnel, the grade poles shall be removed from the filter zone placed directly above the radon barrier.	removed following verification of grade. Document all inspections and corrective actions, where required, on the "Daily Construction Report".	
QUALITY ASSURANCE SAMPLING: Assurance samples for filter zone materials tests are to be obtained at the following minimum frequency: 1. Na soundness tests (ASTM C88): 1 per 100,000 cubic yards. 2. LA abrasion tests (ASTM C131): 1 per 100,000 cubic yards. 3. Absorption tests (ASTM C128): 1 per 100,000 cubic yards. 4. Specific gravity tests ASTM C127): 1 per 100,000 cubic yards. 5. Gradation tests (ASTM C136): 1 per 100,000 cubic yards. A minimum of one of each of the above tests is required for each year that filter zone is placed.	Coordinate with QA personnel in obtaining the quality assurance samples. Record the samples on the "Sample Log". Promptly report result of QC testing to Construction QA Officer so that a comparison of QA and QC testing results can be made.	Conduct or coordinate quality assurance sampling and testing in accordance with the designated frequencies. Obtain test results of QC samples so that a comparison of QA and QC test results can be made. The Construction QA Officer, in consultation with the QC officer, shall be responsible for determining the adequacy of correlation and documentation of the rationale used to determine adequacy. If the correlation is not adequate, new QC and QA samples shall be taken immediately. The Construction QA Officer, in consultation with the QC officer, shall then evaluate the accuracy of the QC sampling and testing and, if necessary, provide for improved sampling and testing procedures and closer inspection and control. Record findings of the quality assurance sampling in the "Daily QA Report".

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
SCOPE: This work element applies to the Class A, and Class A North embankments. This work element also applies to the Class A portion of the Class A South/11e.(2) embankment.		
PLACEMENT: Sacrificial soil will be placed over the filter zone as specified on currently approved engineering drawing series 9821, ~~and~~ 04080, and 07021. Sacrificial soil shall be handled in such a manner as to prevent contamination from waste material and segregation of finer materials.	Observe the placement of the sacrificial soil. Ensure that fines are not concentrated in localized areas. If fines are concentrated in localized areas, the contractor shall be directed to evenly distribute the fines or to remove them. Record corrective actions (where required) in the "Daily Construction Report".	Verify that QC personnel observe the placement of the sacrificial soil such that fines are not concentrated in localized areas.
GRADATION: Gradation of the sacrificial soil shall be as specified on the currently approved engineering drawing series 9821, ~~and~~ 04080, and 07021.	If material is to be stockpiled, perform gradation testing at a rate of one test per 2,500 cubic yard stockpile. If material is transferred directly to the cell from the production plant, perform at least one test per source per day material is placed, or at least one test per 2,500 cubic yards. In addition, perform a minimum of one test per change in soil type by ASTM D 2488. Record the location of all samples in the "Sampling Log". a. Approve material for use as sacrificial soil which meet the specified gradation. b. Material not meeting the specified gradation can not be used.	Verify the frequency of laboratory tests and compliance of test results.
SNOW REMOVAL: When sacrificial soil is to be placed and the work area is covered with snow, the snow must be removed.	Observe that snow is removed. Advise the contractor of any deficiencies. Construction may not continue without taking corrective action to remove the snow. Record corrective actions (where required) in the "Daily Construction Report".	Verify that snow removal is being documented as per DRC requirement.
FINAL GRADING: Thicknesses for the lift will be established by installing grade poles on at least a 50' grid and at all control points. The grade poles must be marked at the appropriate depth to establish grade. After the grade has been checked and approved by QC	Verify the required grade is achieved at all control points. Rework and re-verify areas not meeting the specified grade.	Review the documentation for final grading.

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
personnel, the grade poles shall be removed.		

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
SCOPE: This work element applies to the Class A, Class A North, and Class A South/11e.(2) embankments.		
QUALITY OF ROCK: The rock shall have a "Rock Quality" score of at least 50 based on the following tests: Specific Gravity (ASTM C-128), Absorption (ASTM C-127), Sodium Soundness (ASTM C-88), and L.A. Abrasion (ASTM C-131 or ASTM C-535). The procedures for scoring "Rock Quality" are found in Appendix C.	As described in NUREG-1623, appendix F, perform at least one petrographic examination for each rock source in accordance with ASTM C-295. If a combination of limestone, sandstone, and igneous rock is found for a source, percentages of each type of material shall be determined for scoring. Record the location of all collected samples in the "Sampling Log". Test rock at a rate of one set of test for every 10,000 cubic yards of rock. a. Approve rock for use in the rock erosion barrier which meet the specifications for rock quality. b. Rock not meeting the specifications for rock quality can not be used.	Verify the frequency of laboratory tests and compliance of test results.
GRADATION: Gradation of the rock for the LLRW embankments shall be as specified on the currently approved engineering drawing series 9821,~~, and~~ 04080, and 07021. Gradation of the rock for the 11e.(2) embankment shall be as specified on the currently approved engineering drawing series 07021~~9420-4~~.	Perform gradation testing, in accordance with ASTM D-5519, at a rate of one test per 10,000 cubic yards. Record the location of all samples in the "Sampling Log". a. Approve rock for use in the rock erosion barrier which meet the specified gradation. b. Rock not meeting the specified gradation can not be used.	Verify the frequency of laboratory tests and compliance of test results.
PLACEMENT: Rock erosion material will be placed over the filter zone. Thickness of rock erosion barrier shall be 18 inches inside the centerline of the perimeter ditch and 12 inches outside the centerline of the perimeter ditch. Rock erosion material shall be handled in such a manner as to prevent contamination from waste material and segregation of finer materials.	Observe the placement of the filter zone material. Ensure that soil fines are not concentrated in localized areas. If soil fines are concentrated in localized areas, the contractor shall be directed to evenly distribute the fines or to remove them. Record corrective actions (where required) in the "Daily Construction Report".	Verify that QC personnel observe the placement of the filter zone material such that soil fines are not concentrated in localized areas.
SNOW REMOVAL: When rock erosion barrier material is to be placed and the work area is covered	Observe that snow is removed. Advise the contractor of any deficiencies. Construction may not continue	Verify that snow removal is being documented as per DRC requirement.

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
with snow, the snow must be removed.	without taking corrective action to remove the snow. Record corrective actions (where required) in the "Daily Construction Report".	
FINAL GRADING: Thickness for the lift will be established by installing grade poles on at least a 50' grid and at all control points. The grade poles shall consist of PVC pipe (approximately ½-inch diameter) with surveyor ribbon (or other distinguishable markings). The grade poles must be marked at the appropriate depth to establish grade. After the grade has been checked and approved by QC personnel, the grade poles shall be removed.	Verify the required grade is achieved at all control points. Rework and re-verify areas not meeting the specified grade. Document all inspections and corrective actions, where required, on the "Daily Construction Report".	Review the documentation for final grading.
NOTICE OF COVER CONSTRUCTION: Provide written notice of the completion of cover construction to the DRC within 30 days of completion of each phase of cover construction in the "cut and cover" operation.	Verify the DRC has been notified of completion of cover construction within 30 days of completion of each phase of cover construction.	Verify the DRC has been notified of completion of cover construction within 30 days of completion of each phase of cover construction.
QUALITY ASSURANCE SAMPLING: Assurance samples for rock erosion barrier materials tests are to be obtained at the following minimum frequency: 1. Na soundness tests (ASTM C88): 1 per 100,000 cubic yards. 2. LA abrasion tests (ASTM C131): 1 per 100,000 cubic yards. 3. Absorption tests (ASTM C128): 1 per 100,000 cubic yards. 4. Specific gravity tests ASTM C127): 1 per 100,000 cubic yards. 5. Gradation tests (ASTM C136): 1 per 100,000 cubic yards. A minimum of one of each of the above tests is	Coordinate with QA personnel in obtaining the quality assurance samples. Record the samples on the "Sample Log". Promptly report result of QC testing to Construction QA Officer so that a comparison of QA and QC testing results can be made.	Conduct or coordinate quality assurance sampling and testing in accordance with the designated frequencies. Obtain test results of QC samples so that a comparison of QA and QC test result can be made. The Construction QA Officer, in consultation with the QC officer, shall be responsible for determining the adequacy of correlation and documentation of the rationale used to determine adequacy. If the correlation is not adequate, new QC and QA samples shall be taken immediately. The Construction QA Officer, in consultation with the QC officer, shall then evaluate the accuracy of the QC sampling and testing and, if necessary, provide for improved sampling and testing procedures and closer inspection and control. Record findings of the quality assurance sampling in the "Daily QA Report".

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
required for each year that erosion barrier is placed. Samples should be tested at a different laboratory than the QC samples.		

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
SCOPE: This work element applies to the Class A, Class A North, and Class A South/11e.(2) embankments.		
CLEARING AND GRUBBING: Remove vegetation, debris, organic, or deleterious material from areas to be used for borrow. Grubbing depth will depend on the type of vegetation, debris, organic, or deleterious material on the site. If the area is free of these materials then no clearing and grubbing will be necessary.	Inspect the area once clearing and grubbing has been completed. Record observations and corrective actions (where required) on the "Daily Construction Report".	Verify that the clearing and grubbing has been inspected by QC.
MATERIAL: The imported borrow shall be classified as CL or ML soils by ASTM D-2487.	Perform laboratory classification tests at a rate of 1 test per lot prior to use of material in the road. A lot is defined as a maximum of 3,000 cubic yards (compacted) of specified material type. Record the location of the classification sample on the "Sampling Log". a. Approve lots (which meet the specified classification) for use in the road. b. Lots not meeting the specified classification can not be used.	Verify the frequency of laboratory tests and compliance of test results.
LIFT THICKNESS: Drainage ditch borrow material shall be placed in lifts with an uncompacted thickness of less than or equal to 9 inches. Thickness for the lift will be established by installing grade poles on at least a 50-foot grid lengthwise and at all control points. The grade poles must not be installed deeper than 1 inch into the underlying clay liner. The grade poles must be marked at the appropriate depth to establish the grade. After the grade has been checked and approved by QC personnel, the grade poles shall be removed.	Verify that the required grading is achieved as follows: a. Ensure that the required frequency for placement of grade poles has been met. b. Compare soil level with the marked level on the grade poles. c. Use a string line where necessary between poles to check for high or low spots. d. Define those areas that are high out of specification and advise the contractor to re-work those areas. e. Review areas re-worked and approve areas meeting criteria. f. Continue b through d above until all areas meet criteria. g. Indicate areas meeting criteria in the "Embankment Construction Lift Approval Form".	Observe, at a minimum, five percent of the measurements performed by QC personnel to ensure that the measurements are being performed correctly. Verify that the measurements are being performed at the correct frequency and that the documentation is being completed.

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
SCOPE: This work element applies to the Class A, Class A North, and Class A South/11e.(2) embankments.		
EXCAVATION: Excavation shall be made to the lines, grades, and dimensions prescribed in the approved plans. Prior DRC approval in writing must be obtained before diverting ditches from the current approved design. The purpose and duration of diversion shall be specified in any request to do so. Any over excavation shall be backfilled with select materials and compacted to 95 percent of standard Proctor. The uncompacted lift thickness shall not exceed 9 inches.	Provide daily observation of the cell excavation. Record observations and corrective actions (where required) on the "Daily Construction Report". In areas of over excavation, conduct in-place density test at a rate of one test per lot and record the results on the "Field Density Test" form. A lot is defined as a maximum of 10,000 square feet of a lift of a specified type of material. Test locations shall be chosen on the basis of random numbers. a. Approve lots which meet the specified compaction. b. Rework and retest lots not meeting the specified compaction. Proctors shall be performed at a rate of one test per 100,000 square feet for each material type. At least one proctor shall be performed for each material type. Record the location of the sample on the "Sampling Log".	Observe, at a minimum, five percent of the tests performed by the QC personnel to ensure that the tests and observations are being performed correctly. Verify that the tests are being performed at the correct frequency and that the documentation is being completed.
FINAL GRADING: Smooth roll the excavated surface to prepare for filter zone. Final grading of this surface shall be ±0.1 of a foot.	Inspect the surface for smoothness. Survey the surface on a 50 ft grid and at key points. Final survey measurements will be documented and provided to the QC officer and Construction QA Officer. a. Indicate where the surface meets design line and grade. b. Rework and resurvey areas not meeting the specified grade.	Review the final survey data. Verify the frequency of the survey points.
FILTER ZONE AND ROCK EROSION BARRIER: The filter zone and rock erosion barrier shall be constructed in accordance with the specifications outlined under work elements "Filter	See work elements "Filter Zone" and "Rock Erosion Barrier".	See work elements "Filter Zone" and "Rock Erosion Barrier".

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
Zone" and "Rock Erosion Barrier".		
EROSION CONTROL FOR EXPOSED SOIL: If reviewed and approved drainage ditch soil surfaces are not covered by filter zone within 30 days of lift approval, the following erosion control repair measures shall apply.	Perform monthly inspections. Document the inspection as well as associated maintenance activities on the Daily Construction Report.	
Semi-annually, inspect exposed drainage ditch soil surfaces for evidence of erosion. Rivulet or gullied areas wider than 6 inches or deeper than 6 inches require maintenance to fill the rivulet or gully and restore the area to design grade. Soils imported as fill shall meet the requirements of "Drainage Ditch Imported Borrow", above. Maintenance shall be performed within 30 calendar days when needed, unless additional time is approved by DRC.		
Erosion control blankets, mats, or fiber mulch may be used, in accordance with the manufacturer's instructions, for erosion prevention. DRC shall be notified at least 48 hours prior to deployment of erosion control blankets, mats, or fiber mulch. If used, such erosion control materials shall be removed prior to filter zone construction.		
RADIOLOGICAL SAMPLING FOR EXPOSED SOIL: If reviewed and approved drainage ditch soil surfaces are not covered by filter zone within 30 days of lift approval, the area shall either (a) be sampled and radiologically released in accordance with the Environmental Monitoring Plan; or (b) have a minimum of 6 inches of clay removed and replaced prior to filter zone placement. Under option (b), no environmental sampling is required.	Coordinate sampling and analysis with environmental personnel. Attach a copy of the release report to the lift approval documentation.	

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
SCOPE: This work element applies to the Class A, Class A North, and Class A South/11e.(2) embankments.		
MATERIAL: The material used to construct the road shall conform to the following specification: Sieve Size — % Passing 1-1/2" — 100 3/4" — 75-95 1/2" — 62-82 # 4 — 38-58 # 16 — 16-36 # 200 — 0-18	Perform laboratory classification tests at a rate of 1 test per lot prior to use of material in the road. A lot is defined as a maximum of 3,000 cubic yards (compacted) of specified material type. Record the location of the classification sample on the "Sampling Log". a. Approve lots (which meet the specified classification) for use in the road. b. Lots not meeting the specified classification can not be used.	Verify the frequency of laboratory tests and compliance of test results.
SUBSURFACE PREPARATION: The subsurface will be scarified and re-compacted to at least 95 percent of a standard proctor (ASTM D-698).	Conduct in-place density tests at a rate of one test per lot and record the results on the "Field Density Test" form. A lot is defined as 200 cubic yards (compacted) of material. The test location shall be chosen on the basis of random numbers. a. Approve lots which meet the specified compaction. b. Rework and retest lots not meeting the specified compaction. Proctors shall be performed at a rate of one test per borrow lot. A borrow lot is defined as 3,000 cubic yards (compacted) or less of a specific material type. Record the location of the Proctor sample on the "Sampling Log".	Observe, at a minimum, five percent of the tests performed by the QC personnel to ensure that the tests and observations are being performed correctly. Verify that the tests are being performed at the correct frequency and that the documentation is being completed.
ROAD THICKNESS: The compacted road shall be 12 inches thick plus or minus 0.2 feet.	Measure the thickness of the road at both edges of the road at no greater than 50 foot intervals. Record the results on the "Lift Approval Form". a. Approve section of the road which meet the specified thickness. b. Rework and retest sections not meeting the required thickness.	Observe, at a minimum, five percent of the measurements performed by the QC personnel to ensure that the measurements are being performed correctly. Verify that the measurements are being performed at the correct frequency and that the documentation is being completed.

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
COMPACTION: The road will be compacted to at least 95 percent of standard Proctor (ASTM D-698).	Conduct in-place density tests at a rate of one test per lot and record the results on the "Field Density Test" form. A lot is defined as 200 cubic yards (compacted) of material. The test location shall be chosen on the basis of random numbers. a. Approve lots which meet the specified compaction. b. Rework and retest lots not meeting the specified compaction. Proctors shall be performed at a rate of one test per borrow lot. A borrow lot is defined as 3,000 cubic yards (compacted) or less of a specific material type. Record the location of the Proctor sample on the "Sampling Log".	Observe, at a minimum, five percent of the tests performed by the QC personnel to ensure that the tests and observations are being performed correctly. Verify that the tests are being performed at the correct frequency and that the documentation is being completed.

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
SCOPE: This work element applies to the Class A, Class A North, and Class A South/11e.(2) embankments.		
MATERIALS: All burial embankments and waste storage areas, including immediately adjacent drainage structures, shall be controlled areas, surrounded by six foot high, chain link fence. All permanent fence shall be chain link, six feet high, topped with three strand barbed wire, top tension wire and twisted selvedge.	Obtain a copy of the manufacture's specification for the materials to be used in the construction of the fence. Verify that the materials meet the required specifications. Document materials acceptance on the "Daily Construction Report".	Verify that the materials to be used in the construction of the fence have been approved.
Zinc coated chain link fence shall meet the requirements of ASTM A-392 with Class I coating. Aluminum Coated fence fabric shall meet the requirements of ASTM A-491.		
Fence Fabric: Fence fabric shall be made of 0.148 inch or larger diameter wire. The fabric shall have twisted selvedge.		
Wire and Ties: Tension wires shall be 0.177 inch or larger diameter spiral type. Ring ties for tying fabric to supporting members shall be made of 0.148 inch or larger diameter wire. Wire ties for tying fabric to support members shall be made of 0.12 inch or larger diameter wire. Ties to line posts shall be made of 0.192 inch or larger diameter wire. All wire shall have Class II coating as specified by ASTM A-116.		
Barbed Wire: Barbed wire on zinc coated fence shall meet the requirements of ASTM A-121, including a Class I zinc coating. Barbed wire shall be made of 0.099 inch or larger diameter wire with 0.080 inch or larger diameter wire four point barbs on 5 inch centers. When aluminum or aluminum coated fence is used, aluminum coated barbed ware shall be used meeting the requirements of ASTM A-0491. The support arm		

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
on the fence for the barbed wire shall be capable of supporting a 200 pound vertical load at the end of the arm without permanent deflection. Posts: Line posts may be "H" section or pipe. The minimum strength requirements are as follows: 1. Load at top: 600 lbs. 2. Maximum Moment: 1200 ft-lbs. 3. Maximum permanent set: 0.010 in. "H" posts shall be coated in accordance with the requirements of ASTM A-123. Pipe posts shall conform to the requirements of ASTM A-120 (Schedule 40) for zinc coated pipe. All pipe posts shall be fitted with a weather resistant tip, designed to fit securely over the post, and carry an apron around the outside of the post. Fittings: Fittings shall be malleable cast iron or pressed steel and be coated in accordance to ASTM A-123. Gates: Gate posts and frames shall be constructed of the sizes shown on the approved plans for the various gate dimension. The corners of the gate frame shall be fastened together with pressed steel or malleable iron corner ells riveted or welded in accordance with the plans. Welded steel gate frames shall be galvanized after fabrication in accordance with the provision of ASTM A-123. Chain link fence fabric for covering the gate frames shall be the same as required for the fence. Each gate shall be furnished complete with necessary galvanized hinged, latch, and drop bar locking device for the type of gate used on the project.		
INSTALLATION: The steel posts shall be set true to line and grade in concrete bases. The distances between posts shall be uniform and not exceeding 10 feet. Fence corners and ends shall be constructed in accordance	Verify that the fence is constructed in the location shown on the plans and in accordance with sheet L9. Document any problems in the "Daily Construction Report".	Verify that the fence has been inspected and problems have been properly documented.

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
with Detail A on sheet L9 of the approved engineering drawings. Gates shall be constructed in accordance with Detail B on sheet L9 of the approved engineering drawings.		
A minimum of 6 inches of concrete shall be provided below the bottom of each post. End posts, pull posts, corner posts, and gate posts shall have a concrete base at least 12 inches in diameter. Bases for line posts shall be at least 10 inches in diameter.	Spot check the depth and diameter of the post holes to verify that the holes meet the required specification. Document any problems in the "Daily Construction Report".	Verify that the fence has been inspected and problems have been properly documented.
Pull posts shall be provided at 500 feet maximum intervals. Changes in line of 30 degrees or more shall be considered as corners.	Inspect the fence for proper placement of pull and corner posts. Document any problems in the "Daily Construction Report".	Verify that the fence has been inspected and problems have been properly documented.
The fabric shall be stretched taut, and securely fastened to the posts. Fastening to end, gate, corner, and pull posts shall be with stretcher bars and metal bands, spaced at one foot intervals. The fabric shall be cut and each span fastened independently at all pull and corner posts. Fastening to line posts shall be with tie wire, metal bands, or other approved method at 14 inch intervals. The top edge of fabric shall be attached to the top rail or tension cable at approximately 24 inch intervals. The bottom tension wire is required and shall be attached to the fabric with tie wires at 24 inch intervals and shall be secured to the end or pull posts with brace bands.	Inspect the fencing fabric to verify that it has been installed in accordance with the specifications. Document any problems in the "Daily Construction Report".	Verify that the fence has been inspected and problems have been properly documented.

WORK ELEMENT – SETTLEMENT MONITORING

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
SCOPE: This work element applies to the LARW, Class A, Class A North, Class A South/11e.(2), and Mixed Waste embankments.		
SETTLEMENT MONUMENTS: Settlement monuments constructed before January 1, 2005 consist of #4 or greater rebar that is approximately 3 feet long, secured in place using a sand-cement grout. Grout shall consist of approximately 0.5 cubic foot of low slump fiber reinforced grout per monument. The top of the rebar shall be placed roughly even with the top of the riprap rock. Each monument shall be permanently labeled, flagged, and documented on a reference drawing.		
Settlement monuments constructed after January 1, 2005 shall consist of approximately 4-foot long #5 or greater rebar that is welded to a metal plate. The metal plate shall be approximately 18 inches square with a thickness of 3/16 inch to 1/4 inch. The rebar shall be sized to extend no more than 6 inches above the rock erosion barrier surface. The settlement plate shall be placed on top of the final approved radon barrier (Class A and LARW cells) or on top of the final approved geosynthetics layer (Mixed Waste) and then secured by the rock cover layers as they are built. Each monument shall be permanently labeled, flagged, and documented on a reference drawing.	Inspect settlement monuments for compliance with the specification prior to installation. Observe installation to ensure that the radon barrier or geosynthetic layer is not damaged.	Perform a surveillance of monument installation activities.
SETTLEMENT MONUMENT PLACEMENT: Settlement monuments constructed prior to January 1, 2005 are set at 100- and 200-foot grids, as indicated on Figure 1.		
Settlement monuments constructed after January 1, 2005 on the LARW, Class A, Mixed Waste, 11e.(2), and Class A North embankments shall be placed at the	Perform and document a post-construction survey of the placed settlement monument.	Verify that surveys have been performed.

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
locations identified on Figures 1, 2, 3, 4, and 6 respectively.		
SURVEY REQUIREMENTS: Surveys shall be performed with GPS or approved equivalent equipment. Tolerance shall be no more than ± 0.1 feet.	Calibrate and operate survey equipment in accordance with the manufacturer's recommendations	
SURVEY INTERVAL: Settlement monuments constructed before January 1, 2005 shall be surveyed prior to grouting and again afterwards within 30 days of grouting for coordinate verification. Annual surveys of the existing monuments shall continue for a minimum of 5 years from the date of grouting. In cases where monuments are reset, measurements shall continue at the specified frequency continuing from the last reliable measurement. Weather conditions at the time of the survey and a discussion of the potential for frost to be present shall be documented in the survey report.	Perform and document the required surveys. Provide survey data to the Director of Engineering.	Verify that monument surveys are completed as required.
Settlement monuments constructed after January 1, 2005 shall be set and surveyed for initial location within 30 days of the completion of final cover construction. New monuments shall be surveyed again at 2, 4, and 12 months (± 10 calendar days) after the initial survey. Thereafter, monuments shall be surveyed once annually between October 1 and December 31 until a minimum of 5 years after initial placement. Weather conditions at the time of the survey and a discussion of the potential for frost to be present shall be documented in the survey report.	Perform and document the required surveys. Provide survey data to the Director of Engineering.	Verify that new monument surveys are completed as required.
During the annual survey, perform a visual inspection of the completed cover to evaluate potential areas of settlement that may not be captured by the settlement monument network.	Document observations made during the inspection, and denote areas where differential settlement may be occurring. Provide documentation to the Director of Engineering.	Perform a surveillance of visual inspection activities.

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
REPORTING: Settlement monitoring data shall be summarized and evaluated in the annual as-built report for each embankment. Calculate total and differential settlement for each settlement monument against the most recent measurement and against the baseline monument location. Total settlement of more than 1.5 feet at any settlement monument or differential settlement of more than 1.0 percent slope between adjacent monuments shall be reported to and evaluated by the Director of Engineering within 30 days of measurement and discussed in the annual as-built report. Any failure in the settlement monuments shall be documented. A replacement monument shall be reset as close as possible to the previous location, surveyed, and documented.	Provide settlement monitoring data to the Director of Engineering.	

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
AERIAL SURVEY REQUIREMENTS: An aerial survey of the disposal cells and permitted area shall be performed between August 15 and September 15 each year. The aerial survey shall be performed by a registered land surveyor. Survey control points shall be identified in the survey report. Survey tolerance shall not exceed ± 0.75 ft. **ANNUAL AS-BUILT VOLUMES:** Calculate embankment volumes from the aerial survey data using AutoCAD or approved equivalent equipment. Provide plan view and cross-sections of the as-built embankment based on the aerial survey data. For each embankment, report the embankment design capacity, capacity used to date, and remaining capacity. Compare remaining capacity with the surety reserve capacity for each embankment.	Review the aerial survey report for compliance with this specification.	

TABLE 2

MATERIAL SPECIFICATIONS FOR PORTLAND CEMENT CLSM

PROPERTY	TEST METHOD	MINIMUM	MAXIMUM	FREQUENCY
WET UNIT WEIGHT	ASTM D6023	100 lbs/ft^3	None	1 Test/100 Cubic Yards/Lift
SLUMP **-OR-** FLOW **-OR-** FLOW CONSISTENCY	Energy*Solutions* Slump Test (Appendix B) Energy*Solutions* Efflux Test (Appendix B) Flow Consistency (ASTM D6103)	8 inches NA 8 inches	None 26 seconds None	1 Test/100 Cubic Yards/Lift 1 Test/100 Cubic Yards/Lift 1 Test/100 Cubic Yards/Lift
28 DAY COMPRESSIVE STRENGTH	ASTM D4832	150 psi	None	1 Test/2000 Cubic Yards Placed at 28 days
CEMENT	None	50 lbs for each cubic yard of CLSM	75 lbs for each cubic yard of CLSM	Inspect each load ticket prior to pour
POZZOLAN	None	300 lbs for each cubic yard of CLSM	375 lbs for each cubic yard of CLSM	Inspect each load ticket prior to pour
AGGREGATE SIZE	Gradation Test Certificate from Batch Plant	Percent Passing / Sieve 100 / 3/8" 60 / #8	Percent Passing / Sieve 30 / 100	1 Test/Pour day if material is received form exterior batch plant or 1 certification/stockpile if material is received from site batch plant. **Gradation certificate shall be received by QC Technician prior to pouring any CLSM**

TABLE 3

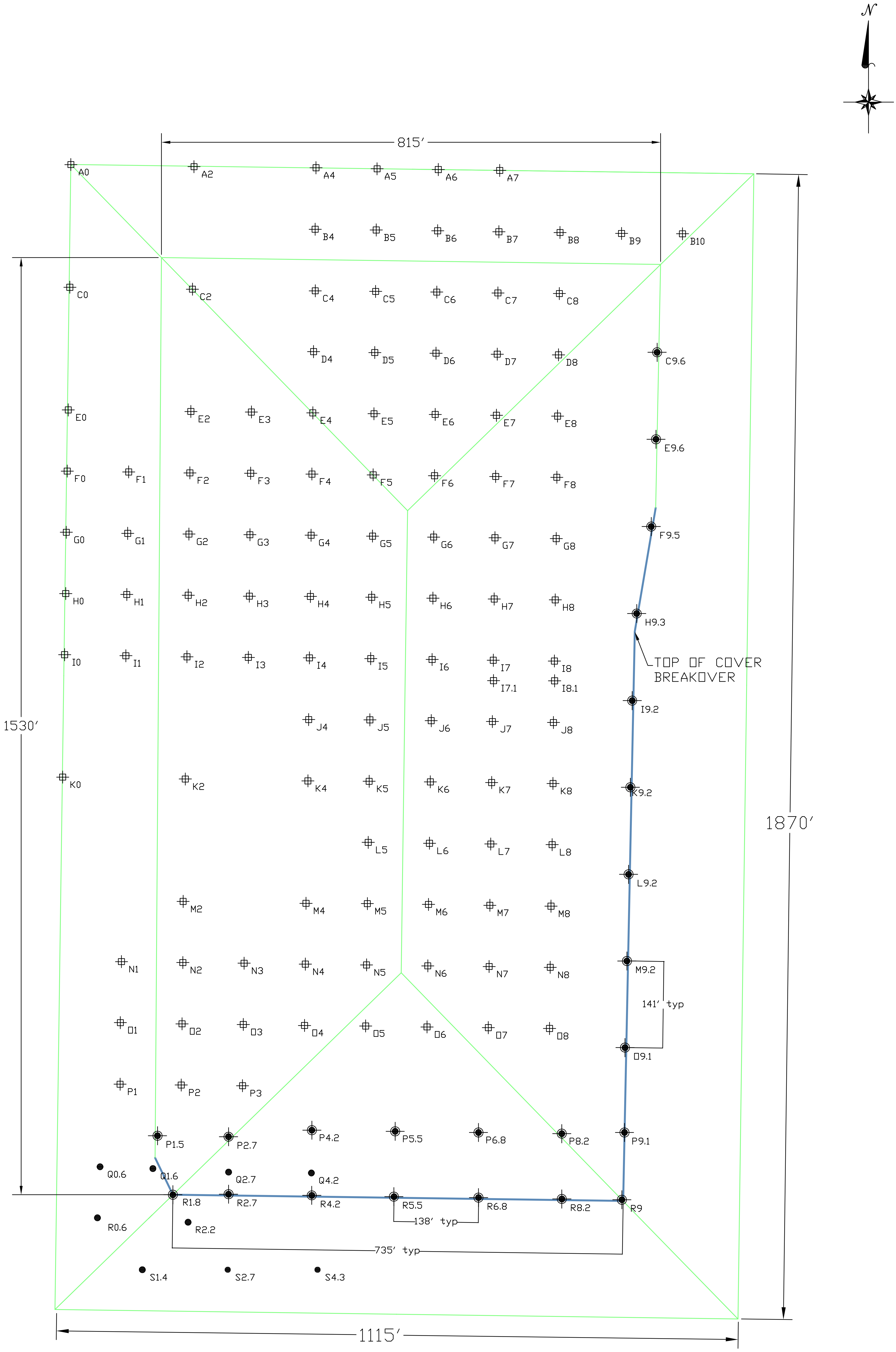
MATERIAL SPECIFICATIONS FOR FLY ASH CLSM

PROPERTY	TEST METHOD	MINIMUM	MAXIMUM	FREQUENCY
WET UNIT WEIGHT	ASTM D6023	100 lbs/ft^3	None	1 Test/100 Cubic Yards/Lift
FLOWABILITY	ASTM D6103	NA	11-inch spread	1 Test/100 Cubic Yards/Lift
28 DAY COMPRESSIVE STRENGTH	ASTM D4832	150 psi	None	1 Test/2000 Cubic Yards Placed at 7 days 1 Test/2000 Cubic Yards Placed at 28 days
TYPE F FLY ASH	None	40.5% of design mix	50.5% of design mix	Inspect each load ticket prior to pour
TYPE C FLY ASH	None	25.1% of design mix	35.1% of design mix	Inspect each load ticket prior to pour
WATER	None	23.0% of design mix	25.4% of design mix	Inspect each load ticket prior to pour
ACTIVATORS	None	0.19% of design mix	0.21% of design mix	Inspect each load ticket prior to pour

3a

LLRW & 11E.(2) CONSTRUCTION QUALITY ASSURANCE/QUALITY CONTROL (CQA/QC) MANUAL

LARW SETTLEMENT MONUMENTS FIGURES



LARW SETTLEMENT MONUMENTS

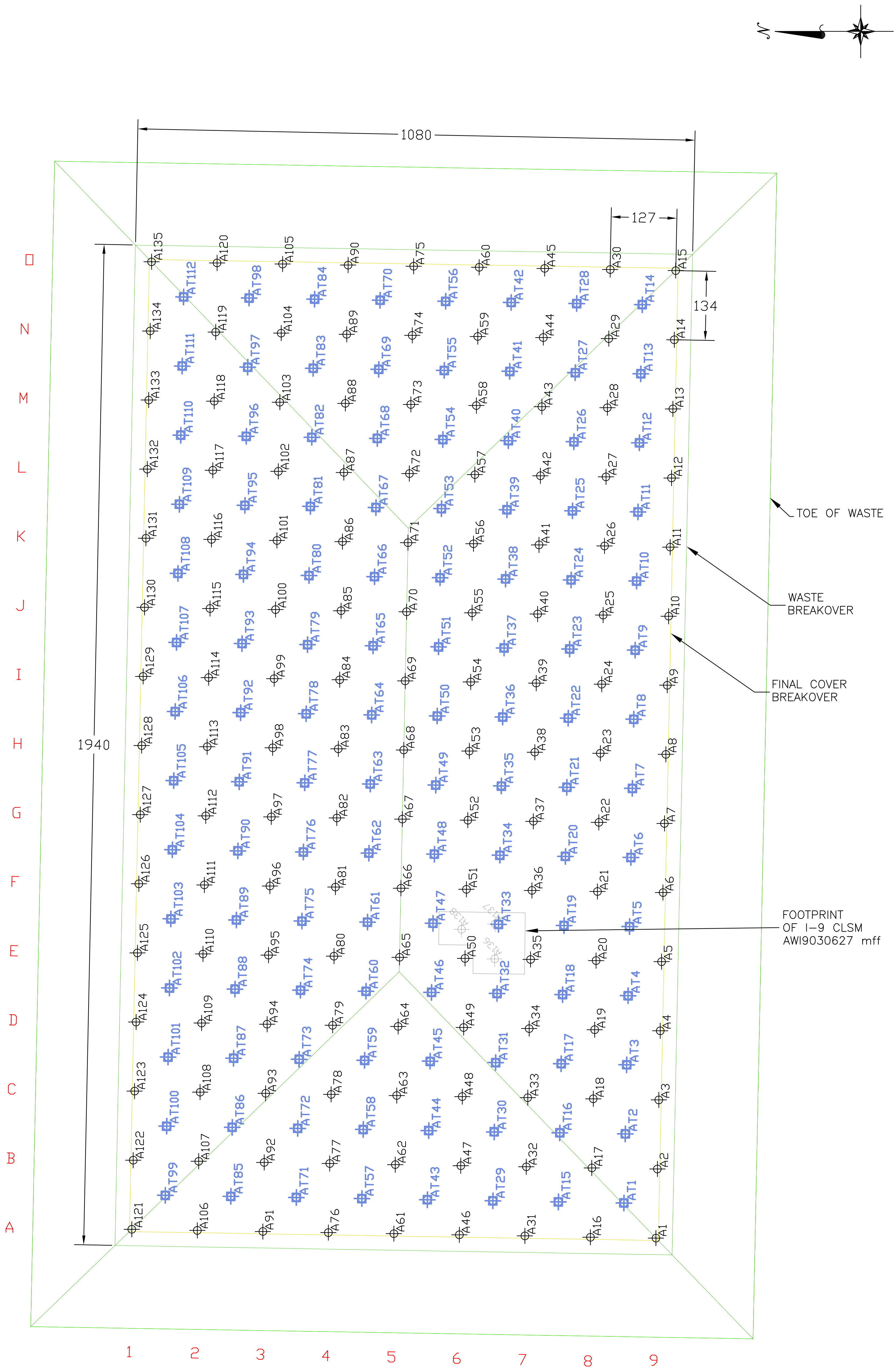
80 0 80 160

LEGEND
- NEW MONUMENTS
- EXISTING MONUMENTS
- SUPPLEMENTAL MONUMENTS ADDED PER LETTER DATED 10/1/04

FIGURE 1

Revised May 1, 2006

ENERGYSOLUTIONS



CLASS A SETTLEMENT MONUMENTS

Monuments shall be placed within a 18" radius of design location

LEGEND

138 MONUMENTS

112 ADDITIONAL FINAL TEMPORARY COVER MONUMENTS

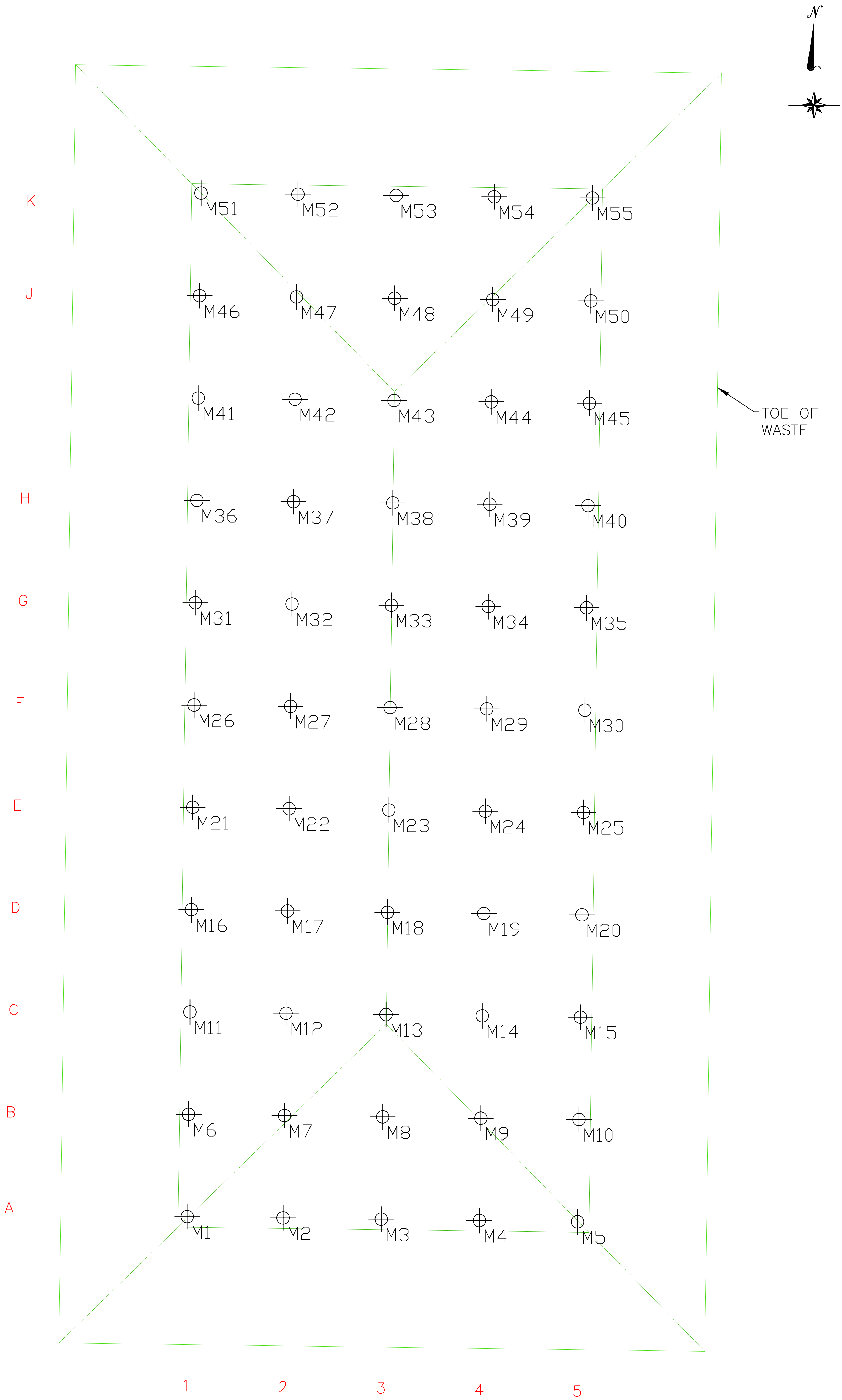
100 0 100 200

FIGURE 2

REVISION 2

JULY 30, 2008

ENERGYSOLUTIONS



MIXED WASTE SETTLEMENT MONUMENTS

FIGURE 3

REVISION 2

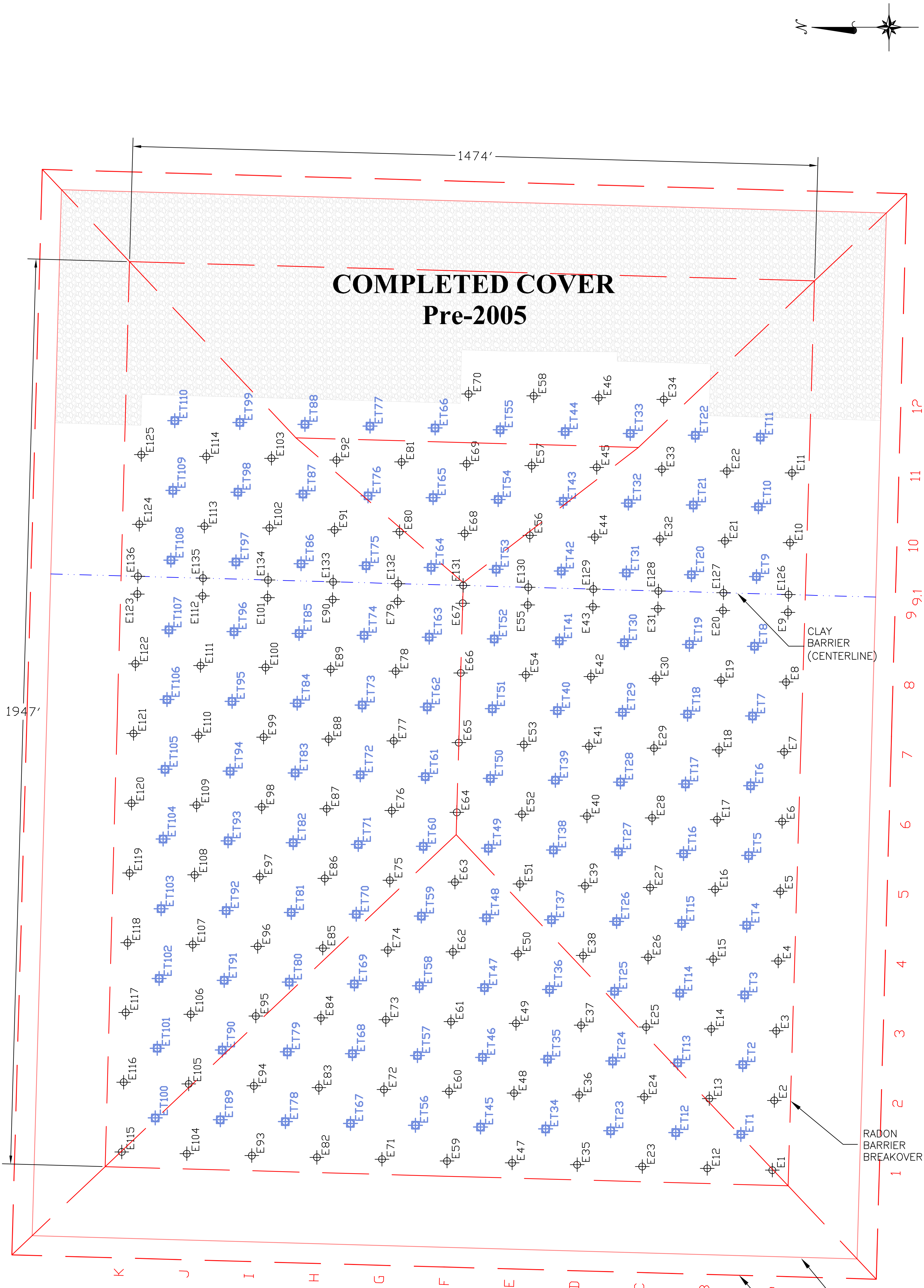
October 10, 2008

60 0 60 120

LEGEND

⌖ MONUMENTS

ENERGYSOLUTIONS



CLASS A SOUTH/11e.(2) SETTLEMENT MONUMENTS

Monuments shall be placed within a 18" radius of design location

LEGEND

⌖ 136 MONUMENTS

⌖ 110 ADDITIONAL FINAL TEMPORARY COVER MONUMENTS

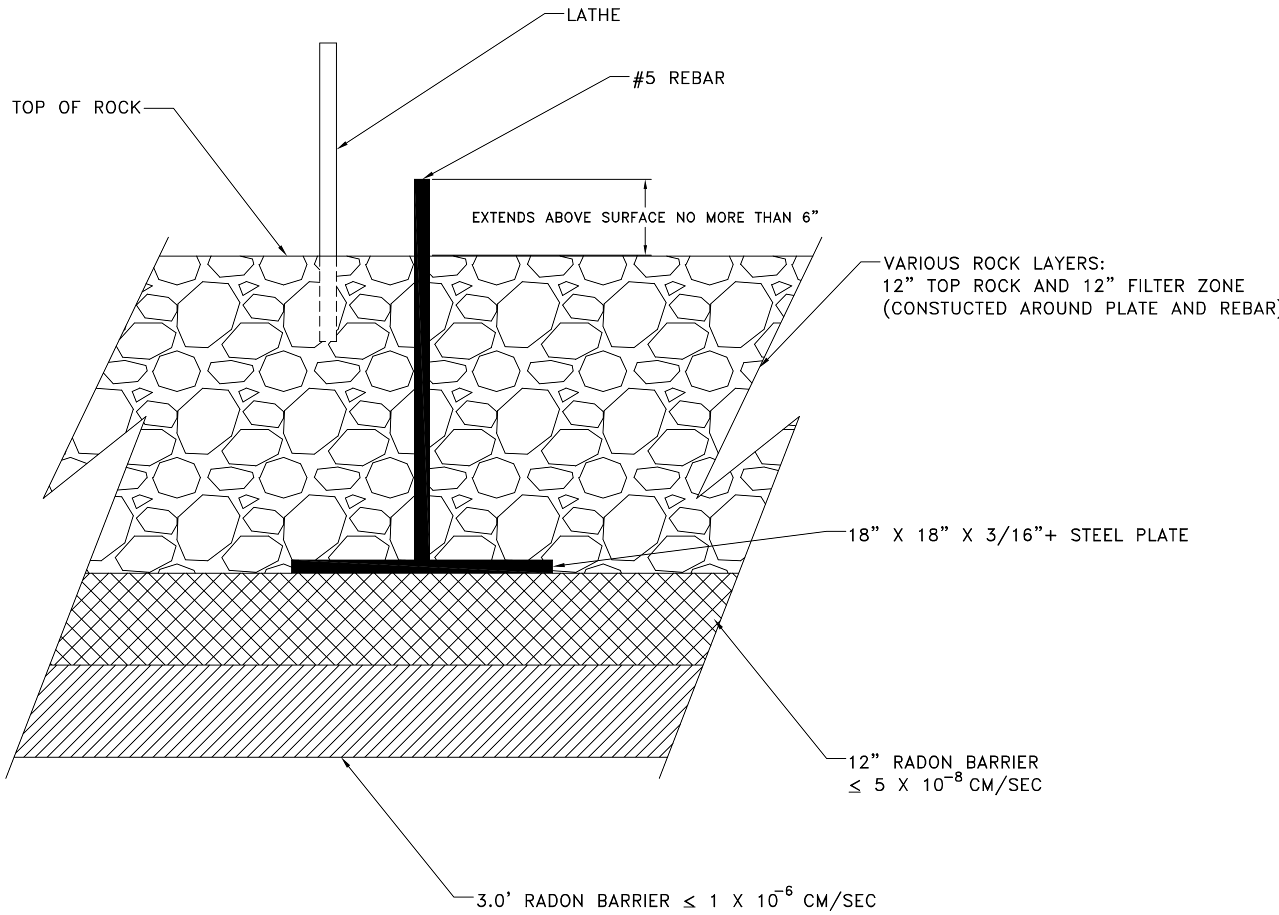
100 0 100 200

FIGURE 4

REVISION 3

JUNE 08, 2009

ENERGYSOLUTIONS



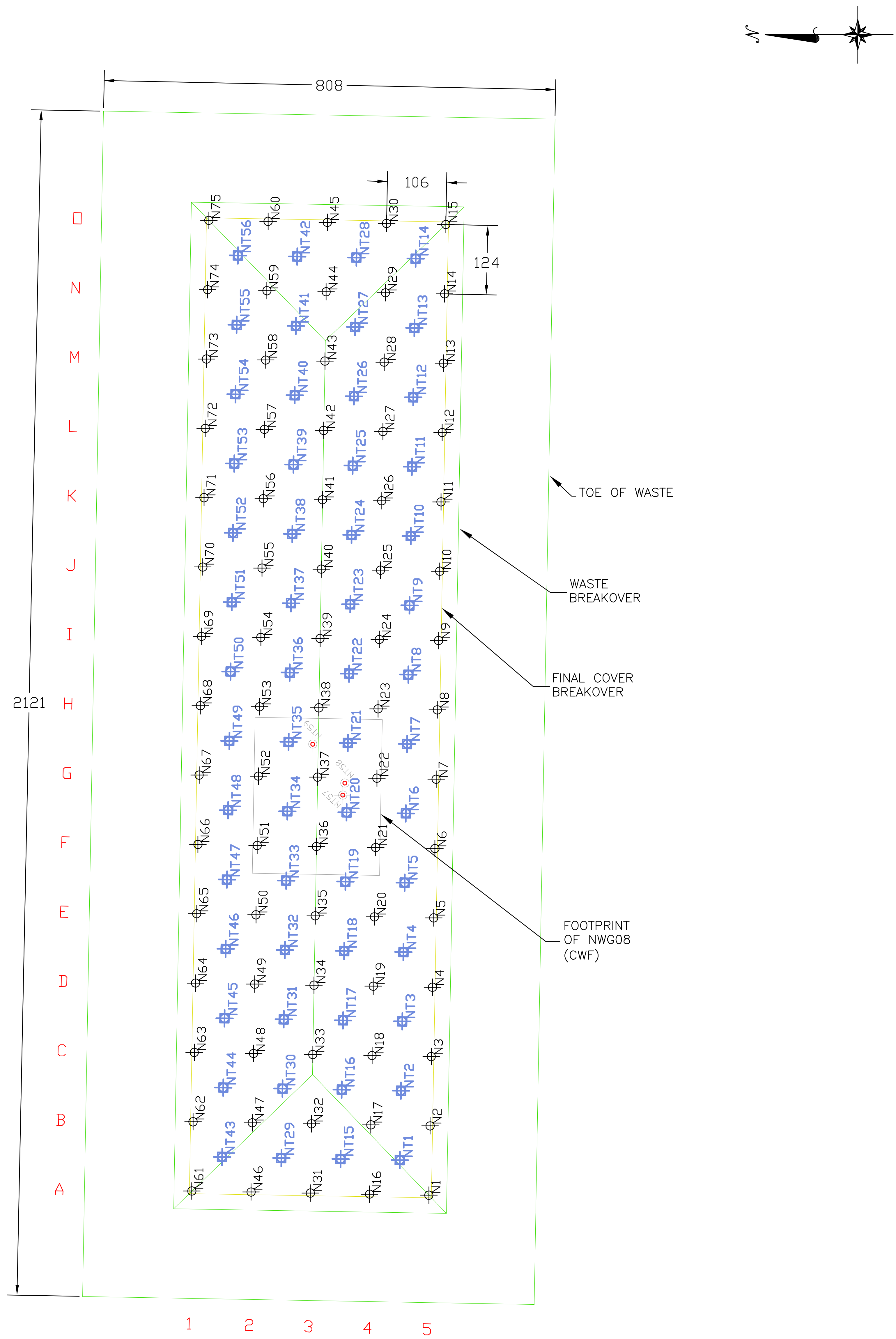
CROSS SECTION OF 11E(2) SETTLEMENT PLATE MONUMENT INSTALLATION (TYP)

NTS

FIGURE 5

REVISION 0 2/16/07

ENERGYSOLUTIONS



CLASS A NORTH SETTLEMENT MONUMENTS

Monuments shall be placed within a 18" radius of design location

LEGEND

- 75 MONUMENTS
- 56 ADDITIONAL FINAL TEMPORARY COVER MONUMENTS
- 3 ADDITIONAL (CWF) FINAL TEMPORARY COVER MONUMENTS

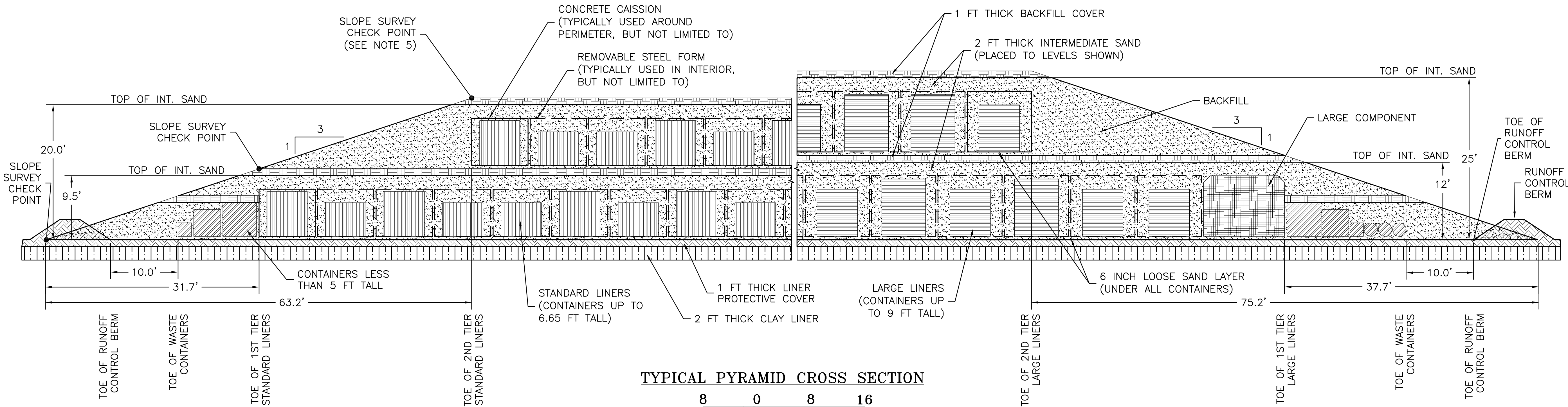
100 0 100 200

FIGURE 6

REVISION 1

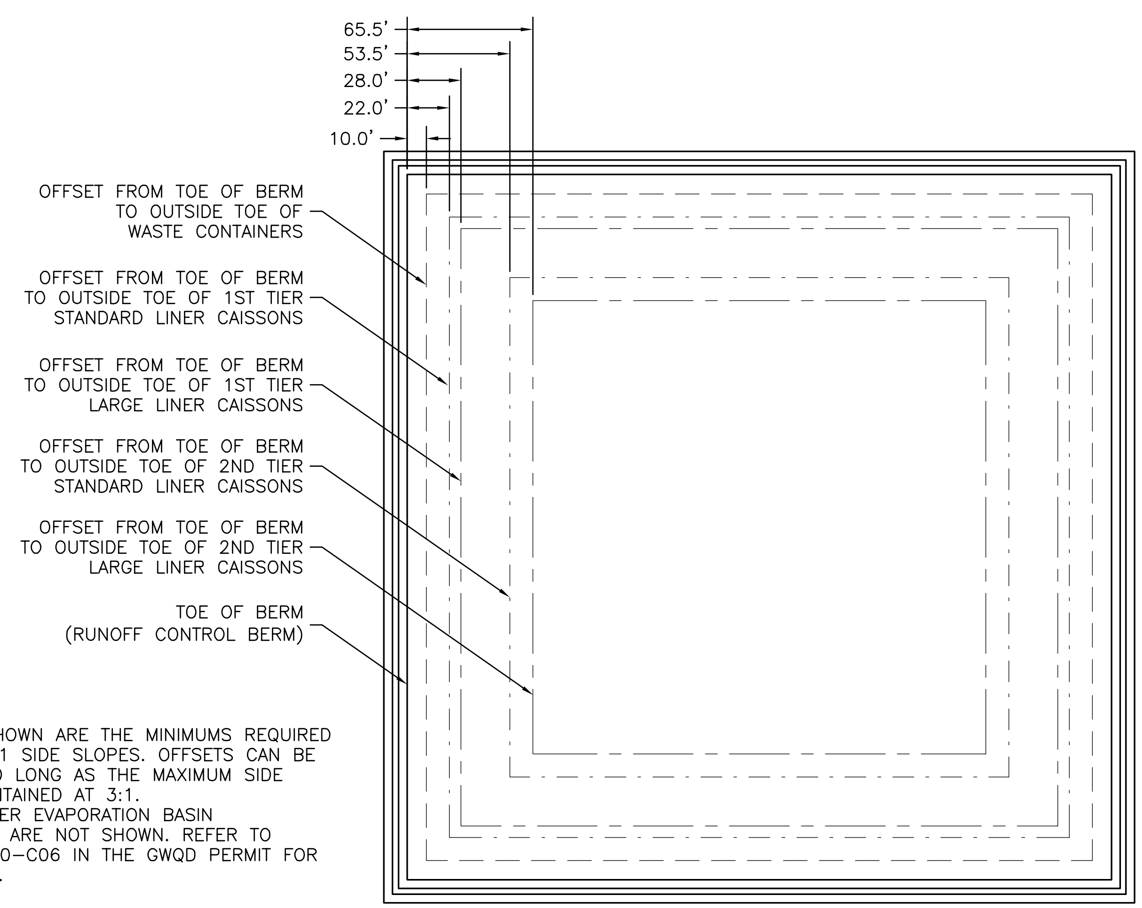
JULY 30, 2008

ENERGYSOLUTIONS



TYPICAL PYRAMID CROSS SECTION

NOTES:
1. DISTANCES AND THICKNESSES SHOWN ARE MINIMUM REQUIREMENTS.
2. LARGE LINERS CAN BE PLACED IN THE SECOND LIFT ABOVE STANDARD LINERS AND VICE-VERSA, AS LONG AS PYRAMID, BACKFILL, INTERMEDIATE SAND AND BACKFILL COVER MINIMUM REQUIREMENTS ARE MET.
3. STAGGER 2ND TIER LINERS OVER 1ST TIER LINERS.
4. REMOVE, IF NEEDED, RUNOFF CONTROL BERM PRIOR TO COMPLETION OF BACKFILL COVER CONSTRUCTION.
5. SIDE SLOPE (3:1) IS VERIFIED BY GPS SURVEY, TYPICALLY AT OR NEAR THE " SLOPE SURVEY CHECK POINTS" SHOWN.
6. REFER TO THE CQA/QC PLAN FOR BACKFILL, INTERMEDIATE SAND AND BACKFILL COVER MATERIAL AND PLACEMENT SPECIFICATIONS.



NOTE:
1. OFFSETS SHOWN ARE THE MINIMUMS REQUIRED TO ASSURE 3:1 SIDE SLOPES. OFFSETS CAN BE INCREASED, SO LONG AS THE MAXIMUM SIDE SLOPE IS MAINTAINED AT 3:1.
2. STORM WATER EVAPORATION BASIN REQUIREMENTS ARE NOT SHOWN. REFER TO DRAWING 04080-C06 IN THE GWQD PERMIT FOR REQUIREMENTS.

TYPICAL CELL PLAN VIEW
NTS

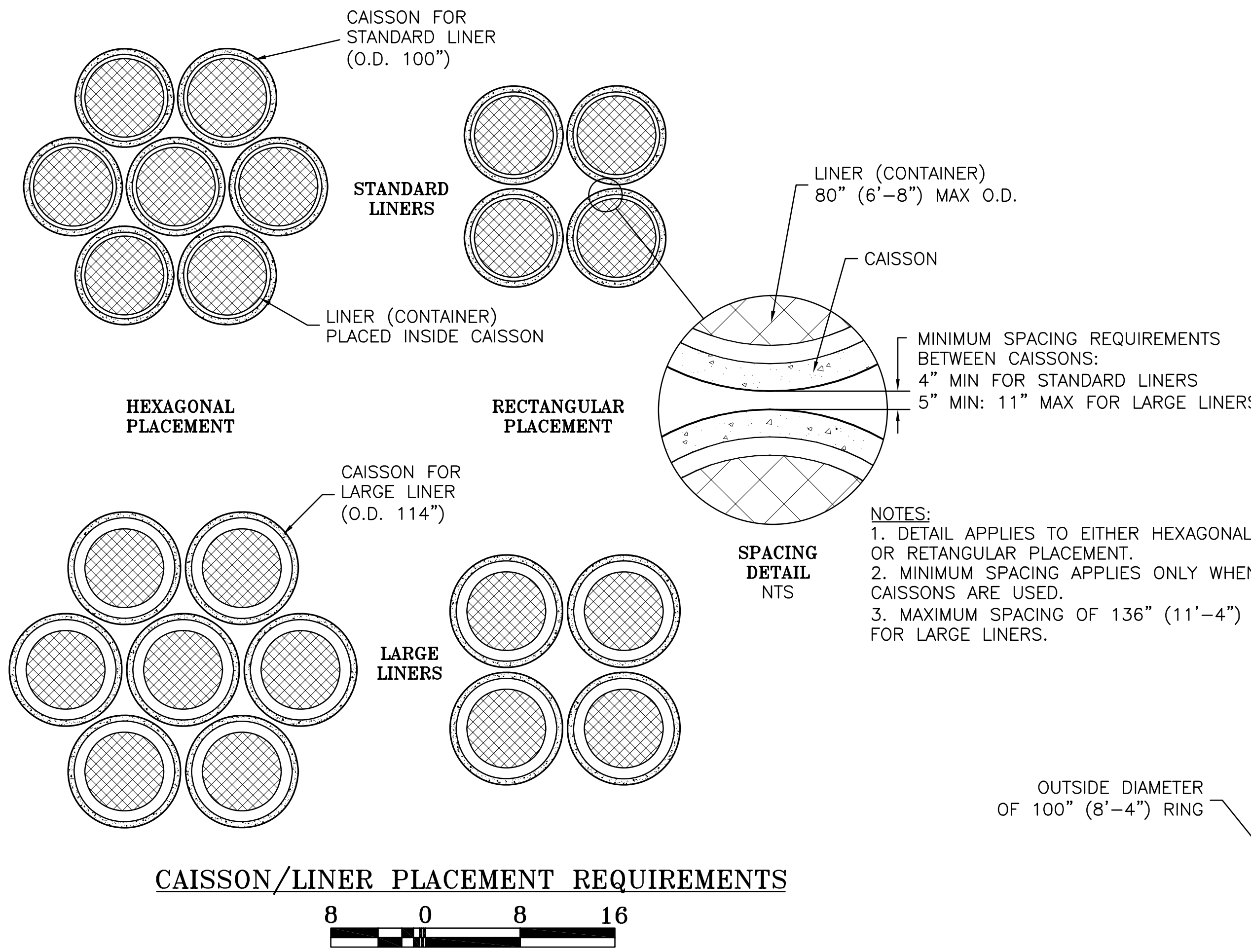
	DATE	BY	DESCRIPTION OF CHANGE
1	10/07	DFB	CQA/QC PLAN REFERENCE – ADDED NOTES AND REMOVED BACKFILL COVER FROM SIDE SLOPES
0	10/07	DFB	FOR CQA/QC PLAN REFERENCE

ENERGYSOLUTIONS

ENERGYSOLUTIONS "CLIVE" FACILITY
CONTAINERIZED WASTE FACILITY (CWF)
CELL CONSTRUCTION REQUIREMENTS, 1 OF 2
CLIVE, UTAH

DRAFTED BY D.BOOTH
REVIEWED BY G.DUTSON
APPROVED BY D.BOOTH
SCALE AS NOTED | DATE 10/10/07 | REV. 1
DRAWING NO.

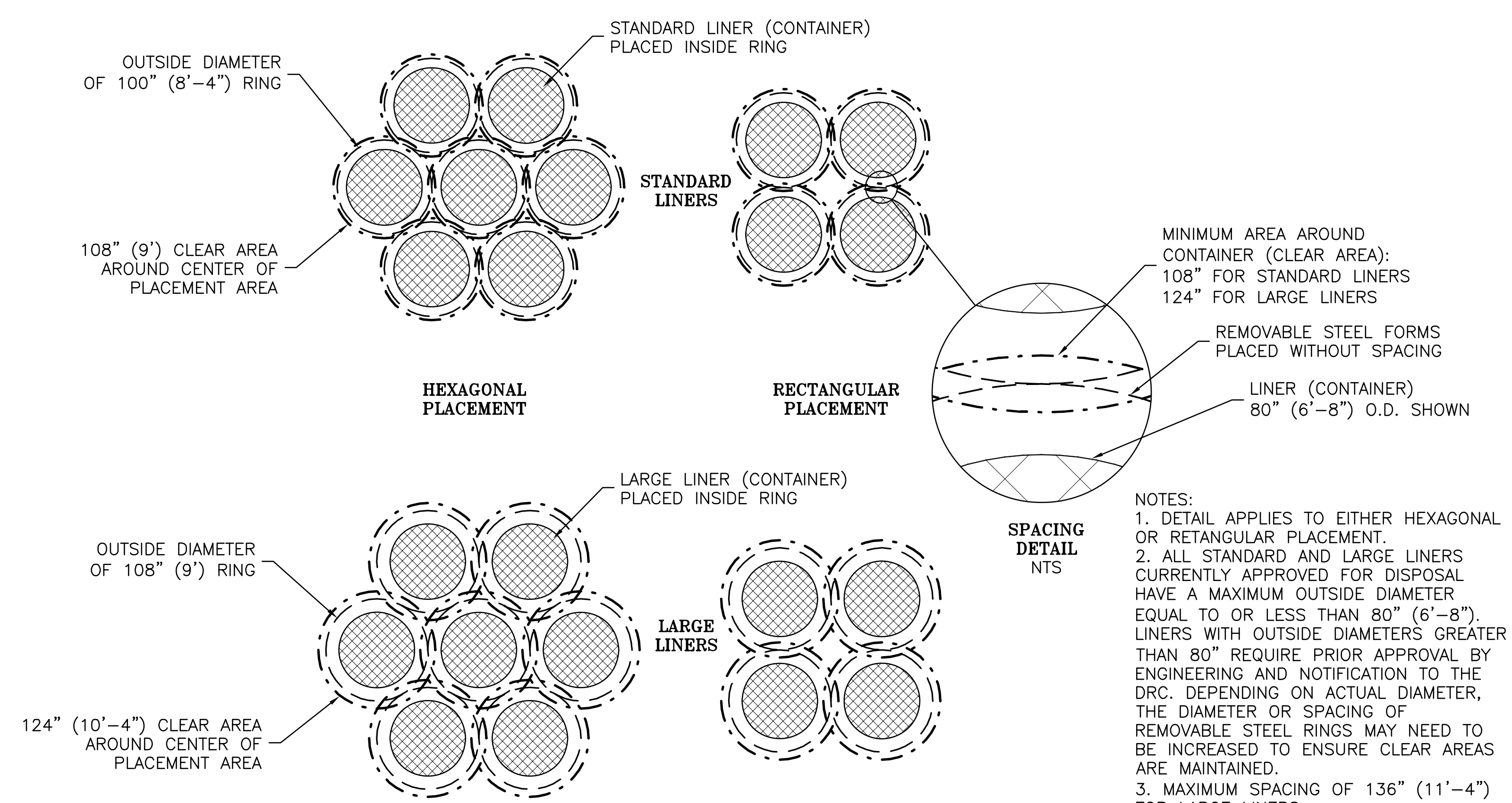
FIGURE 7



NOTES:
1. DETAIL APPLIES TO EITHER HEXAGONAL OR RETANGULAR PLACEMENT.
2. MINIMUM SPACING APPLIES ONLY WHEN CAISSONS ARE USED.
3. MAXIMUM SPACING OF 136" (11'-4") FOR LARGE LINERS.

CAISSON/LINER PLACEMENT REQUIREMENTS

8 0 8 16



NOTES:
1. DETAIL APPLIES TO EITHER HEXAGONAL OR RETANGULAR PLACEMENT.
2. ALL STANDARD AND LARGE LINERS CURRENTLY APPROVED FOR DISPOSAL HAVE A MAXIMUM OUTSIDE DIAMETER EQUAL TO OR LESS THAN 80" (6'-8"). LINERS WITH OUTSIDE DIAMETERS GREATER THAN 80" REQUIRE PRIOR APPROVAL BY ENGINEERING AND NOTIFICATION TO THE DRC. DEPENDING ON ACTUAL DIAMETER, THE DIAMETER OR SPACING OF REMOVABLE STEEL RINGS MAY NEED TO BE INCREASED TO ENSURE CLEAR AREAS ARE MAINTAINED.
3. MAXIMUM SPACING OF 136" (11'-4") FOR LARGE LINERS.

REMOVABLE STEEL FORM/LINER PLACEMENT REQUIREMENTS

8 0 8 16

REV	DATE	BY	DESCRIPTION OF CHANGE
0	10/07	DFB	FOR CQA/QC PLAN REFERENCE

ENERGYSOLUTIONS

ENERGYSOLUTIONS "CLIVE" FACILITY
CONTAINERIZED WASTE FACILITY (CWF)
CELL CONSTRUCTION REQUIREMENTS, 2 OF 2
CLIVE, UTAH

DRAFTED BY: D.BOOTH
REVIEWED BY: G.DUTSON
APPROVED BY: D.BOOTH
SCALE: AS NOTED | DATE: 10/10/07 | REV. 0
DRAWING NO.

FIGURE 8

3b

LLRW & 11E.(2) CONSTRUCTION QUALITY ASSURANCE/QUALITY CONTROL (CQA/QC) MANUAL

CQA/QC DOCUMENTATION FORMS

APPENDIX A

CQA/QC DOCUMENTATION FORMS

EC-1901	Daily Quality Assurance Report
EC-1902	Daily Construction Report
EC-1903	Sample Log
EC-1904	Lift Approval Form
EC-1905	Field Density Test
EC-1906	Field Permeability Test
EC-1907	Aggregate Gradation Form
EC-1908	Soil Classification Form
EC-1909	Standard Proctor Form
EC-98181	CLSM Inspection Form
EC-1923	CLSM Testing Form
EC-1911	Breach of Berm Form
EC-1912	Liner/Radon Barrier Inspection Form
EC-98252	Embankment Construction Lift Approval Form
EC-98225	CWF Lift Approval Form
EC-98039	Disposal Lift Survey Data Form

EC-1901

rev 3

DAILY QUALITY ASSURANCE REPORT

PROJECT: MW ____________ **11e(2)** ____________ **LLRW** ____________ **OTHER** ________________

DATE: ________________

QUALITY ASSURANCE ACTIVITIES: ____

PROBLEMS NOTED: ____

PROBLEM RESOLUTIONS: ____

______________________________ QA OFFICER APPROVAL

______________________________ DATE

DAILY CONSTRUCTION REPORT

PROJECT: CAN ______ MW ______ 11e.(2) ______ CLASS A ______ OTHER ______________________

DATE: ____________________________

WEATHER: Fair: ____ Cloudy: ____ Warm: ____ Rain: ____ Snow: ____ Wind: ____ Other: ____________

CONSTRUCTION OPERATIONS: Waste Placement ______ Cell Excavation ______ Clay Liner ________________

Radon Barrier ______ Rock Placement ______ Other ____

PERSONNEL ON SITE: Operations ____ Others ____________________________

EQUIPMENT USED:

Rock trucks	______	Track hoes	______	Loaders	______	Dozers	______
Locomotives	______	Forklifts	______	Graders	______	Backhoes	______
Sheepsfoot	______	Scrapers	______	Tillers	______	Rollers	______
CAT 815	______	Water trucks	______	CAT 826	______	Other	____________

DAILY PROGRESS MEETING: Yes ______ No ______

LIFTS TESTED: ____

LIFTS APPROVED: ____

EXPLANATIONS:

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FIELD ENGINEER/INSPECTOR ______________________________

QC OFFICER APPROVAL	**DATE**	**QA OFFICER APPROVAL**	**DATE**

ENERGYSOLUTIONS

SAMPLING LOG

PROJECT:____**CAN** ____**MW** ____**11e.(2)** ____**CLASS A** **OTHER**______________________________
DATE:______________________________

INDICATE LOCATION AND NUMBER OF SAMPLE ON MAP

SAMPLE NUMBER:________________________ MATERIAL TYPE: SOIL__________ ROCK __________
LOCATION:____
____
TEST(S) TO BE PERFORMED: SAMPLED BY:________________________
PROCTOR:__________ CLASSIFICATION:__________ LABORATORY PERMEABILITY:__________
NA SOUNDNESS:__________ LA ABRASION:__________ ABSORPTION:__________
SPECIFIC GRAVITY:________ GRADATION:__________
COMMENTS:____
____

SAMPLE NUMBER:________________________ MATERIAL TYPE: SOIL__________ ROCK __________
LOCATION:____
____
TEST(S) TO BE PERFORMED: SAMPLED BY:________________________
PROCTOR:__________ CLASSIFICATION:__________ LABORATORY PERMEABILITY:__________
NA SOUNDNESS:__________ LA ABRASION:__________ ABSORPTION:__________
SPECIFIC GRAVITY:________ GRADATION:__________
COMMENTS:____
____

SAMPLE NUMBER:________________________ MATERIAL TYPE: SOIL__________ ROCK __________
LOCATION:____
____
TEST(S) TO BE PERFORMED: SAMPLED BY:________________________
PROCTOR:__________ CLASSIFICATION:__________ LABORATORY PERMEABILITY:__________
NA SOUNDNESS:__________ LA ABRASION:__________ ABSORPTION:__________
SPECIFIC GRAVITY:________ GRADATION:__________
COMMENTS:____
____

____________________	__________	____________________	__________
QC OFFICER APPROVAL	DATE	QA OFFICER APPROVAL	DATE

ENERGYSOLUTIONS

LIFT APPROVAL FORM

PROJECT: ______ **CAN** ______ **MW** ______ **11e.(2)** ______ **CLASS A** **OTHER** ______

NW CORNER **DATE:** ______

	P 1 ______
	EW: ____ X ____ = ____
	NS: ____ X ____ = ____
	P 2 ______
	EW: ____ X ____ = ____
	NS: ____ X ____ = ____
	P 3 ______
	EW: ____ X ____ = ____
	NS: ____ X ____ = ____
	P 4 ______
	EW: ____ X ____ = ____
	NS: ____ X ____ = ____
	P 5 ______
	EW: ____ X ____ = ____
	NS: ____ X ____ = ____
	Page 2 attached: Y N

IDENTIFY LOTS ABOVE

LIFT ID: ______ NW CORNER: ______ INTERFACE RANDOM #: ______

WASTE GENERATOR ID NUMBER(S) : ______

THICKNESS: UNC: ____ COM: ____ ELEV: ____ Debris Insp. By: ____ Date: ____ Time: ____

DEBRIS CALCULATIONS:

KEYING IN NOTES: N E S W ______ DENSITY TESTS ID # (S): ______

COMMENTS:

LIFT APPROVED BY: ______ DATE: ______ TIME: ______

QC OFFICER APPROVAL ______ DATE ______ QA OFFICER APPROVAL ______ DATE ______

RANDOM NUMBER CONTINUATION SHEET

Date: ______________

Lift ID: ______________ **NW Corner** ______________

P 6 ______ EW: ____ X ____ = ____ NS: ____ X ____ = ____	*P* 14 ______ EW: ____ X ____ = ____ NS: ____ X ____ = ____	*P* 22 ______ EW: ____ X ____ = ____ NS: ____ X ____ = ____
P 7 ______ EW: ____ X ____ = ____ NS: ____ X ____ = ____	*P* 15 ______ EW: ____ X ____ = ____ NS: ____ X ____ = ____	*P* 23 ______ EW: ____ X ____ = ____ NS: ____ X ____ = ____
P 8 ______ EW: ____ X ____ = ____ NS: ____ X ____ = ____	*P* 16 ______ EW: ____ X ____ = ____ NS: ____ X ____ = ____	*P* 24 ______ EW: ____ X ____ = ____ NS: ____ X ____ = ____
P 9 ______ EW: ____ X ____ = ____ NS: ____ X ____ = ____	*P* 17 ______ EW: ____ X ____ = ____ NS: ____ X ____ = ____	*P* 25 ______ EW: ____ X ____ = ____ NS: ____ X ____ = ____
P 10 ______ EW: ____ X ____ = ____ NS: ____ X ____ = ____	*P* 18 ______ EW: ____ X ____ = ____ NS: ____ X ____ = ____	*P* 26 ______ EW: ____ X ____ = ____ NS: ____ X ____ = ____
P 11 ______ EW: ____ X ____ = ____ NS: ____ X ____ = ____	*P* 19 ______ EW: ____ X ____ = ____ NS: ____ X ____ = ____	*P* 27 ______ EW: ____ X ____ = ____ NS: ____ X ____ = ____
P12 ______ EW: ____ X ____ = ____ NS: ____ X ____ = ____	*P20* ______ EW: ____ X ____ = ____ NS: ____ X ____ = ____	*P* 27 ______ EW: ____ X ____ = ____ NS: ____ X ____ = ____
P 13 ______ EW: ____ X ____ = ____ NS: ____ X ____ = ____	*P* 21 ______ EW: ____ X ____ = ____ NS: ____ X ____ = ____	*P* 29 ______ EW: ____ X ____ = ____ NS: ____ X ____ = ____

COMMENTS:

EnergySolutions

FIELD DENSITY TEST

PROJECT: _____ **CAN** _____ **MW** _____ **11e.(2)** _____ **CLASS A** **OTHER** __________________

LIFT IDENTIFICATION: ______________________________ DATE: ________________

TEST ID NUMBER(S): ____

TEST LOCATION: ______________________________ TEST METHOD: _____ D1556 _____ D6938

ASTM D6938 (DENSITY DETERMINATION)

Make/Model ____________ Gauge Serial # ____________

Last Calibration Date: ________________

Daily Standard Counts:

Density ________________ Moisture ____________

_____ *Method A (Direct Transmission)* *or* _____ *Method B (Backscatter)*

Depth Setting _____ *(inches)* Count Time _____ *(minutes)*

Moisture Count __________ Density Count __________

Wet Density (ρ_m) ________ *(lbs/ft^3)* Dry Density ________ *(lbs/ft^3)*

Moisture Density ________ *(lbs/ft^3)* Moisture Fraction ________ *(%)*

MOISTURE DETERMINATION

_____ ASTM D2216 @ 110º C or _____ ASTM D4643

Container ID ______________________

Mass of container & wet specimen ***(M_{cms})***		g
Mass of container & dry specimen ***(M_{cds})***		g
Mass of water ***(M_w)*** ***$M_w = M_{cms} - M_{cds}$***		g
Mass of container ***(M_c)***		g
Mass of dry specimen ***(M_s)*** ***$M_s = M_{cds} - M_c$***		g
Moisture content ***(w)*** ***$w = (M_w / M_s) \times 100$***		%

Dry Density ***$(\rho_d) = (100 \times \rho_m)/(100 + w)$***

ρd = (100 x ________) / (100 + ________ = ____________ *lbs/ft^3*

Note: Wet Density from ASTM D 1556 (ρ_m) takes presidence over ASTM D 6938 (ρ_m)

Percent Compaction = ρ_d / $\gamma_d max$ x 100

_______ / _______ x 100 = ______________ %

ASTM D1556 (DENSITY DETERMINATION)

Testing Apparatus _______ Calibrated Vol. *(lbs/ft^3)* _______

Bulk Density of sand ***(ρ_1)*** ________ *g/cm^3* ________ *lbs/ft^3*

Mass of Sand to Fill Cone & Plate ***(M_2)*** ____________ *g*

Mass of bottle & cone **before** filling cone, plate & hole		g
Mass of bottle & cone **after** filling cone, plate & hole		g
Mass of sand to fill cone, plate, & hole ***(M_1)***		g
Mass of sand to fill hole		g
Mass of wet soil & container		g
Mass of container		g
Mass of wet soil ***(M_3)***		g

Test Hole Volume ***$V = (M_1 - M_2) / \rho_1$*** ________ *cm^3*

Dry Mass of soil ***$M_4 = 100 M_3 / (w + 100)$*** ________ *g*

Wet Denisty ***$\rho_m = (M_3 / V) \times 62.43$*** ________ *lbs/ft^3*

Dry Denisty ***$\rho_d = M_4 / V$*** ________ *g/cm^3*

Dry Unit Weight ***$\gamma_d = \rho_d \times 62.43$*** ________ *lbs/ft^3*

Soil Description: ______________________________

Proctor ID: ______________________

_____ ASTM D698 or _____ ASTM D1557

Maximum Dry Density ***($\gamma_d max$)*** ___________ (lbs/ft^3)

Optimum Moisture ***(w_{opt})*** ___________ (%)

Required Moisture: _______ % to _______ %

Required Percent Compaction: ___________ (%)

Comments:

TEST RESULTS:

________ Pass Date: ________

________ Failed Moisture

________ Failed Compaction Time: ________

By: ____________________ / ____________________
(print) *(signature)*

______________________ QC OFFICER APPROVAL ________ DATE

______________________ QA OFFICER APPROVAL ________ DATE

ENERGYSOLUTIONS

FIELD PERMEABILITY TEST

PROJECT: ______ CAN ______ MW ______ 11e.(2) ______ CLASS A OTHER ______
Test Location: ______ Elevation/Lift ______ Lot No. ______

TESTING DATA: TESTED BY: ______
Soil Saturation Start: Date: ______ Time: ______ Max. Dry Density ______ pcf
Soil Saturation Finish: Date: ______ Time: ______ Opt. Moisture ______ %
Depth of Wet Front Measurements: 1) ______ 2) ______ 3) ______ Density test # ______
Average Depth of Wet Front (L) ______ cm Dry Density ______ pcf
Radius of Measuring Tube (Rt) ______ cm Moisture content ______ %
Radius of Permeameter Ring (Rr) ______ cm Compaction ______ %
Height of Water, (Ht) ______ cm

Soil/Water temp, in ring, after test ______ °C (**N/R for 11e(2)**)

$\frac{dH}{dT} = \frac{\text{Change in Head (cm)}}{\text{Time (minutes)}} = \frac{\_\_\_\_\_\_ \text{ cm}}{\text{min}}$ (dH/dT) = ______ Based on linear regression

R = ______ (From Figure 1) *(R = 1.000 for 11e(2))

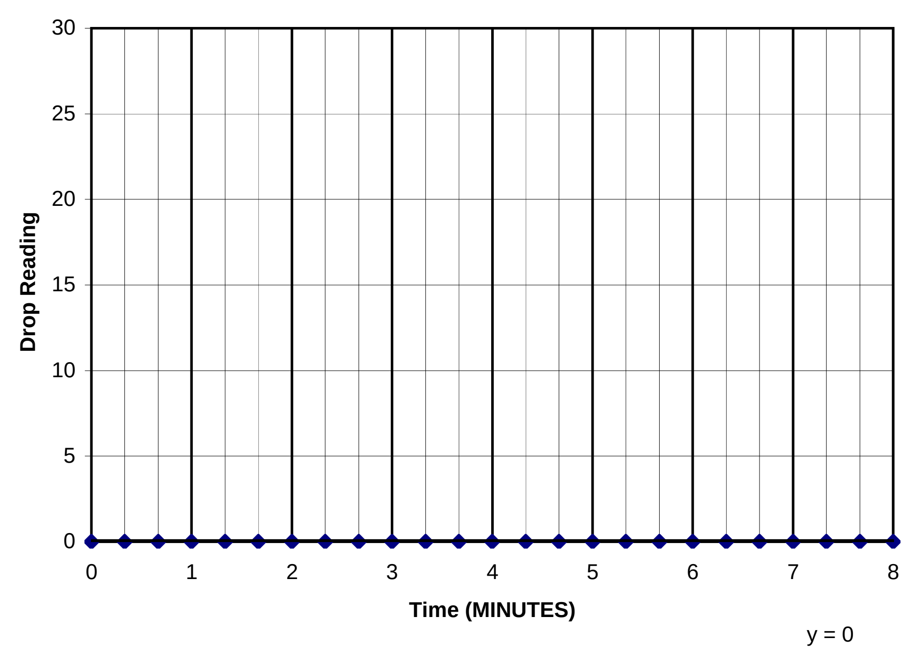
$$K_s = \left[\frac{(2)\quad(dH/dT)\quad(L)}{(60)\,((Ht)+(0.5)(L))}\right]\left[\frac{(Rt)2}{(Rr)2}\right] \text{ X } (R)$$

$$K_s = \left[\frac{(2)(\qquad\qquad)\ (\qquad)}{(60)((\qquad\qquad) + (0.5)\ (\qquad))}\right]\left[\frac{(\qquad)^2}{(\qquad)^2}\right] \text{ X}$$

K_s = ______ cm/sec **Required Permeability:** ______ $\leq 1X10^{-6}$ ______ $\leq 5X10^{-8}$ ______ $\leq 1X10^{-7}$

Timed Water Drop Reading ______ $\leq 5X10^{-7}$ & $\geq 1X10^{-7}$ (11e.(2) Clay liner)

min.		min.	
0:00		4:20	
0:20		4:40	
0:40		5:00	
1:00		5:20	
1:20		5:40	
1:40		6:00	
2:00		6:20	
2:20		6:40	
2:40		7:00	
3:00		7:20	
3:20		7:40	
3:40		8:00	
4:00			



Required Permeability:

______

Actual Permeability:

______

Soil/Water Temp (°C)	Corr. Factor (R)
0	1.783
1	1.723
2	1.664
3	1.611
4	1.560
5	1.511
6	1.465
7	1.421
8	1.379
9	1.339
10	1.301
11	1.265
12	1.230
13	1.197
14	1.165
15	1.135
16	1.106
17	1.077
18	1.051
19	1.025
20	1.000
21	0.976
22	0.953
23	0.931
24	0.910
25	0.889
26	0.869
27	0.850
28	0.832
29	0.814
30	0.797
31	0.780
32	0.764
33	0.749
34	0.733
35	0.719
36	0.705
37	0.692
38	0.678
39	0.665
40	0.653

Figure 1

Test Results: **Pass** **Fail** **By** ______ **Date** ______

______ QC OFFICER APPROVAL ______ DATE ______ QA APPROVAL ______ DATE

ENERGYSOLUTIONS

AGGREGATE GRADATION FORM

PROJECT: _____ **CAN** _____ **MW** _____ **11e.(2)** _____ **CLASS A** **OTHER** ____________

SAMPLE NAME: ______________________________ **DATE:** ____________

GRADATION AS RECEIVED			
SCREEN SIZE	WEIGHT DRY	PERCENT RETAINED	PERCENT PASSING
16”			
12”			
10”			
8”			
6”			
4 1/2”			
4”			
3”			
2”			
1 1/2”			
1”			
3 / 4”			
1 / 2”			
3 / 8”			
#4			
-#4			X
TOTAL DRY MASS			X
#8			
#10			
#16			
#30			
#40			
#50			
#100			
#200			
-#200			X
TOTAL MASS			X

QUALITY OF ROCK DETERMINATION		
TEST	VALUE	WEIGHTED SCORE
SPECIFIC GRAVITY (SSD)		
ABSORPTION		
SODIUM SOUNDNESS		
L.A. ABRASION		

GRADATION TEST RESULTS	
PERCENT GRAVEL	
PERCENT SAND	
PERCENT FINE SAND	
PERCENT SILT & CLAY	
D_{100} =	D_{90} =
D_{85} =	D_{70} =
D_{50} =	D_{15} =
D_{10} =	D_{5} =

QUALITY SCORE =

ROCK PERMEABILITY =

NOTES:

TEST RESULTS: PASS FAIL By: ______________________ Date ________

QC OFFICER APPROVAL ________ DATE ________ QA OFFICER APPROVAL ________ DATE ________

ENERGYSOLUTIONS

SOIL CLASSIFICATION FORM

PROJECT: ____ **CAN** ____ **MW** ____ **11e.(2)** ____ **CLASS A** **Other** ____

SAMPLE NAME: ____ **DATE:** ____

GRADATION AS RECEIVED			
SCREEN SIZE	WEIGHT DRY (g)	PERCENT RETAINED	PERCENT PASSING
3"			
1-1 / 2"			
1"			
3 / 4"			
3 / 8"			
#4	**0.0**	**0**	**100**
-#4	**100.0**	**100**	
TOTAL DRY MASS	**100.0**	**100**	
#8			
#16			
#30			
#40			
#100			
#200			
-#200			
TOTAL MASS			

AS TESTED MOISTURE DETERMINATION		
	+#4	-#4
CONTAINER & WT. AGGREGATE (g)	**N/A**	**N/A**
CONTAINER & DRY AGGREGATE (g)	**N/A**	**N/A**
CONTAINER MASS (g)	**N/A**	**N/A**
PERCENT MOISTURE	**N/A**	**N/A**

GRADATION TEST	
PERCENT GRAVEL	**0**
PERCENT SAND	**N/A**
PERCENT FINE SAND	**N/A**
PERCENT SILT & CLAY	**N/A**

ATTERBERG LIMITS	
LIQUID LIMIT	
PLASTIC LIMIT	
PLASTIC INDEX	
CLASSIFICATION	

Notes:

TEST RESULTS: PASS FAIL By: ____ Date ____

QC OFFICER APPROVAL ____ DATE ____ QA OFFICER APPROVAL ____ DATE ____

STANDARD PROCTOR FORM

(Calculations)

PROJECT: ___ **CAN** ___ **MW** ___ **11E.(2)** ___ **CLASS A** **OTHER** ___________

SAMPLE NAME: ______________________ DATE: ________

Mold ID: ________ METHOD: A B C Estimated Specific Gravity = ______ (G_S)

Mold Vol.: ________

Type of Rammer: ____________ Preparation Method: ______ As Received Water Content ______ %

Test Number	1	2	3	4	5	6	7
Water Added							
Cylinder & Soil Wt.							
Cylinder Wt.							
Wet Soil Wt.							
Wet Density (lbs/ft^3)							

ASTM D2216 *(110º C ± 5º C)*

Container Number							
Container & Wet Soil Weight (g)							
Container & Dry Soil Weight (g)							
Water Weight (g)							
Container & Dry Soil Weight (g)							
Container Weight (g)							
Dry Soil Weight							
Moisture Content (% of Dry Weight)							
Dry Density (lbs/ft^3)							

$$\text{Wet Density} = \frac{\text{Wet Soil Weight}}{\text{Volume of the mold}}$$

$$\text{Dry Density} = \frac{\text{Wet Density x 100}}{\text{100 + \% moisture}}$$

TESTED BY: ______________________ DATE: ________

QC OFFICER APPROVAL ________ DATE ________ QA OFFICER APPROVAL ________ DATE ________

ENERGYSOLUTIONS

STANDARD PROCTOR FORM
(Graph)

PROJECT: _____ **CAN** _____ **MW** _____ **11E.(2)** _____ **CLASS A** **OTHER** __________

SAMPLE NAME: ______________________________ DATE: ________

ASTM D-698 METHOD: A B C

P_C = #REF! % P_F = #REF! %

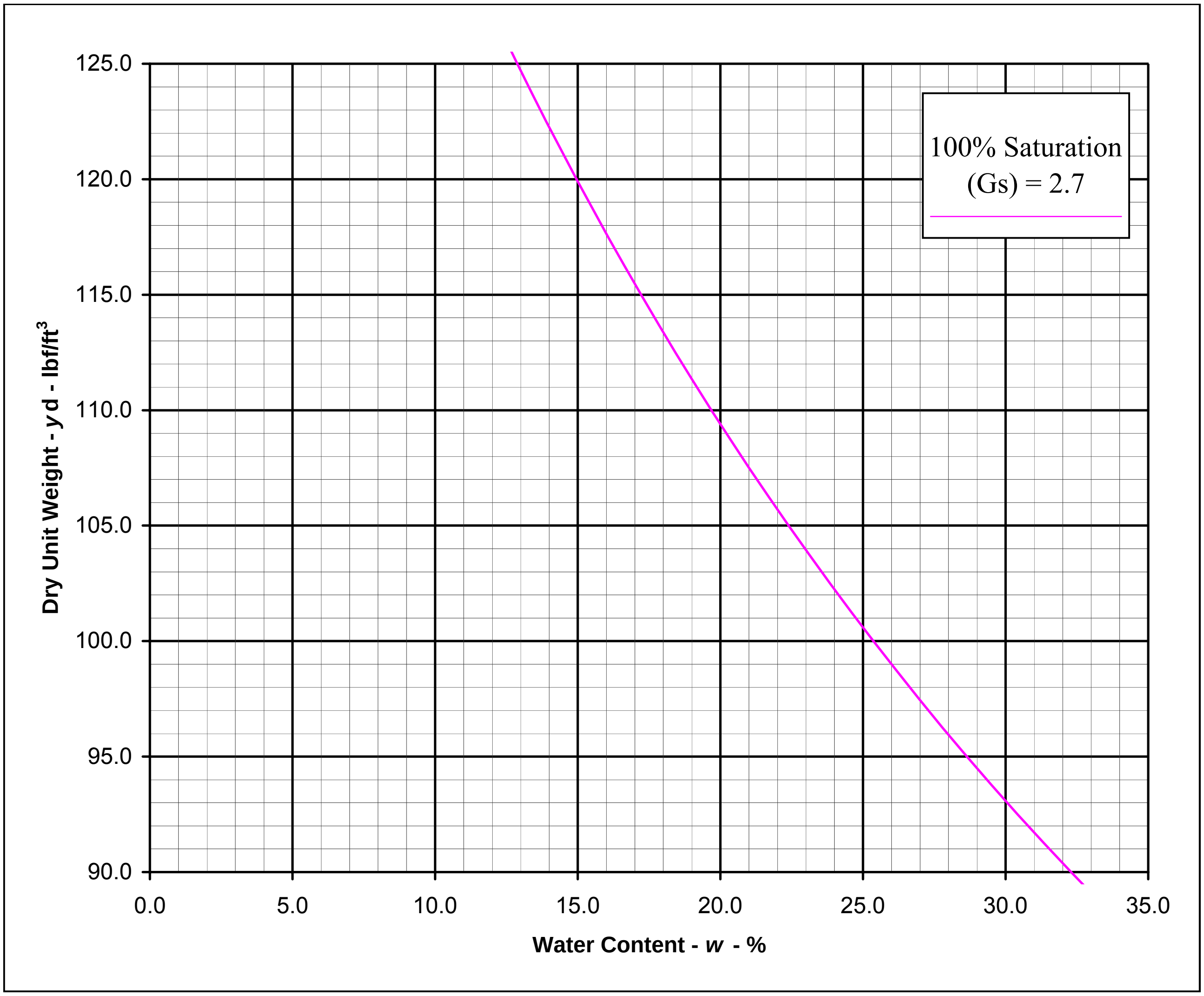
STANDARD MAX. DRY UNIT WEIGHT (Std-$\gamma_{d,max}$): ______ lbf/ft^3

STANDARD OPTIMUM WATER CONTENT (Std-w^{opt}): ______ %

OVERSIZED CORRECTION

CORR. MAX. DRY UNIT WEIGHT (Std-$\gamma_{d,max}$): ______ lbf/ft^3

CORR. OPTIMUM WATER CONTENT (Std-w^{opt}): ______ %



TESTED BY: ______________________________ DATE: ________

QC OFFICER APPROVAL ________ DATE ________ QA OFFICER APPROVAL ________ DATE ________

ENERGYSOLUTIONS

CLSM INSPECTION FORM

PROJECT:____CAN ____MW ____11e.(2) ____CLASS A OTHER (specify) ____________

Lift Identification____ Date:_______________

TYPES OF DEBRIS TO BE POURED (circle):

Uncontainerized Debris   Debris-Filled Containers (excluding drums)   Debris-Filled Drums

Resin-Filled Containers   Soil-Filled or Fines-Filled Containers   Other specify)_____________________

GENERAL:

____________ The height of the pour is ≤ the height of one layer of boxes plus six inches (6”).

____________ Compressible debris has been secured (i.e., using incompressible debris) to prevent floating.

____________ Engineering review has been performed for objects greater than 100,000 lbs (attached).

____________ Are there any special design mix specifications for this pour? (If yes, see attached Engineering Review)

____________ A gradation has been performed for the CLSM sand stockpile (at least monthly).

INSPECT FOR VOIDS/ACCESSIBILITY:

____________ Any wrapping/plastic has been removed from all openings to allow the CLSM to flow into all void spaces.

____________ Debris has been placed in a manner to allow flow throughout pour area and prevent nesting, voids, or only partial fill of internal voids of individual debris.

____________ Any pieces of debris with internal voids that cannot be filled readily with CLSM have been inspected and approved by the Site Engineer, if any.

____________ Pour area is free from collapsed soil around the perimeter of the formed pour.

____________ Base of pour is sufficiently compacted and free of loose soil.

UNCONTAINERIZED DEBRIS:

____________ Wood has been spread out throughout to prevent localized stacking or concentration of wood debris.

DEBRIS-FILLED CONTAINERS (excluding drums):

____________ Containers have had their lids removed (unless exempted by DRC for ALARA reasons).

____________ All containers have a minimum of two holes at the bottom of the container.

____________ Any densely packed containers that potentially will not allow CLSM to flow throughout the container have had flowability tests performed on them.

Flowability results: ____

____

____

____________ Containers have been filled to minimize quantity of CLSM required.

____________ Containers that contain primarily wood have been removed.

CLSM INSPECTION FORM (continued)

DEBRIS-FILLED DRUMS:

_____________ Lids have been removed or a hole pierced into the lid with a minimum dimension of 2" X 4" to allow flow into the container.

_____________ Any drums containing compressible debris with the lids remaining have been segregated and formed to allow required 6" CLSM cap.

RESIN-FILLED CONTAINERS

_____________ Containers are only constructed of steel or poly.

_____________ 24-hr advance notification for filling head space voids made to DRC on ________________.

_____________ Head space of containers has been filled with inert material. *(CLSM **shall not** be used to fill headspace void.)*

Head space void has been filled with ____.

_____________ Lids have been replaced on the container and latched, banded, or otherwise secured.

_____________ The container is watertight. (i.e., secured ring around the lid of a drum, a flexible gasket placed between the lid and the container, or is otherwise sealed).

_____________ Containers have been clearly marked "RESIN" on lids and sides to identify resin-filled containers in the pour and prevent operators from punching holes in the containers.

_____________ Resin-filled containers have **not** been placed directly adjacent to each other within the CLSM pour.

_____________ Volume of resins have been calculated and determined to be $\leq$ 25 % of the total volume of the CLSM pour. Total volume of resins (R) = ______________ ft^3. Estimated volume of the CLSM pour (V) = ______________ ft^3. (R / V) x 100 = _____________%.

(If the completed total volume of the CLSM pour is $\leq$ the estimated volume of the CLSM pour, the percentage of resins shall be recalculated on the Lift Approval Form to ensure that the volume of resins is $\leq$ 25 % of the total volume of the CLSM pour.)

_____________ Containers have been surveyed (attach survey report).

_____________ Containers have **not** been placed directly above resin-filled containers in previous lifts within the CLSM pyramid (provide locations of previously poured resin-filled containers directly below this CLSM pour area on the attached survey report, if any).

SOIL-FILLED OR FINES-FILLED CONTAINERS

_____________ Containers with compressible debris have $\leq$ 10 % of the volume of the filled container and the total debris quantity is $\leq$ 25 % of the volume of the filled container.

_____________ Lids have been removed or a hole pierced into the lid with a minimum dimension of 2" X 4" to allow flow into the container.

_____________ Any soil-filled containers containing compressible debris with the lids remaining have been segregated and formed to allow required 6" CLSM cap.

_____________ Containers that cannot be entirely in-filled with CLSM have been removed or dumped out in a compactable soil lift.

CLSM INSPECTION FORM (continued)

MISCELLANEOUS

_____________ Photos taken of CLSM pour (attached).

48-hr Advanced Notification of the CLSM Pour Made to DRC on __________________________.

CLSM pour started on_____________________________________.

COMMENTS

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___________________________	_______	___________________________	_______
QC Inspector Approval	Date	QC Officer Approval	Date

ENERGYSOLUTIONS

CLSM TESTING FORM

PROJECT:_____CAN _____MW _____11e.(2) _____CLASS A OTHER (specify) ____________________

Lift Identification_________________________ Sample ID______________________________ Date:______________

_______ Initial Screening Test or _______ Load Acceptance Test

Design Mix Number____ Load Number_____________________

Ambient Temperature________________ Sample Temperature_______________ Water Added On-Site_____________

UNIT WEIGHT TEST *(ASTM D6023)*

Volume of Measure (V)__________________________ Weight of Measure (W)_______________________________

Start Time of Test________________________________ Time of weight measurement___________________________

Weight of Measure with CLSM (MC) ___________g or lbs CLSM Weight (WC) = [MC - W] =_________g or lbs

CLSM Unit Weight = [WC / V] = ___________________lb/ft^3 QC Technician_________________________________

FLOW CONSISTENCY TEST *(ASTM D6103)*

Time Sample Taken _____________________________ Start Time of Test ______________________________

QC Technician _________________________________

First Measurement (F) _________ Second Measurement (S) __________ Average Measurement [(F+S)/2] ____________

COLD WEATHER REQUIREMENTS (if less than 35° F ambient temp)

___________ Moisture/density test performed on adjacent soil (for soil base pour area)

___________ CLSM heated to above 50 degrees F

___________ Sufficient tenting/coverings available to completely cover and keep CLSM above 40^0 F

Initial temperature of in-place CLSM: __________ Time: ____________

Subsequent measurements of CLSM

Temperature ________________ Time: ______________ Temperature ____________________ Time: ______________

Temperature ________________ Time: ______________ Temperature ____________________ Time: ______________

___________ CLSM pour is adequately tented and heated or covered with concrete blankets to keep CLSM warm.

Final 24-hr Measurement of CLSM

Temperature: _______________ Time: ______________ For CLSM Placed on: ____________________

COMMENTS/EXPLANATIONS:____

____

____

____

____

QC OFFICER APPROVAL	DATE	QA APPROVAL	DATE

BREACH OF BERM

PROJECT: ____CAN ____MW ____11e.(2) ____CLASS A OTHER________________

LOCATION OF BERM:____

____

Sketch location (if needed)

TYPE OF BREACH:

______ Permanent removal of berm, or

______ Temporary removal of berm

ACTION:

______ New and / or temporary berms have been inspected and permission is granted to breach the berm.

______ The breach and repair of the berm will be accomplished during one shift; therefore, no temporary berms are required. Permission is granted to breach the berm for one shift on _________________.
Date

______ Permission to breach the berm is denied because _________________________

____

________________________________ ________________________________
QC OFFICER APPROVAL Date

ENERGYSOLUTIONS

LINER / RADON BARRIER
INSPECTION FORM

PROJECT: CAN_____ CLASS A_____ MW____ 11e(2)_____ Other (Specify)________________

LOCATION OF LINER / RADON BARRIER:____

____

COMMENTS:____

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______________________________ ______________________

Energy*Solutions* Date

COMMENTS:____

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______________________________ ______________________

DRC Date

ENERGYSOLUTIONS

FIELD DENSITY TEST

PROJECT: _____ **CAN** _____ **MW** _____ **11e.(2)** _____ **CLASS A** **OTHER** __________

LIFT IDENTIFICATION: __________ DATE: __________

TEST ID NUMBER(S): __________

TEST LOCATION: __________ TEST METHOD: _____ D1556 _____ D6938

ASTM D6938 (DENSITY DETERMINATION)

Make/Model __________ Gauge Serial # __________

Last Calibration Date: __________

Daily Standard Counts:

Density __________ Moisture __________

_____ *Method A (Direct Transmission)* *or* _____ *Method B (Backscatter)*

Depth Setting _____ *(inches)* Count Time _____ *(minutes)*

Moisture Count __________ Density Count __________

Wet Density (ρ_m) __________ *(lbs/ft^3)* Dry Density __________ *(lbs/ft^3)*

Moisture Density __________ *(lbs/ft^3)* Moisture Fraction __________ *(%)*

MOISTURE DETERMINATION

_____ ASTM D2216 @ 110º C or _____ ASTM D4643

Container ID __________

Mass of container & wet specimen (M_{cms})		g
Mass of container & dry specimen (M_{cds})		g
Mass of water (M_w) $M_w = M_{cms} - M_{cds}$		g
Mass of container (M_c)		g
Mass of dry specimen (M_s) $M_s = M_{cds} - M_c$		g
Moisture content (*w*) $w = (M_w / M_s) \times 100$		%

Dry Density $(\rho_d) = (100 \times \rho_m)/(100 + w)$

ρd = (100 x _____) / (100 + _____ = __________ *lbs/ft^3*

Note: Wet Density from ASTM D 1556 (ρ_m) takes presidence over ASTM D 6938 (ρ_m)

Percent Compaction = $\rho_d \;/\; \gamma_d max \times 100$

_____ / _____ x 100 = __________ %

ASTM D1556 (DENSITY DETERMINATION)

Testing Apparatus _____ Calibrated Vol. *(lbs/ft^3)* _____

Bulk Density of sand (ρ_1) _____ *g/cm^3* _____ *lbs/ft^3*

Mass of Sand to Fill Cone & Plate (M_2) _____ *g*

Mass of bottle & cone **before** filling cone, plate & hole		g
Mass of bottle & cone **after** filling cone, plate & hole		g
Mass of sand to fill cone, plate, & hole (M_1)		g
Mass of sand to fill hole		g
Mass of wet soil & container		g
Mass of container		g
Mass of wet soil (M_3)		g

Test Hole Volume
$V = (M_1 - M_2) / \rho_1$ _____ *cm^3*

Dry Mass of soil
$M_4 = 100\, M_3 / (w + 100)$ _____ *g*

Wet Denisty
$\rho_m = (M_3 / V) \times 62.43$ _____ *lbs/ft^3*

Dry Denisty
$\rho_d = M_4 / V$ _____ *g/cm^3*

Dry Unit Weight
$\gamma_d = \rho_d \times 62.43$ _____ *lbs/ft^3*

Soil Description: __________

Proctor ID: **S5060511**

_____ ASTM D698 or _____ ASTM D1557

Maximum Dry Density ($\gamma_d max$) **127.7** (lbs/ft^3)

Optimum Moisture (w_{opt}) **8.5** (%)

Required Moisture: **FALSE** % to **FALSE** %

Required Percent Compaction: **FALSE** (%)

Comments:

TEST RESULTS:

_____ Pass Date: _____

X Failed Moisture

X Failed Compaction Time: _____

By: __________ / __________
(print) *(signature)*

__________ QC OFFICER APPROVAL __________ DATE __________ QA OFFICER APPROVAL __________ DATE

CWF LIFT APPROVAL FORM

PROJECT: ______CAN ______CLASS A OTHER (specify) ______________________________

NW CORNER **DATE:______________________**

	P_1 ______________________ EW:________ X ________ =________ NS: ________ X ________ =________
	P_2 ______________________ EW:________ X ________ =________ NS: ________ X ________ =________
	P_3 ______________________ EW:________ X ________ =________ NS: ________ X ________ =________
	P_4 ______________________ EW:________ X ________ =________ NS: ________ X ________ =________
	P_5 ______________________ EW:________ X ________ =________ NS: ________ X ________ =________ Page 2 attached: Y N

IDENTIFY LIFT CONFIGURATION ABOVE

LIFT ID:______________________ NW CORNER:__________________________ BASE LIFT ELEVATION:____________

WASTE GENERATOR ID NUMBER(S) :____

TOTAL ACTIVE PLACEMENT AREA SINCE LAST MOISTURE/DENSITY TEST: ___________________

NEW ACTIVE PLACEMENT AREA (INCLUDING THIS LIFT): _______________________

Loose 6" Sand Inspection Results (including initials/date): ____

Container Placement Inspection Results (including initials/date): ______________________________________

Moisture content testing for backfill performed each day of backfilling and meets requirements (attach results). Inspector:____________

Backfilled Containers Inspection Results (including initials/date): ______________________________________

Backfill Inspection Results following Consolildation/Vibration (including initials/date): ____________________________

Observation Results from Compaction of Intermediate Sand (including initials/date): _________________________

INTERMEDIATE SAND THICKNESS:______________ BACKFILL COVER THICKESS:________________

Observation Results from Compaction of Backfill Cover (including initials/date): _____________________________

DENSITY TESTS ID # (S): _______________________________________

COMMENTS:____

____

____

____

____

LIFT APPROVED BY:________________________________ DATE:________________________ TIME: _____________

_____________________________ ________________ ______________________________ _______________

QC OFFICER APPROVAL DATE QA OFFICER APPROVAL DATE

DISPOSAL LIFT SURVEY DATA FORM

Compacted Survey

Lift Number: ________________________ Date______________________

Benchmark Elevation: _________________
Backsight Reading: ___________________
Instrument Elevation: _________________
$\overline{X}$ Average: __________________________
Lift Surface Elevation: ________________
Last Lift Elevation: ___________________
Lift Thickness:________________________
Benchmark Closure Reading: ___________

Surveyed by:_________________________

Date:________________

Verified by[1]:_________________________

Date:________________________

Indicate survey points as X

Compacted Survey

Lift Number: _________________________ Date______________________

Benchmark Elevation: _________________
Backsight Reading: ___________________
Instrument Elevation: _________________
$\overline{X}$ Average: __________________________
Lift Surface Elevation: _________________
Last Lift Elevation: ___________________
Lift Thickness: _______________________
Benchmark Closure Reading: ___________

Surveyed by: _________________________

Date: _________________________

Verified by[1]:_________________________

Date:_________________________

Indicate survey points as X

Comments: ____

____

____

[1]Note: Survey data is to be reviewed at least weekly to verify the accuracy of any calculations performed. Verification may not be performed by the same individual who performed the original survey.

3c

LLRW & 11E.(2) CONSTRUCTION QUALITY ASSURANCE/QUALITY CONTROL (CQA/QC) MANUAL

TESTING METHODS

TESTING METHODS

ASTM C 88	Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 117	Standard Test Method for Materials Finer than 75-μm (No. 200) Sieve in Mineral Aggregate by Washing
ASTM C 127	Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate
ASTM C 128	Standard Test Method for Specific Gravity and Absorption of Fine Aggregate
ASTM C 131	Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C 535	Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 702	Standard Practice for Reducing Field Samples of Aggregate to Testing Size
ASTM C 939	Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)
ASTM D 75	Standard Practice for Sampling Aggregates
ASTM D 422	Standard Test Method for Particle-Size Analysis of Soils
ASTM D 698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))
ASTM D 1140	Standard Test Method for Amount of Material in Soils Finer than the No. 200 (74-μm)
ASTM D 1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1587	Standard Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes

ASTM D 2216	Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 2325	Standard Test Method for Capillary-Moisture Relationships for Coarse- and Medium-Textured Soils by Porous-Plate Apparatus
ASTM D 2434	Standard Test Method for Permeability of Granular Soils (Constant Head)
ASTM D 2487	Standard Practice for Standard Classification of Soils for Engineering Purposes (Unified Soils Classification System)
ASTM D 2488	Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)
ASTM D 3152	Standard Test Method for Capillary-Moisture Relationships for Fine-Textured Soils by Pressure-Membrane Apparatus
ASTM D 4318	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D 4643	Standard Test Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Method
ASTM D 4718	Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles
ASTM D 4959	Standard Test Method for Determination of Water (Moisture) Content of Soil by Direct Heating
ASTM D 5084	Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D 5519	Standard Test Method for Particle Size Analysis of Natural and Man-Made Riprap Materials
ASTM D 6023	Standard Test Method for Unit Weight, Yield, Cement Content, and Air Content (Gravimetric) of Controlled Low Strength Material (CLSM)
ASTM D 6938	Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

Soil Science Society of America, Methods of Soil Analysis: Part 1, (MOSA) Chapter 26, "Water Retention: Laboratory Methods," A. Klute

"Procedures for Sealed Single Ring Infiltrometer Field Permeability Test"

"Efflux Test"

"Slump Test"

"Containerized Waste Facility Waste Placement Test Pad Destructive Testing"

PROCEDURES FOR SEALED SINGLE RING INFILTROMETER FIELD PERMEABILITY TEST

The sealed single ring infiltrometer testing procedure for field permeability testing is as follows:

1. Equipment

   a. Metal Ring – With a minimum area of 1294 cm^2. The bottom of the ring is beveled for a cutting edge. A flange welded to the top of the metal ring is provided to allow connection of a lid.
   b. Lid – Cover for the metal ring. Provided with a gasket to seal the cover to the ring flange. Also provided with a nipple to connect a water supply hose and a vent valve.
   c. Water Reservoir – Supplies water for the saturation portion of the test. Connects to the lid and the readout tube.
   d. Readout Tube – Approximately .32 cm diameter to measure the flow of water into the system.
   e. Stand – Method to support the water reservoir and the readout tube.
   f. Static Weight Penetrometer – The probe construction will be a stainless steel rod with a quarter (1/4) inch nominal diameter and a flat tip. The probe will have a weight such that the minimum tip pressure is one hundred pounds per square inch (100 psi).

2. Testing Procedure

   a. Metal rings with a minimum radius of 20.3 cm will be utilized for permeability testing during test pad construction.
   b. Prepare the area to be tested by smoothing the ground surface and removing any loose or disturbed soil.
   c. Place the metal ring on the area prepared. Push the metal ring at least 15.2 cm into the soil.
   d. Remove any soil disturbed from inside the metal ring by the insertion process.
   e. Seal the inside of the metal ring by compacting the soil immediately adjacent to the ring.
   f. Place a small plate on the soil surface and pour water over the plate into the ring, filling the ring with water to within approximately 1.3 cm of the top of the ring.
   g. Place the lid on the ring and seal with clamps or other devices.
   h. Connect the water reservoir and readout tube to the lid and set on support stand.
   i. Fill the system with water, filling the ring, reservoir and all hoses.
   j. Secure the reservoir at least 91.4 cm above the ring.

k. Allow the water to permeate into the soil for a minimum of 4 hours (For test pads only: Minimum 0.76 cm wet front depth for each wet front depth test. The average wet front depth for all nine SSRI tests performed for each test pad must be at least 0.86 cm).

l. Fill the readout tube with water and secure the readout tube so that the water level in the tube is approximately 152.4 cm above the ring. Allow the readings to stabilize prior to starting the test. The water level shall be greater than or equal to 121.9 cm when the test starts. Record the initial height of the water above the soil surface inside the ring.

m. Record the water level in the readout tube every 20 seconds for 8 minutes. Plot the water drop over time.

n. Dismantle the system and measure the temperature at the soil-water interface (inside the ring, measured in °C). The appropriate Temperature Correction Factor shall be identified from Figure 1 of Envirocare's Field Permeability Test Form EC-1906, or from Table 1 of ASTM D 5084. Then measure the depth that the water penetrated into the soil, using the static weight penetrometer. The average of at least three wet front depth tests shall be used for calculating the water penetration depth.

o. Calculate the Change in Head during the test based on a linear interpretation of the plotted results. None of the full 8 minutes of the plotted test results can deviate significantly from the linear interpretation.

p. Calculate the permeability.

3. Documentation

Record the following items: (Record all length measurements in cm)

a. Date and time soil saturation began and when permeability test readings were taken.
b. Test location and elevation.
c. Timed water drop readings.
d. Height of water at beginning of readings.
e. Size of ring and readout tube (if required).
f. Soil-water interface temperature.
g. Average depth of wet front.
h. Plot of water level drop with time.
i. Plot the linear interpretation of water level drop with time. (The entire 8 minutes must approximately correspond to linear interpretation)
j. Calculated permeability.

EFFLUX TEST

1. Equipment needed:

   a. Flow cone - Cone with a 7 inch top diameter, 12 inch height, volume for CLSM fill of 1725 cm^3, and a discharge tube at the bottom. The cone must also have a point gage to measure the height of grout in the cone.
   b. Receiving container - A container of at least 2000 cm^3 volume.
   c. Ring stand - Firm stand or other similar device capable of supporting the flow cone in a vertical, steady position over the receiving container.
   d. Level
   e. Watch
   f. Stop Watch (if watch does not incluce a stop watch function with .2 accuracy)
   g. Scoop
   h. Pen
   i. Thermometer
   j. Beaker of 2000 ml volume or greater

2. Procedure

   a. Mount the flow cone firmly so it is free of vibration.
   b. Close the outlet of the discharge tube with a finger or stopper.
   c. Fill the cone with 1725 cm^3 of water and adjust the point gage to indicate the level of the water surface. Then allow the water to drain.
   d. Obtain a sample of CLSM from the mix and record the time.
   e. Close the outlet of the discharge tube with a finger or stopper and fill the cone until the CLSM surface rises to contact the point gage.
   f. Start the stop watch and simultaneously remove the finger or stopper.
   g. Stop the watch at the first break in the continuous flow of CLSM from the discharge tube, then look into the cone;

      1) if light is visible, the time indicated by the stop watch is the efflux of the grout.

      2) if light is not visible, the flow cone test is invalid and must be repeated. Adjust the load mix's water/cement ratio (if necessary) and/or cement additive (admix) concentration. Repeat the test beginning with step 2.d and/or adjust the load mix until a valid test is performed and record the indicated value as the efflux time.

      Note: If after three tests a valid test has still not been performed, the flow cone test is not applicable for grout of this consistency and the slump test may then be used as an indicator of flowability.

3. Documentation

   a. Date and the time the sample was taken from the mix.
   b. Sample ID number and lift the CLSM will be placed in.
   c. The design mix number and load number.
   d. CLSM temperature.
   e. Ambient temperature
   f. Starting time for the test performed.
   g. Efflux time from a passing test or justification for why the flow cone test cannot be used for the CLSM.

SLUMP TEST

1. Equipment needed:

   a. Mold - Shall be in the form of a cone with an 8 in. base diameter, 4 in. top diameter, and 12 in. height (dimensions according to ASTM C 143-90a).
   b. Tamping Rod - Rod with dimensions according to ASTM C 143-90a.
   c. Measuring device
   d. Pen
   e. Shovel or scoop
   f. Watch
   g. Thermometer

2. Testing Procedure:

   a. Obtain a sample from the CLSM to be poured.
   b. Dampen the mold and place it on a flat, moist, rigid surface.
   c. Hold the mold firmly in place by standing on the two foot pieces.
   d. Fill the mold one-third full and rod the CLSM with 25 strokes of the tamping rod. Distribute the strokes uniformly over the entire layer.
   e. Create another layer by adding CLSM until the mold is approximately 2/3 full and rod the layer throughout its depth so that the strokes just penetrate into the underlying layer.
   f. Complete the final layer by filling the cone above the top rim and rod the final layer as outlined above, making sure the CLSM does not fall below the rim. If the CLSM does fall below the top rim, add additional fill and re-rod the final layer.
   g. Strike off the top surface of the CLSM with the tamping rod until flush.
   h. Remove the mold immediately from the CLSM by raising it vertically in a smooth, uninterrupted motion (avoid any lateral or twisting motion). The time elapsed for cone removal should be approximately 5 seconds.
   i. Immediately place the cone next to the CLSM and measure the vertical difference between the top of the mold and the top center of the displaced CLSM. The measured difference is the slump of the CLSM.

3. Documentation

   Record the following items:

   a. Date and the time the sample was taken from the mix.
   b. Sample ID number and lift the CLSM will be placed in.
   c. The design mix number and load number.
   d. CLSM temperature.
   e. Starting time for the test performed.
   f. Slump, in terms of inches, to the nearest 1/4 inch.

Test Method

Containerized Waste Facility Waste Placement Test Pad Destructive Testing

1. Equipment Needed
   a) Balance
   b) Density cylinders
   c) Shovel or scoop
   d) Pen
   e) Watch
   f) Tape measure
   g) Ruler
   h) Oven
   i) Moisture content dishes
   j) Moisture sample plastic bags

2. Procedure
   a) Weigh empty density cylinders and record volume. Assign a unique ID number to each cylinder.
   b) Place at least four cylinders within the test pad during test pad construction. Cylinder placement shall be chosen to ensure representative sampling of the backfill density. Record the location of each density cylinder.
   c) Complete construction of the backfill test pad in accordance with the CQA Plan and the test pad construction plan.
   d) Accurately measure the dimensions (H x W x L) of the backfill test pad. Calculate the total volume of the backfill test pad. Do not include the backfill soil cover in this volume.
   e) Complete construction of the backfill cover test lift in accordance with the CQA Plan and the backfill cover test lift construction plan.
   f) Deconstruct the backfill test pad and backfill cover test lift:
      i. Carefully remove framing on one face of the test pad.
      ii. Closely observe the test pad and note any voids created during form removal or subsequent container removal (that is, flowable backfill moving into the newly-created open space as the form is removed). Estimate from the visual observation the length, width, and depth of these voids. Record these dimensions and the location.
      iii. Inspect the exposed backfill for voids within the test pad. Measure each external void and record the location, average length, average width, and average depth.
      iv. Carefully remove any loose material in order to inspect the base of the containers.
      v. Inspect backfill surrounding the base of the containers for voids. Measure each external void and record the location, average length, average width, and average depth.
      vi. Carefully remove a single container from one end of the exposed row. Repeat steps ii. through v. above.

vii. Systematically working across the row, remove each container and repeat steps ii. through v. above.
viii. Repeat steps ii. through vii. for each row in the test pad.
ix. Using the measured average void length, width and depth, calculate the volume of each external void identified within the test pad.
x. Sum all measured external voids to determine the total external void volume within the test pad.
xi. Calculate the external void percentage by dividing the total external void volume by the total test pad volume recorded in c) above.

g) Density cylinders:
i. At the location of each density cylinder, carefully expose the cylinder.
ii. Strike off excess material from the top of the cylinder so that the backfill is flush with the top surface of the density cylinder.
iii. Clean excess material from the exterior of the density cylinder.
iv. Identify and record the ID number of the cylinder.
v. Measure the total weight of the density cylinder and backfill.
vi. Determine the net weight of the backfill by subtracting the container weight from the total weight.
vii. Calculate the total unit weight by dividing the net weight of the backfill by the known volume of the density cylinder.
viii. Perform an oven dry back moisture test on a representative sample from each density cylinder in accordance with ASTM D-2216.
ix. Calculate the dry unit weight by dividing the total unit weight by one plus the moisture content.
x. Repeat steps i. through vii. for each density cylinder.
xi. Calculate the average dry unit weight of the test pad backfill by summing the dry unit weight of each density cylinder in the test pad and dividing by the number of density cylinders.
xii. Calculate the average percent compaction in comparison to a standard proctor or relative density by taking the average dry unit weight recorded in viii) above and dividing it by the maximum dry density (from a standard proctor) or the maximum relative density of the backfill and multiple by 100 to convert to percent compaction.

3. Documentation

Record the following information:
a) Date and time destructive testing begins
b) Total volume of the backfill test pad
c) Total volume of voids in the backfill test pad
d) Total percentage of voids in the backfill test pad
e) Average unit weight of the backfill
f) Average percent compaction of the backfill
g) Maximum moisture content of the backfill
h) Photograph representative steps of testing

3d

LLRW & 11E.(2) CONSTRUCTION QUALITY ASSURANCE/QUALITY CONTROL (CQA/QC) MANUAL

APPENDIC C
ROCK QUALITY SCORING

APPENDIX C

ROCK QUALITY SCORING

ROCK QUALITY SCORING

The results from the following test will be utilize in the scoring criteria:

TEST	STANDARD DESIGNATION
Specific Gravity	ASTM C-128
Absorption (%)	ASTM C-127
Sodium Soundness (%)	ASTM C-88
L.A. Abrasion (%)	ASTM C-131 & ASTM C-535

Each test will be given a score of 0 (lowest) to 10 (highest) from Table D-1 - Scoring Criteria for Rock Quality based on the results of the above tests. These scores will be multiplied by the weighting factors outlined in Table D-1 for different rock types. Table D-1 includes weighting factors for limestone, sandstone, and igneous rocks. The rock quality score is obtained by the following formula:

$$\text{ROCK QUALITY} = \frac{\text{SUM (TEST SCORE X WEIGHT FACTOR)}}{\text{MAXIMUM POSSIBLE SCORE}} \times 100$$

SCORING CRITERIA FOR ROCK QUALITY[1]

TEST*	WEIGHTING FACTOR LIME-STONE	SAND-STONE	IGN-EOUS	SCORE 10	9	8	7	6	5	4	3	2	1	0
Specific Gravity	12	6	9	2.75	2.70	2.65	2.60	2.55	2.50	2.45	2.40	2.35	2.30	2.25
Absorption (%)	13	5	2	.1	.3	.5	.67	.83	1.0	1.5	2.0	2.5	3.0	3.5
Sodium Soundness (%)	4	3	11	1.0	3.0	5.0	6.7	8.3	10.0	12.5	15.0	20.0	25.0	30.0
L.A. Abrasion (%)	1	8	1	1.0	3.0	5.0	6.7	8.3	10.0	12.5	15.0	20.0	25.0	30.0
Schmidt Hammer	11	13	3	70.0	65.0	60.0	54.0	47.0	40.0	32.0	24.0	16.0	8.0	0.0
Tensile Strength (psi)	6	4	10	1400	1200	1000	833	666	500	400	300	200	100	0.0

* The lowest score (i.e. 0) may be substituted for results of test not preformed which are required by Section III.c.

[1] U.S. Nuclear Regulatory Commission, Staff Technical Position - Design of Erosion Protection Covers for Stabilization of Uranium Mill Tailing Sites, U.S. Nuclear Regulatory Commission, Washington, D.C., August, 1990, p D-27.

4

WHETSTONE ASSOCIATES

ENERGYSOLUTIONS CLASS A SOUTH CELL INFILTRATION AND TRANSPORT MODELING

DECEMBER 7, 2007

Whetstone Associates

ENERGY*SOLUTIONS* CLASS A SOUTH CELL INFILTRATION AND TRANSPORT MODELING

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1. INTRODUCTION

Energy*Solutions* operates a radioactive waste and mixed waste disposal facility in Tooele County, Utah. Waste disposal cells at the site (Figure 1) are permanent, clay-lined cells with composite clay and rock caps designed to perform for a minimum of 500 years. Two Class A waste disposal cells on site are partially filled, and Energy*Solutions* proposes to place Class A waste in the western half of the existing 11e.(2) cell, which would be called the Class A South cell.

The footprint of the Class A South and 11e.(2) disposal cell would not change from the currently approved 11e.(2) cell. At completion, the entire cell would occupy approximately 100 acres in Section 32 of T1S, R11W, SLBM. The Class A South portion of the cell would occupy approximately 58 acres. The engineered cover for the Class A South portion of the cell would be designed and constructed similar to other Class A disposal cells on site. The cover would include a top rock, a frost protection layer, and two filter zones above the radon barrier to minimize infiltration through the cell.

1.1 Purpose and Objective

The groundwater discharge permit for the facility requires that environmental impacts to groundwater are kept within tolerable risk levels. The flow of water and transport of constituents from the proposed Class A South disposal cell to a compliance well must be predicted for a period of 200 and 500 years after closure, for hazardous and radioactive constituents, respectively.

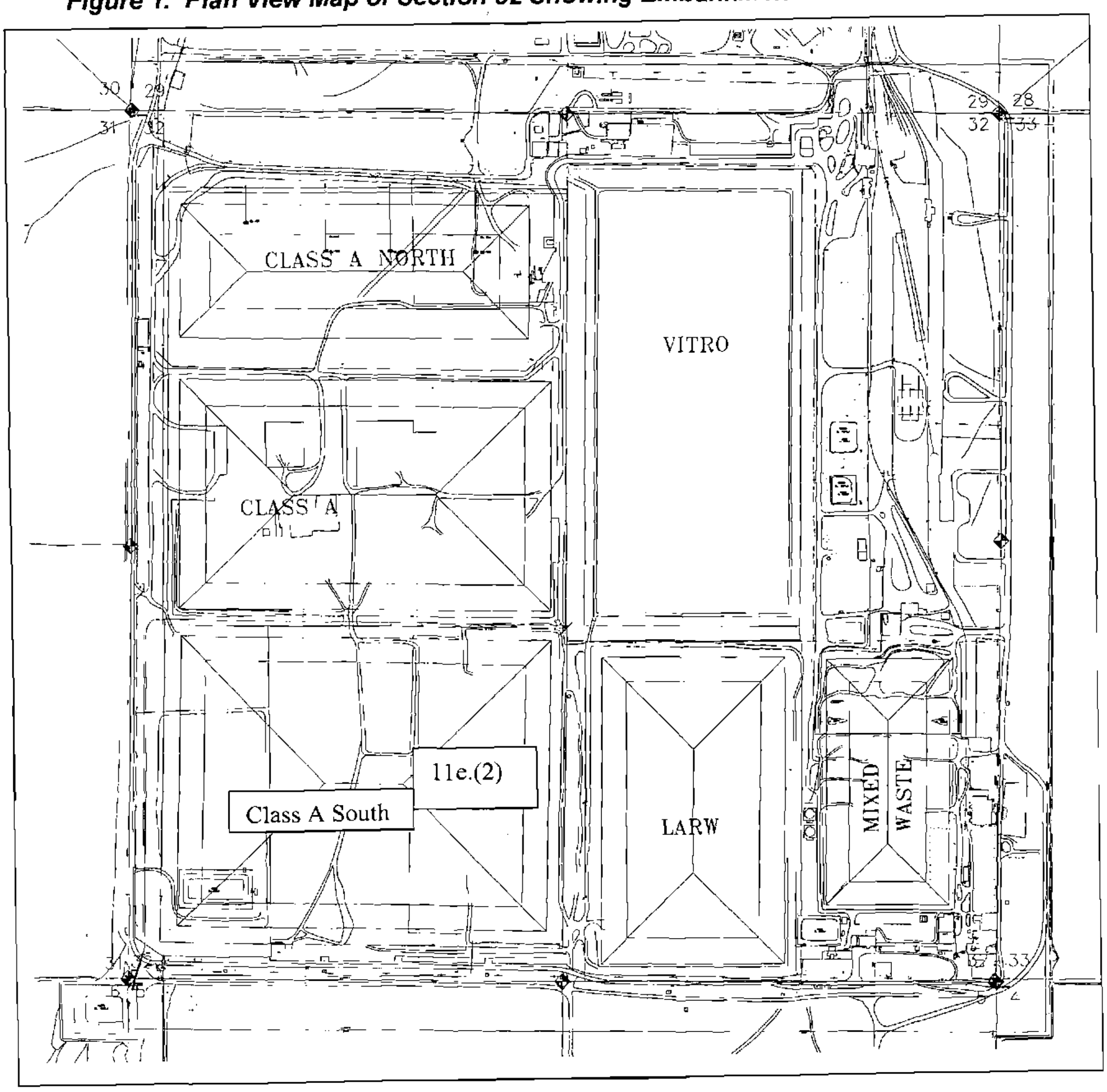
Groundwater modeling (including infiltration, unsaturated groundwater flow, and contaminant transport) was performed for the Class A South cell to evaluate future groundwater quality at compliance wells. The purpose of this document is to describe the input parameters used in the modeling and to summarize the modeling results.

1.2 Background

Fate and transport modeling of a similar nature has been performed previously for the LARW cell, 11e.(2) cell, Class A cell, Class A, B, & C cell, Mixed Waste cell, and Class A Combined cell at the Energy*Solutions* Clive facility. This modeling has been based on site-specific parameters, where available, or conservative assumptions where no site-specific data existed. Over time, as more data have been collected for the site, these models have been refined and updated to provide more accurate yet extremely environmentally conservative estimates of the leaching, transport, and arrival of constituents at compliance monitoring wells for decades and centuries into the future.

Previous groundwater flow and contaminant transport models of the Envirocare facility have been generated by Rogers and Associates Engineering (1990), Bingham Environmental (1991, 1993a. 1993b, 1994a, 1995a, 1995c), Adrian Brown Consultants (1996a, 1996b, 1997a, 1997b, 1997d, 1998), the Utah Department of Environmental Quality (DEQ) Division of Water Quality (1993, 1994), and Whetstone Associates (2000a, 2000d, 2000e, 2000f, 2001a, 2001b, 2003, 2005a, 2005b). The methodology used in the modeling was described in a two-volume comprehensive modeling report for the LARW cell, prepared by Adrian Brown Consultants in 1997. The reader is encouraged to review these documents, which may be found as Appendix M to Envirocare's 1998 Radioactive Material License Renewal Application.

Figure 1. Plan View Map of Section 32 Showing Embankments and Buffer Zones



Existing modeling reports using this methodology include the following:

- Volume I. Final Report on Infiltration Modeling, Adrian Brown Consultants, December 4, 1997
- Volume II. LARW Groundwater Fate and Transport Modeling, Adrian Brown Consultants, February 12, 1998
- Revised Western LARW Infiltration and Transport Modeling report, Whetstone Associates, July 19, 2000
- Class A, B, & C Cell Infiltration and Transport Modeling report, Whetstone Associates, August 1, 2000
- Mixed Waste Cell Infiltration and Transport Modeling report, Whetstone Associates, November 22, 2000
- 11e.(2) Cell Infiltration and Transport Modeling report, Whetstone Associates, June 5 and July 26, 2001
- Technical memorandum on 11(c).2 Cell Transport Modeling Using New Zn Kd and Higher Radionuclide Concentrations, Whetstone Associates, November 10, 2003
- Class A Combined (CAC) Cell Infiltration and Transport Modeling report, Whetstone Associates, June and November, 2005
- Class A Combined (CAC) Cell Infiltration and Transport Modeling report, Whetstone Associates, May, 2006

The engineering design for the proposed Class A South cell is very similar to that of the existing Class A and Class A North cells. The approach and methodology for the modeling are similar.

2. APPROACH

The potential migration of hazardous and radioactive constituents from the Class A South cell were investigated using the EPA HELP model (Schroeder and Peyton, 1995), the Pacific Northwest Laboratories UNSAT-H model (Fayer and Jones, 1990), and the PATHRAE-RAD model (Merrell, et al, 1995).

The modeling project was divided into the following four phases:

1. The infiltration through the closed Class A South cell was predicted using the EPA HELP model;
2. Percolation rates predicted by the HELP model were input into the UNSAT-H model to predict the moisture content and time of travel from the bottom of the waste to the top of the aquifer;
3. A dispersive solution for contaminant transport from the base of the cell to the top of the water table (vertical solution) was determined using the PATHRAE model; and
4. The horizontal migration of constituents through the saturated zone to a compliance well was modeled, again using PATHRAE.

The infiltration (HELP) and moisture content (UNSAT-H) models are described in Sections 3 and 4 of this report. The contaminant transport (PATHRAE) modeling is described in Section 5.

3. INFILTRATION (HELP) MODELING

The infiltration modeling code and input are briefly described below. Again, for more detailed information on the infiltration modeling approach, code, and design in relation to the Energy*Solutions* site, refer to the document entitled Volume I. Final Report on Infiltration Modeling, dated December 4, 1997, which may be found as Appendix M to the 1998 Radioactive Material License Renewal Application.

3.1 Code

Infiltration through the Class A South cell was modeled using the EPA Hydrologic Evaluation of Landfill Performance (HELP) model (version 3.06). The HELP program (Schroeder and Peyton, 1995) is a quasi-two-dimensional code developed by Paul Schroeder (U.S. Army Corps of Engineers) and R. Lee Peyton (University of Missouri, Columbia). The model was adapted from the EPA HSSWDS model (Perrier and Gibson, 1980) and various codes from the US Agricultural Research Service, and National Weather Service, and uses weather, soil, and landfill design data to perform water balance analysis of the designed cell. Surface storage, snowmelt, runoff, infiltration, evapotranspiration, soil moisture storage, lateral subsurface drainage, and unsaturated surface drainage can all be modeled.

The HELP code is distributed by EPA and has widespread acceptance as a tool for the evaluation of the hydrologic performance of landfills. The HELP code was used previously in the prediction of infiltration at the Energy*Solutions* site, and was accepted by DRC as part of license renewal.

3.2 Weather Data Input

The HELP weather data input to Class A South cell model was based on 12 years of meteorological data available for the Clive site, as reported by Meteorological Solutions, Inc (MSI, 2004). The precipitation measured from 1993-2005 indicates that the average annual precipitation at the Energy*Solutions* Clive facility is 7.58 inches per year. The evapotranspiration, precipitation, temperature, and solar radiation data files were generated using a synthetic weather generator, based on site-specific data, as described in previous reports. The weather generator routine, developed by the USDA Agricultural Research Service (Richardson and Wright, 1984), generated 100 years of daily climate data based on site-specific monthly average precipitation and temperature coupled with the climate distribution parameters for a selected analog city.

The climatological input values are summarized in Table 1 and described briefly in the following sections.

Table 1. Summary of HELP Model Weather and Climate Input

```
                         EVAPOTRANSPIRATION AND WEATHER DATA
         NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM SALT LAKE CITY UTAH
           STATION LATITUDE                         = 40.69 DEGREES
           MAXIMUM LEAF AREA INDEX                  =  0.00
           START OF GROWING SEASON (JULIAN DATE)    =   117
           END OF GROWING SEASON (JULIAN DATE)      =   289
           EVAPORATIVE ZONE DEPTH                   = 18.0  INCHES
           AVERAGE ANNUAL WIND SPEED                =  6.67 MPH
           AVERAGE 1ST QUARTER RELATIVE HUMIDITY    = 50.50 %
           AVERAGE 2ND QUARTER RELATIVE HUMIDITY    = 28.60 %
           AVERAGE 3RD QUARTER RELATIVE HUMIDITY    = 22.70 %
           AVERAGE 4TH QUARTER RELATIVE HUMIDITY    = 47.90 %

       NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
                COEFFICIENTS FOR    SALT LAKE CITY      UTAH

                NORMAL MEAN MONTHLY PRECIPITATION (INCHES)
   JAN/JUL      FEB/AUG      MAR/SEP      APR/OCT      MAY/NOV      JUN/DEC
   -------      -------      -------      -------      -------      -------
    0.79         0.92         0.85         1.25         0.94         0.90
    0.34         0.32         0.34         0.75         0.58         0.60

       NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
                COEFFICIENTS FOR    SALT LAKE CITY      UTAH

           NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)
   JAN/JUL      FEB/AUG      MAR/SEP      APR/OCT      MAY/NOV      JUN/DEC
   -------      -------      -------      -------      -------      -------
    30.40        32.00        41.70        49.10        60.10        69.60
    78.40        77.00        65.50        50.90        36.70        28.90

       NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
                COEFFICIENTS FOR    SALT LAKE CITY      UTAH
                   AND STATION LATITUDE  =  40.69 DEGREES
```

3.2.1 Evapotranspiration

Evapotranspiration was calculated by HELP using the location, maximum leaf area, and evaporative zone depth (EZD) specified for the site.

Location. Salt Lake City appears to be the most appropriate analog city for the Clive site DRC (1997a). Therefore, Salt Lake City was used in the model as the analog city, from which HELP generated synthetic evapotranspiration data. The default latitude (40.76°) was adjusted to 40.6858°(40°41'15") for the Clive site.

Evaporative Zone Depth (EZD). The EZD is defined as the depth to which evaporation and transpiration from the soil or rock can occur. Because the Class A South cell will not be vegetated, the EZD represents the maximum depth of evaporation. Any water which percolates below the EZD could only be routed laterally, via a filter (or lateral drainage) layer, or vertically downward as percolation. The model determined the amount evaporation based on the available energy in the system, according to the temperature, solar radiation, and wind speed for each given day.

The modeling was conducted using an 18-inch EZD, which only allows water to evaporate from the 18-inch thick rip rap layer. Water that percolates down to the upper filter layer or to the sacrificial soil cannot be removed from the HELP model by evaporation. This input value is considered to be extremely environmentally conservative.

Maximum Leaf Area Index. The maximum leaf area was set to zero, which is appropriate for bare ground. The Class A South cell will not be vegetated.

Growing Season. The model is insensitive to the input values for the start and end of growing season, because the Class A South cell will not be vegetated. The growing season for Salt Lake City (start day 117, end day 289) was left as the default input.

Wind Speed. The site-specific 12-year average wind speed (July 1, 1992 through March 17, 2005) of 2.98 meters per second (6.67 miles per hour) was used in the base case model. This value is 16% higher than the long-term average wind speed from Dugway, Utah (5.75 mph) used in previous modeling.

Previous sensitivity analyses using wind speeds of 5.75, 7.27, and 8.8 mph (ABC, 1998) indicated that the HELP model is insensitive to slight variations in wind speed. As stated in the 1998 report:

> "Long-term climatic data from Dugway ... indicates that the average annual wind speed is 5 knots (5.75 mph). The long term average wind speed measured at the site from April through September 1994 was 3.5 meters per second ... or 7.27 mph. The default wind speed for Salt Lake City is 8.8 mph. The long-term Dugway value of 5 knots (5.75 mph) was used in the modeling. A sensitivity analysis ... indicates that the model was insensitive to these slight variations in wind speed."

The site-specific average wind speed (2.98 meters per second, 6.67 mph) used in the Class A South cell modeling is within the range of previous sensitivity analyses.

Relative Humidity. The long-term relative humidity data from Dugway was used in the HELP model simulations. The data are based on a 20-year period of record of monthly mean relative humidity values, from 13:00 hours local standard time from NWS, NOAA. The quarterly values were derived as a simple average of the monthly values.

Table 2. Quarterly Relative Humidity at Dugway Proving Ground

Quarter	Month 1	Month 2	Month 3	Quarterly Average
1st (Jan., Feb., Mar.)	57.9	52.8	40.9	50.5
2nd (Apr., May, June)	33.4	27.5	25	28.6
3rd (July, Aug., Sept.)	19.8	21.8	26.7	22.7
4th (Oct., Nov., Dec.)	34.3	47.2	62.4	47.9

Note: Dugway average monthly relative humidity data from 13:00 hours local standard time from NWS, NOAA (summarized from NOAA internet site data))

3.2.2 Precipitation

Precipitation data was generated using the HELP synthetic precipitation generator to stochastically generate 100 years of daily precipitation data. The mean monthly precipitation values, from which the 100 years of daily precipitation data were generated, include twelve years of recorded precipitation available for the Clive site (MSI 2004). The precipitation measured from 1992 – 2004 at the Clive meteorological station is summarized in Table 3. The annual average precipitation, based on valid data from the twelve-year record, is 8.58 inches per year. The monthly values were input to the HELP synthetic weather generator, which generated a 100-year data set with an average annual precipitation of 8.72 inches per year[1].

A statistical analysis of the 100-year synthetic precipitation data set indicates that the synthetic weather generator produced daily data having a mean annual precipitation of 8.72 in/yr, with a minimum of 5.09 in/yr and a maximum of 12.90 in/yr. The 100-year data set contains 252 days having precipitation greater than 0.4 inches, 54 days having precipitation greater than 0.6 inches, and 20 days having precipitation greater than 0.8 inches. The complete data set is presented in Attachment 4, file M100.d4.

Table 3. Summary of Precipitation at Clive, Utah July 1992-June 2004

MONTH	1992-1993	1993-1994	1994-1995	1995-1996	1996-1997	1997-1998	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004	12-YR AVE
July	0.51	0.03	0.06	0.17	1.10	1.19	0.43	0.06	0.07	0.13	0.24	0.03	0.34
August	0.24	0.10	0.39	0.04	0.01	0.32	0.28	0.68	1.05	0.25	0.01	0.45	0.32
September	0.07	0.27	0.51	0.15	0.41	0.90	0.52	0.12	0.15	0.22	0.52	0.21	0.34
October	0.89	0.78	0.89	0.06	0.69	0.47	1.94	0.04	1.92	0.20	0.95	0.17	0.75
November	0.33	0.33	1.91	0.24	0.6	0.72	0.10	0.13	0.15	1.25	0.58 a	0.62	0.58 c
December	1.03	0.18	0.22	0.78	0.77	0.6	0.32	0.18	0.44	0.81	0.53 a	1.27	0.60 c
January	1.17	0.13	0.95	1.31	1.56	0.71	0.81	1.31	0.21	0.50	0.87 a	0.06	0.79 c
February	0.39	0.63	0.78	0.78	0.87	2.21	0.64	1.87	0.55	0.07	0.88 a	1.30	0.92 c
March	0.67	1.14	1.74	0.88	0.17	1.67	0.46	0.23	1.48	0.44	0.89 a	0.43	0.85 c
April	0.17	1.66	0.44	0.91	1.42	1.63	2.65	0.38	1.17	1.36	1.18 a	1.98	1.25 c
May	0.99	0.79	2.58	1.9	0.98	1.04	0.41	0.53	0.0	0.57	0.91	0.60	0.94
June	0.70	0.02	1.88	0.29	2.36	2.69	1.84	0.10	0.52	0.08	0.12	0.19	0.90 c
ANNUAL	7.17	6.06	12.35	7.51	10.94	14.69	10.41	5.61	7.74	5.87	7.68 b	7.29	8.58 c

Source: MSI (2004)
a) Monthly means based on 10-year climatological average
b) Annual total based on valid data and 10-year climatological averages
c) Mean is based on 11 years of data (excludes 2002-2003 data)

The 100-year synthetic data set had a mean precipitation of 8.72 inches. For comparison, the 8.72 inches of precipitation used in the HELP model is 13% higher than the long-term average annual precipitation measured at Dugway from September 1950 – January 2005. The monthly precipitation received at Clive has been similar to that received at Dugway over a 12-year period (Figure 2). The monthly average during this period has been similar (Figure 3), although the precipitation received at the EnergySolutions Clive site has exceeded Dugway's by 2.3% (Table 4).

Precipitation in recent years has exceeded the long-term average. During the 12-year period from July 1992 to June 2004, the average precipitation at Dugway exceeded the long-term average by 11% (Table 4). Assuming that the Clive precipitation has also exceeded the long-term average by 11%, the calculated long-term precipitation at Clive is 7.76 inches per year (Table 4) and the 8.72 inches used in the model is conservatively high.

[1] The synthetic weather generator created a 100-year synthetic precipitation data set having a mean annual precipitation of 8.72 inches per year, which was 0.14 inches (1.6%) higher than the sum of the monthly values (8.58 inches) input to the weather generator.

Figure 2. Monthly Precipitation at Clive and Dugway, July 1992 – June 2004

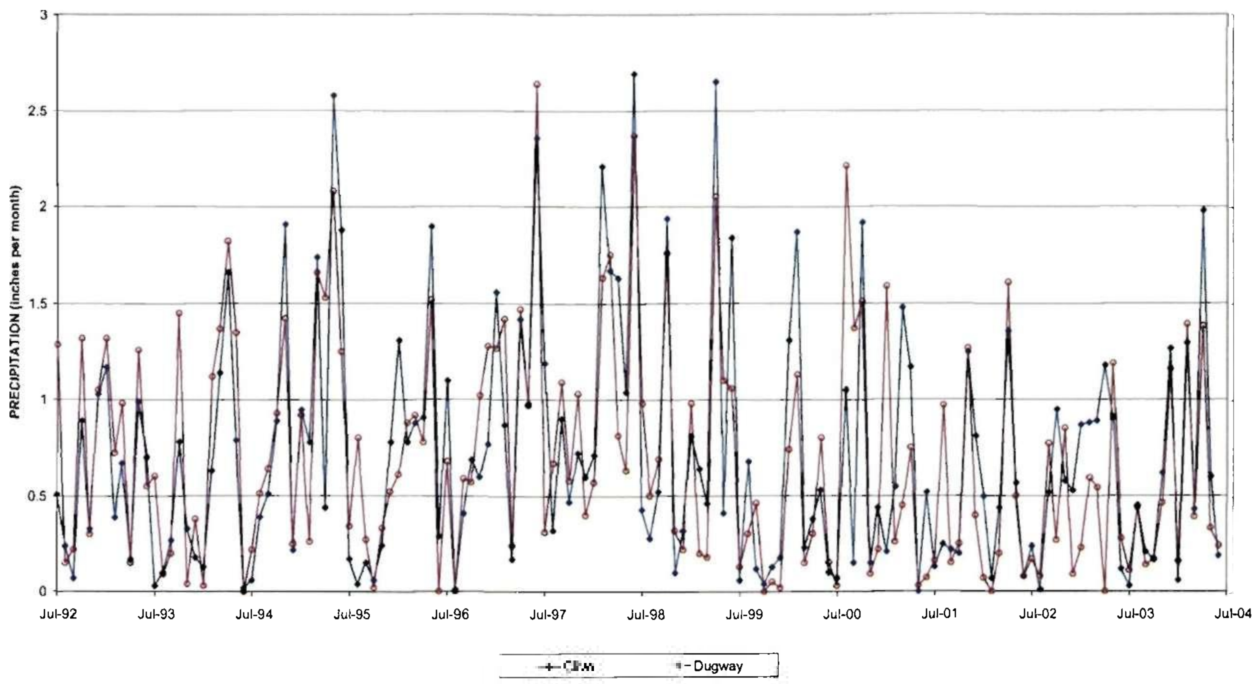


Figure 3. 12-Year Mean Monthly Precipitation at Clive and Dugway, July 1992 – June 2004

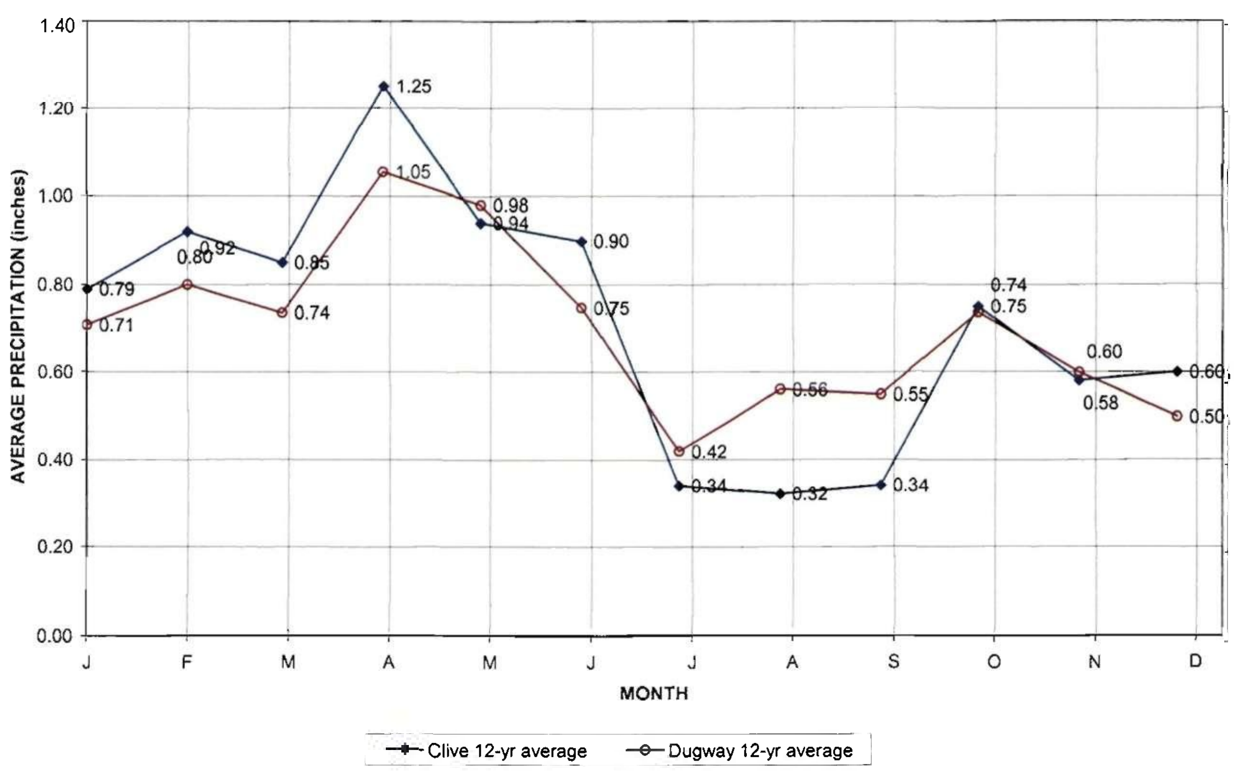


Table 4. Monthly Precipitation (in inches) at Clive and Dugway Stations July 1992-June 2004 with Comparison to Long-Term Mean

DATA	J	F	M	A	M	J	J	A	S	O	N	D	ANNUAL
12-yr Average Clive	0.79	0.92	0.85	1.25	0.94	0.90	0.34	0.32	0.34	0.75	0.58	0.60	8.58
12-yr Average Dugway	0.71	0.80	0.74	1.05	0.98	0.75	0.42	0.56	0.55	0.74	0.60	0.50	8.39
1950-2004 Avg. Dugway	0.56	0.62	0.75	0.82	0.97	0.54	0.49	0.58	0.59	0.73	0.55	0.55	7.58
Dugway 12-yr avg./Long-term	1.26	1.29	0.98	1.29	1.01	1.38	0.85	0.97	0.93	1.01	1.09	0.91	1.11
Clive fraction of Dugway	1.12	1.15	1.16	1.19	0.96	1.20	0.81	0.57	0.62	1.02	0.97	1.20	1.023
Clive long-term	0.57	0.63	0.77	0.84	0.99	0.55	0.50	0.59	0.60	0.75	0.56	0.56	7.76
Clive long-term (sum of monthly means)													7.93

NOTES:

Precipitation data reported in inches.

12-year average: Monthly averages for Dugway are based on mean monthly values for July 1992 - June 2004. Annual average is calculated as the sum of the mean monthly values.

% of long-term: Calculated by dividing twelve-year average at Dugway by the long term average at Dugway; determined that Dugway precipitation from July 1992 - June 2004 has been 11% higher than long-term average.

Clive fraction: Calculated by dividing twelve-year average at Clive by the twelve-year average at Dugway; Determined that on an annualized basis, the precipitation at Clive is 104.7% of that at Dugway

Clive long-term: Calculated by multiplying the long-term average at Dugway by the annualized conversion factor (104.7%).

DATA SOURCES:

Dugway data for 1950-Jan 2005 from Western Regional Climate Center (WRCC, 2005)

Clive data from Meteorological Solutions Inc (MSI, 2004)

Long-term statistics for Dugway calculated by WRCC

12-year statistics for Clive calculated by MSI

The synthetic precipitation data set (with a long-term mean of 8.72 in/yr) used in the HELP model is considered environmentally conservative because 1) the precipitation data set is based on a 12-year period of above-average precipitation in the region and 2) the data set captures extreme precipitation events.

3.2.3 Temperature

One hundred years of temperature data were created using the HELP synthetic temperature generator based on coefficients for Salt Lake City and the monthly average temperature at the Clive site. A statistical analysis of the 100 years of synthetic daily precipitation data indicates that the mean daily temperature is 51.88 °F, with a minimum of 3.7 °F and a maximum of 94.0 °F (Table 5). The 100-year data set contains 22,655 days having temperatures lower than 60 °F, 11,972 days having temperatures lower than 40 °F, and 1,033 days having temperatures lower than 20 °F (Table 6).

Table 5. Summary and Evaluation of Daily Temperature Data in HELP Model 100-Year Synthetic Weather Data Set

(See large tables at end of report document)

Table 6. Event Distribution of Mean Daily Temperature in 100-year Synthetic Data Set

Temperature (°F)	Number of Events
<95	36600
<90	36571
<80	34339
<70	28111
<60	22655
<50	17512
<40	11972
<30	5510
<20	1033
<10	45
<5	5

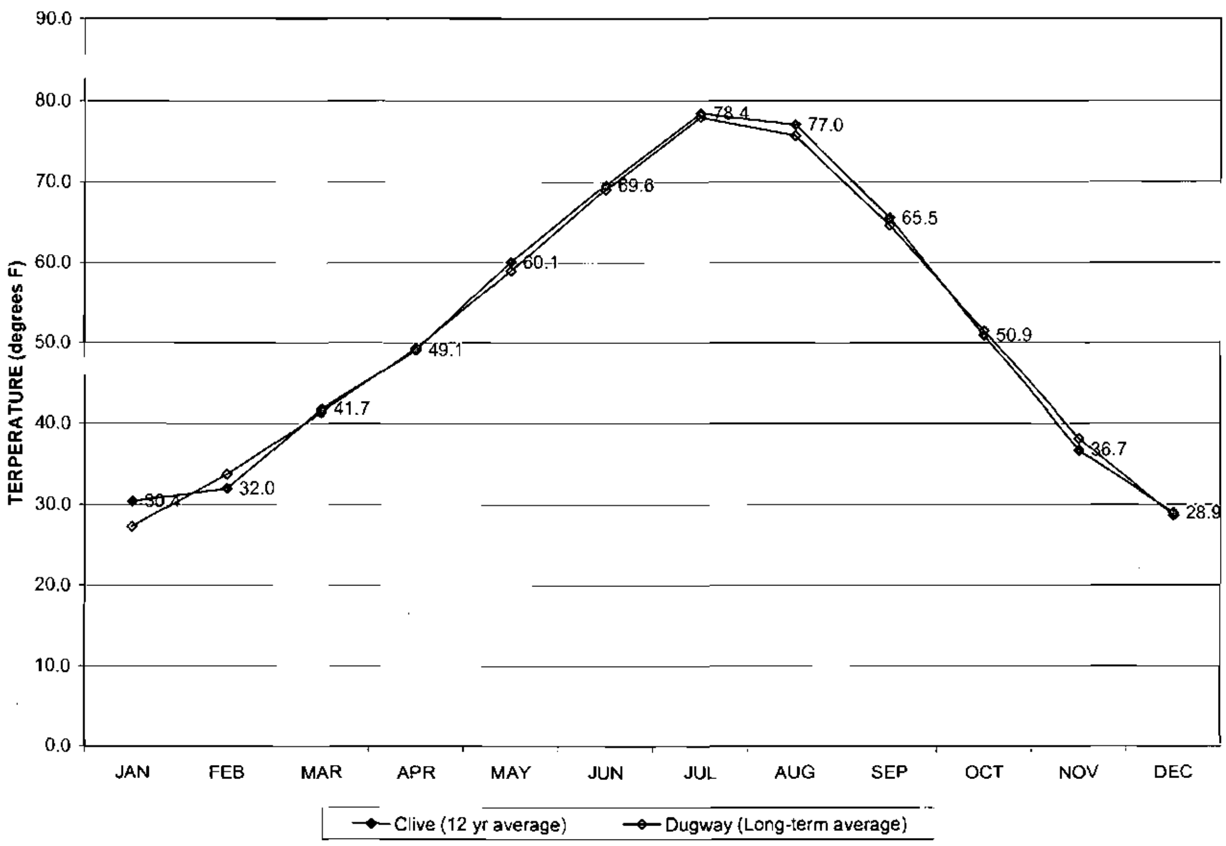
The 12-year average monthly temperatures from the Energy*Solutions* meteorological station (MSI, 2004) compare favorably with the long-term (Sept. 1950 – March 2005) average monthly temperatures at Dugway, Utah (Table 7, Figure 4) indicating that the temperature values from Dugway used in previous modeling were representative of the site. Long-term temperatures for Dugway tend to be slightly higher in the winter and lower in the summer than the 12-year average temperatures for the Clive site.

Table 7. Mean Monthly Temperature for the* Energy*Solutions Site

Month	12 -Year Average Temperature (°C) at Energy*Solutions* Site	12 -Year Average Temperature (°F) at Energy*Solutions* Site	Long-Term Average Temperature (°F) at Dugway Sept 1950 – March 2005
January	-0.9	30.4	27.3
February	0.0	32.0	33.8
March	5.4	41.7	41.3
April	9.5	49.1	49.3
May	15.6	60.1	59.0
June	20.9	69.6	69.1
July	25.8	78.4	78.0
August	25.0	77.0	75.6
September	18.6	65.5	64.6
October	10.5	50.9	51.5
November	2.6	36.7	38.1
December	-1.7	28.9	28.6

Data Sources: Energy*Solutions* 12-year data: MSI (2004)
Dugway 1950-2005 data: Western Regional Climate Center (WRCC, 2005)

Figure 4. Comparison of 12-Year Mean Monthly Temperature at Clive (July 1992 – June 2004) with Long-term at Dugway (Sept 1950 – March 2005)



3.2.4 Solar Radiation Data

The synthetic generation of solar radiation data is a strong function of precipitation, therefore the precipitation data sets were generated first, followed by temperature, followed by solar radiation. The solar radiation data set was generated by first generating precipitation data (based the long-term average of 8.78 inches/year), then generating synthetic temperature data (based on long-term mean monthly temperatures at the Energy*Solutions* Clive meteorological station), then generating the solar radiation data using the location coefficients for Salt Lake City and the latitude (40°41'15", 40.6858°) for the Clive site.

Solar radiation data collected at the site over a 12-year period indicates that the maximum solar radiation occurs in June and averages 670 Langleys per day (MSI, 2004).

3.3 Landfill Soil and Design Data

The design of the Class A South cell is similar to the design of the Class A and Class A North cells, except that the Class A South has a longer maximum slope length (740 ft) and lower slope (2.1% - 2.4%). At completion, the footprint of the Class A South disposal cell will be approximately 1,476 x 1,880 feet, covering approximately 64 acres (Figure 5). The perimeter of the waste would be 1,426 x 1,775 feet (approximately 58 acres). The cell will be excavated into native soils and lined with compacted clay materials. Waste will be placed above the liner and will be covered with a layered engineered cover constructed of natural (no man-made) materials. The cell cover will be a layered composite which includes rip rap, filter material, sacrificial soil, and a clay radon barrier (Figure 6). The top slopes of the cell will be finished at a 2.1% - 2.4% grade, with side slopes no steeper than 5:1 (20%).

Figure 5. Class A South Cell Plan

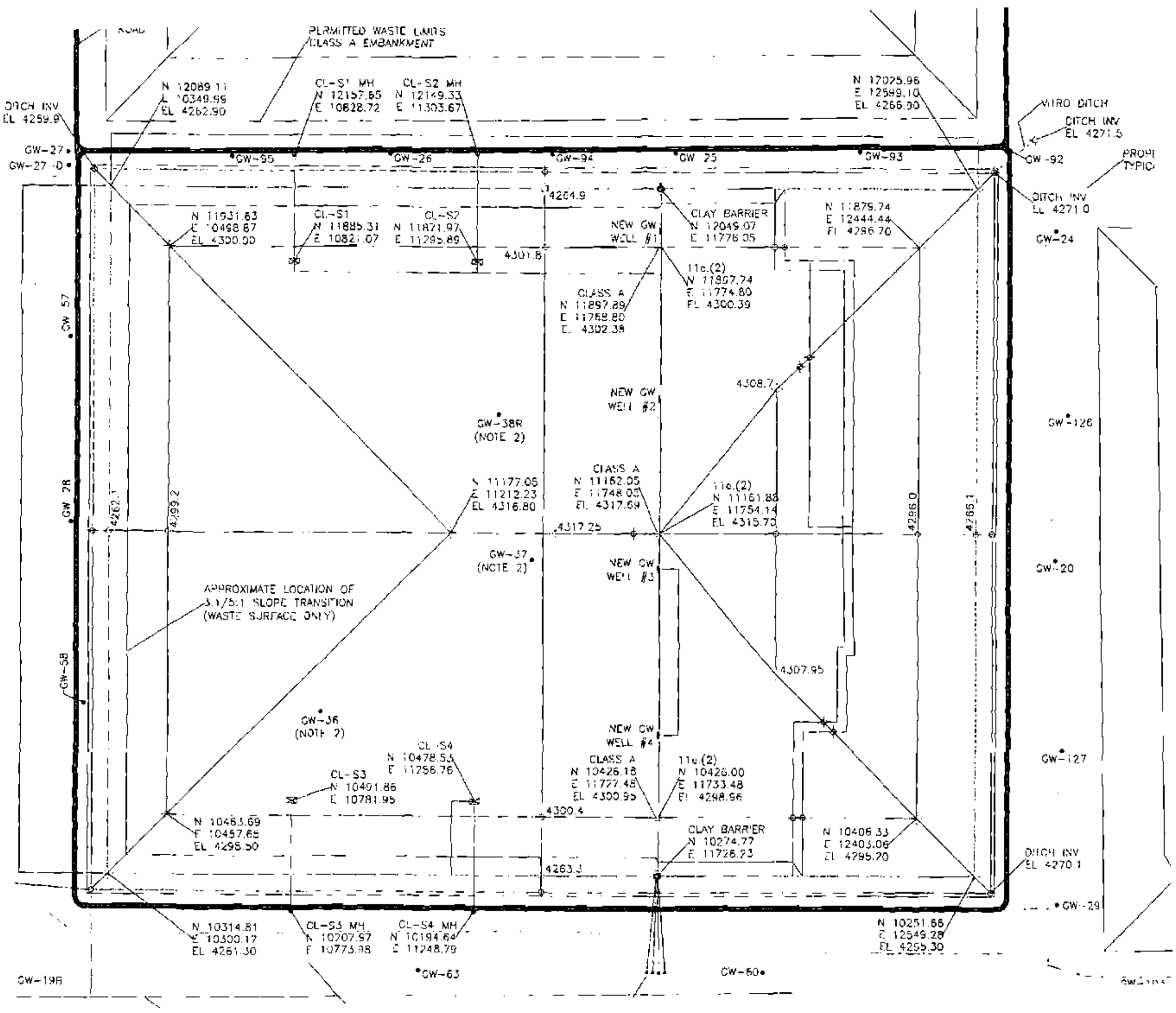
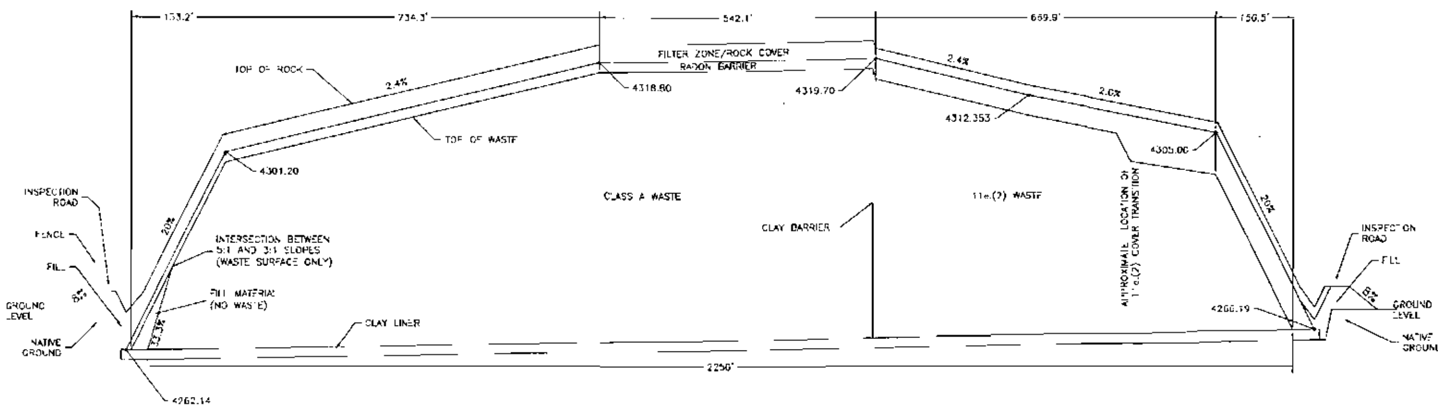
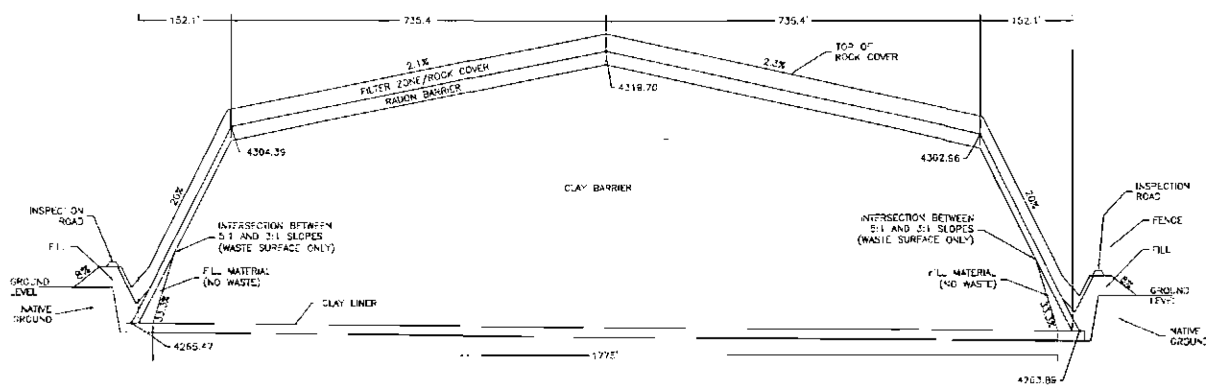


Figure 6. Class A South Cell Section



(a) East West Section



(b) North South Section

3.3.1 Top-Slope

The Class A South cell top slope has been designed with a 2.1 – 2.4% grade and a maximum slope length of 740 feet. The layers used in the Class A South top slope cover are listed in Table 8, and consist of the following:

- Lower Liner. The cell will be lined with a 2-foot thick layer of compacted clayey soil. This bottom clay liner has been constructed with a field hydraulic conductivity of 1.0×10^{-6} cm/sec or less.
- Waste. The waste layer will reach a maximum thickness of approximately 53 feet above the top of the clay bottom liner at the crest. The height of waste at the shoulder of the top slope (the contact between the top slope and side slope) will be approximately 37 feet, and the average waste height will be approximately 45 feet in the top slope area ((53+37)/2). Since the moisture contents of the waste are initialized to steady state (no moisture goes into or out of storage in the waste), the model is completely insensitive to waste thickness. A unit thickness of 100 inches was used for the waste in all HELP model runs.

- Radon Barrier. The proposed uniform waste cover design will consist of an upper 12 inches of radon barrier with a maximum hydraulic conductivity of $5x10^{-8}$ cm/sec and a lower 12 inches of radon barrier having a hydraulic conductivity of $1x10^{-6}$ cm/sec or less.
- Filter Zone (Lower). Six inches of Type-B filter material will be incorporated in the top slope cover design. This filter material ranges in size from 0.2 inches to 1.5 inches, with 100% passing a 1 ½-inch sieve, less than 40% passing a 3/8-inch sieve, and not more than 10% passing a 4.75 mm sieve. The Type-B size gradation corresponds to a coarse sand and fine gravel mix, according to the Universal Soil Classification System. A series of sensitivity analyses on the top slope show no difference in infiltration for through the top slope for Type B thicknesses of 6-, 12-, and 18-inches (Section 3.4.3).
- Sacrificial Soil (freeze/thaw) Layer. A 12-inch thick layer of silty sand and gravel will be used in the top slope cover, above the lower filter zone, in order to protect the lower layers of the cover from freeze/thaw effects. The engineering design specifies a D_{15} grain size of 1.68 mm, a D_{60} of 3/8 inch, and a $D_{100} \leq 3/4$ inch.
- Filter Zone (Upper). Six inches of Type-A filter material will be used on the top slope. The Type-A filter material ranges in size from 0.08 inches (2 mm) to 6.0 inches, with 100% passing a 6-inch sieve, 70% passing a 3-inch sieve, and not more than 10% passing a 2 mm sieve. The Type-A size gradation corresponds to a poorly sorted mixture of coarse sand to coarse gravel and cobble, according to the Universal Soil Classification System.
- Rip Rap Layer. Approximately 18-inches of rip rap will be placed on the top slopes, above the upper (Type A) filter zone. The Type-B rip rap to be used on the top slopes will range in size from 0.75-4.50 inches, with the D_{100} grain size ≤ 4.5 inch, $D_{50} \geq 1.25$ inch, and $D_{10} \geq 0.75$ inch. The coarser Type-A rip rap, used on the side slopes, will range in size from 2-16 inches (equivalent to coarse gravel to boulders), with the D_{100} grain size ≤ 16 inch, $D_{50} \geq 4.5$ inch, and $D_{10} \geq 2$ inch.

Table 8. HELP Infiltration Model Layers and Material Properties – Class A South Cell Top Slope

Layer	Material	Thickness (inches)	N (vol/vol)	θ_{fc} (vol/vol)	θ_{wp} (vol/vol)	Available Moisture (vol/vol)	θ_i (vol/vol)	K_s (cm/sec)	Layer Type n/a	Size Range (inches)	Material Description n/a
Layer 1	Type-B Rip Rap	18	0.190	0.024	0.007	0.017	initialized to ss	42	Vertical percolation	0.75-4.5	1.25 inches
Layer 2	Type-A Filter (upper)	6	0.190	0.024	0.007	0.017	initialized to ss	42	lateral drainage	0.08-6.0	Coarse Sand - Fine Cobble
Layer 3	Sacrificial Soil	12	0.31	0.2	0.025	0.175	0.31	4.00E-03	barrier soil	<0.75	Silty Sand and Gravel
Layer 4	Type-B Filter (lower)	6	0.28	0.032	0.013	0.019	initialized to ss	3.5	lateral drainage	0.2-1.5	Coarse Sand -Fine Gravel
Layer 5	Upper Radon Barrier	12	0.430	0.390	0.28	0.11	0.43	5.00E-08	barrier soil	n/a	Clay
Layer 6	Lower Radon Barrier	12	0.430	0.390	0.28	0.11	initialized to ss	1.00E-06	Vertical percolation	n/a	Clay
Layer 7	Waste	100	0.437	0.062	0.024	0.038	initialized to ss	5.00E-04	Vertical percolation	n/a	Sand
Layer 8	Clay Liner	24	0.430	0.390	0.28	0.11	0.43	1.00E-06	barrier soil	n/a	Clay

n = porosity
θ_{fc} = Field Capacity
θ_{wp} = Wilting Point
θ_i = Initial Moisture Content
K_s = Saturated Hydraulic Conductivity
θ_i = Value for initialized steady-state (ss) moisture content are given in model output files (Attachment 1).

Notes: Available Moisture: Moisture available to be evaporated is only applicable in the upper 18 inches of the model
Layer 1: Rip rap size is nominal diameter
Layer 3: Sacrificial soil is placed at $4x10^{-4}$ cm/sec; freeze/thaw reduces K to $4x10^{-3}$ cm/sec.
Layer 7: Waste Unit thickness is set at 100 inches. HELP model is insensitive to waste thickness variation.

3.3.2 Side-Slope

The Class A South Side Slope has been designed with a 20% grade and a slope length of 150 feet. From bottom to top, the side slope design includes a 2-ft thick lower liner, waste, 12-inch lower radon barrier, 12-inch thick upper radon barrier, 18-inch Type-B filter zone, 12-inch sacrificial soil (consisting of silty sand and gravel), 6-inch Type-A filter zone, and 18-inch Type-A rip rap (Table 9). The material used for the Type-A filter and Type-A rip rap are described above. The thickness of waste will range from zero at the edge of the cell to approximately 37 feet at the shoulder, for an average waste height of 18.5 feet ((0+37)/2). The side-slope infiltration modeling used a unit waste thickness of 100 inches, as discussed above for the top-slope simulations.

The thickness of the Type-B filter was 18 inches in the base case Side Slope model. Sensitivity analyses were performed using thicknesses of 6 inches and 12 inches for the Type-B filter (as described in Section 3.4.3).

Table 9. HELP Infiltration Model Layers and Material Properties – Class A South Cell Side Slope

Layer	Material	Thickness (inches)	N (vol/vol)	θ_{fc} (vol/vol)	θ_{wp} (vol/vol)	Available Moisture (vol/vol)	θ_i (vol/vol)	K_s (cm/sec)	Layer Type n/a	Size Range (inches)	Material Description n/a
Layer 1	Type-A Rip Rap	18	0.170	0.007	0.003	0.004	initialized to ss	80	vertical percolation	2.0-16.0	12 inches
Layer 2	Type-A Filter (upper)	6	0.190	0.024	0.007	0.017	initialized to ss	42	lateral drainage	0.08-6.0	Coarse Sand - Fine Cobble
Layer 3	Sacrificial Soil	12	0.31	0.2	0.025	0.175	0.31	4.0E-03	barrier soil	<0.75	Silty Sand and Gravel
Layer 4	Type-B Filter (lower)	18	0.28	0.032	0.013	0.019	initialized to ss	3.5	lateral drainage	0.2-1.5	Coarse Sand -Fine Gravel
Layer 5	Upper Radon Barrier	12	0.430	0.390	0.28	0.11	0.43	5.0E-08	barrier soil	n/a	Clay
Layer 6	Lower Radon Barrier	12	0.430	0.390	0.28	0.11	initialized to ss	1.0E-06	vertical percolation	n/a	Clay
Layer 7	Waste	100	0.437	0.062	0.024	0.038	initialized to ss	5.0E-04	vertical percolation	n/a	Sand
Layer 8	Clay Liner	24	0.430	0.390	0.28	0.11	0.43	1.0E-06	barrier soil	n/a	Clay

n – Porosity
θ_{fc} – Field Capacity
θ_{wp} – Wilting Point
θ_i = Initial Moisture Content
K_s = Saturated Hydraulic Conductivity
θ_i – Value for initialized steady-state moisture content are given in the model output files (Attachment 1).

Notes: Layer 1: Rip rap size is nominal diameter
Layer 3: Sacrificial soil is placed at $4x10^{-4}$ cm/sec; freeze/thaw reduces K to $4x10^{-3}$ cm/sec.
Layer 4: Sensitivity analyses were performed using 6-inch and 12-inch Type-B filter layer.
Layer 7: Waste Unit thickness is set at 100 inches. HELP model is insensitive to waste thickness variation.

3.3.3 Side-Slope Run-on

The side-slope modeling includes the effects of run-on from the filter layers in the Top Slope. As described in previous reports, run-on or drainage from up-slope can be simulated by adjusting the slope length to an effective length (L'). The procedure is summarized as follows:

1. Run the HELP3 simulation on the up-slope panel (which is the Top Slope, in this case.) Note the initial volume estimate of drainage (D_u).
2. Run the simulation on the receiving (down-slope) panel using the actual slope length (L) for that section. Note the initial volume estimate of drainage (D_{d1}).
3. Determine an incremental increase in slope length (ΔL):

$$\Delta L = L \cdot \left(\frac{D_u}{D_d} \right)$$

4. Add the incremental increase in slope length to the initial slope length to determine the effective slope length:

$$L' = \Delta L + L$$

5. If the new estimate of drainage (D_{d2}) is significantly different from the previous estimate (D_{d1}), repeat the process to calculate a new effective length (L') and run the simulation again to compute a final estimate of drainage (D_d), runoff, evapotranspiration, and percolation.

The effective slope length calculations are shown in Table 10.

Table 10. Class A South Cell HELP Infiltration Modeling – Effective Slope Length For Lateral Drainage Run-On To Side Slopes

CELL	RUN	DESCRIPTION	SLOPE LENGTH ft.	WIDTH ft.	AREA acres	PERC. in.	LATERAL DRAINAGE			ΔL	L'
								in.	ft^3/yr		
6" Filter, Side Slope Analysis:											
Class A So.	11e2-T6	Top-slope Drainage	740	100	1.699	0.109	D_u	2.633	21074		
Class A So.	11e2-S6	Side-slope, Without Run-on	150	100	0.344	0.078	D_{d1}	2.948	3685	858	1008
Class A So.	11e2-S6A	Receiving Side-slope, 1st Iteration	1008	100	0.344	0.250	D_{d2}	3.140	3926	805	955
Class A So.	11e2-S6B	Receiving Side-slope, 2nd Iteration	955	100	0.344	0.253	D_{d3}	3.129	3912	808	958
Class A So.	11e2-S6C	Receiving Side-slope, 3rd Iteration	958	100	0.344	0.253	D_{d4}	3.130	3912	808	958
12" Filter, Side Slope Analysis:											
Class A So.	11e2-T6	Top-slope Drainage	740	100	1.699	0.109	D_u	2.633	21074		
Class A So.	11e2S12	Side-slope, Without Run-on	150	100	0.344	0.063	D_{d1}	2.963	3704	853	1003
Class A So.	11e2S12A	Receiving Side-slope, 1st Iteration	1003	100	0.344	0.238	D_{d2}	3.151	3940	802	952
Class A So.	11e2S12B	Receiving Side-slope, 2nd Iteration	952	100	0.344	0.235	D_{d3}	3.151	3934	804	954
Class A So.	11e2S12C	Receiving Side-slope, 3rd Iteration	954	100	0.344	0.234	D_{d4}	3.148	3935	803	953
Class A So.	11e2S12D	Receiving Side-slope, 3rd Iteration	953	100	0.344	0.234	D_{d4}	3.148	3935	803	953
18" Filter, Side Slope Analysis:											
Class A So.	11e2-T6	Top-slope Drainage	740	100	1.699	0.109	D_u	2.633	21074		
Class A So.	11e2S18	Side-slope, Without Run-on	150	100	0.344	0.023	D_{d1}	3.002	3754	842	992
Class A So.	11e2S18A	Receiving Side-slope, 1st Iteration	992	100	0.344	0.153	D_{d2}	3.235	4044	782	932
Class A So.	11e2S18B	Receiving Side-slope, 2nd Iteration	932	100	0.344	0.113	D_{d3}	3.265	4082	774	924
Class A So.	11e2S18C	Receiving Side-slope, 3rd Iteration	924	100	0.344	0.113	D_{d4}	3.265	4082	774	924

3.4 HELP Infiltration Modeling Results

The results of the HELP modeling runs are summarized in Table 11 and Table 12 and discussed in the following sections. The output files are provided in Attachment 1.

Table 11. Class A South Cell HELP Infiltration Model Results for Base Case and Sensitivity Analyses

CELL	RUN:	CASE:	INFILTRATION (in/yr)	(cm/yr)
Class A South	**T6**	**Top Slope, 740 ft length, 2.1% slope**	**0.1087**	**0.276**
Class A South	T12	Top Slope, 740 ft length, 2.1% slope, 12" Filter	0.1086	0.276
Class A South	T18	Top Slope, 740 ft length, 2.1% slope, 18" Filter	0.1086	0.276
Class A South	11E2-S6	Side-slope, frost prot. layer, length 150 ft, no run-on	0.078	0.198
Class A South	11E2-S6a	Side-slope, frost prot. layer, length 1008 ft, with run-on	0.250	0.634
Class A South	11E2-S6b	Side-slope, frost prot. layer, length 955 ft, with run-on	0.253	0.643
Class A South	**11E2-S6c**	**Side-slope, frost prot. layer, length 958 ft, with run-on**	**0.253**	**0.643**
Class A South	11E2-S12	Side-slope, frost prot. layer, 12" filter, L=150 ft, no run-on	0.063	0.160
Class A South	11E2-S12a	Side-slope, frost prot. layer, 12" filter, L=1003 ft, with run-on	0.238	0.604
Class A South	11E2-S12b	Side-slope, frost prot. layer, 12" filter, L=952 ft, with run-on	0.235	0.597
Class A South	11E2-S12c	Side-slope, frost prot. layer, 12" filter, L=954 ft, with run-on	0.234	0.595
Class A South	**11E2-S12d**	**Side-slope, frost prot. layer, 12" filter, L=953 ft, with run-on**	**0.234**	**0.595**
Class A South	11E2-S18	Side-slope, frost prot. layer, 18" filter, L=150 ft, no run-on	0.023	0.059
Class A South	11E2-S18a	Side-slope, frost prot. layer, 18" filter, L=992 ft, with run-on	0.153	0.388
Class A South	11E2-S18b	Side-slope, frost prot. layer, 18" filter, L=932 ft, with run-on	0.113	0.288
Class A South	**11E2-S18c**	**Side-slope, frost prot. layer, 18" filter, L=924 ft, with run-on**	**0.113**	**0.286**

Table 12. Class A South Cell HELP Infiltration Model Water Balance Summary (in/yr) for Base Case and Sensitivity Analyses

HELP Results (inches of water)	**Top Slope 6" Filter** 11e2-T6	**Top Slope 12" Filter** 11e2-T12	**Top Slope 18" Filter** 11e2-T18
Precipitation	8.72	8.72	8.72
Runoff	0.052	0.052	0.052
Evapotranspiration	5.142	5.142	5.142
Drainage Collected from Layer 2	0.043	0.043	0.043
Percolation/leakage through Layer 3	3.483	3.483	3.483
Average Head on Top of Layer 3	0.001	0.001	0.001
Drainage Collected from Layer 4	3.374	3.374	3.374
Percolation/Leakage through Layer 5	0.10862	0.10860	0.10858
Average Head on Top of Layer 5	0.016	0.016	0.016
Percolation/Leakage through Layer 8	0.10866	0.10856	0.10863
Average Head on Top of Layer 8	0.000	0.000	0.000
Change in Water Storage	0.000	0.000	0.000

HELP Results (inches of water)	Class A South Side Slope – 18" Type-B Filter			
	11e2-S18	11e2-S18a	11e2-S18b	11e2-S18c
Precipitation	8.72	8.72	8.72	8.72
Runoff	0.058	0.058	0.058	0.058
Evapotranspiration	5.058	5.058	5.058	5.058
Drainage Collected from Layer 2	0.577	0.215	0.224	0.225
Percolation/leakage through Layer 3	3.026	3.388	3.379	3.378
Average Head on Top of Layer 3	0.001	0.001	0.001	0.001
Drainage Collected from Layer 4	3.002	3.235	3.265	3.265
Percolation/Leakage through Layer 5	0.023	0.153	0.113	0.113
Average Head on Top of Layer 5	0.002	0.002	0.002	0.002
Percolation/Leakage through Layer 8	0.0231	0.1528	0.1134	0.1127
Average Head on Top of Layer 8	0.000	0.001	0.000	0.000
Change in Water Storage	0.000	0.000	0.000	0.000

HELP Results (inches of water)	Class A South Side Slope Sensitivity Analysis – 12" Filter				
	11e2-S12	11e2-S12a	11e2-S12b	11e2-S12c	11e2-S12d
Precipitation	8.72	8.72	8.72	8.72	8.72
Runoff	0.058	0.058	0.058	0.058	0.058
Evapotranspiration	5.058	5.058	5.058	5.058	5.058
Drainage Collected from Layer 2	0.577	0.214	0.221	0.221	0.221
Percolation/leakage through Layer 3	3.026	3.389	3.382	3.382	3.382
Average Head on Top of Layer 3	0.001	0.001	0.001	0.001	0.001
Drainage Collected from Layer 4	2.963	3.151	3.147	3.148	3.148
Percolation/Leakage through Layer 5	0.063	0.238	0.235	0.234	0.234
Average Head on Top of Layer 5	0.001	0.002	0.002	0.002	0.002
Percolation/Leakage through Layer 8	0.0628	0.2377	0.2351	0.2344	0.2342
Average Head on Top of Layer 8	0.000	0.001	0.001	0.001	0.001
Change in Water Storage	0.000	0.000	0.000	0.000	0.000

HELP Results (inches of water)	Class A South Side Slope Sensitivity Analysis – 6" Filter			
	8.72	8.72	8.72	8.72
Precipitation	0.058	0.058	0.058	0.058
Runoff	5.058	5.058	5.058	5.058
Evapotranspiration	0.577	0.213	0.221	0.220
Drainage Collected from Layer 2	3.026	3.390	3.382	3.383
Percolation/leakage through Layer 3	0.001	0.001	0.001	0.001
Average Head on Top of Layer 3	2.948	3.140	3.129	3.130
Drainage Collected from Layer 4	0.078	0.250	0.253	0.253
Percolation/Leakage through Layer 5	0.001	0.002	0.002	0.002
Average Head on Top of Layer 5	0.0779	0.2496	0.2531	0.2532
Percolation/Leakage through Layer 8	0.000	0.001	0.001	0.001
Average Head on Top of Layer 8	0.000	0.000	0.000	0.000
Change in Water Storage	8.72	8.72	8.72	8.72

3.4.1 Top Slope Infiltration Results

The top slope infiltration modeling indicates that an average of 0.109 inches per year (0.276 cm/yr) would infiltrate through the Class A South cell top slope under long-term quasi-steady state. The infiltration rate is affected by the relatively long slope length, low precipitation, and lateral drainage layers. The infiltration through the top slope is essentially identical for the 6-inch, 12-inch, and 18-inch Type-B Filter cases (0.109

in/yr, 0.276 cm/yr), because no buildup of hydraulic head occurs in the top slope lower filter layer (as discussed in Section 3.4.3).

3.4.2 Side Slope Infiltration Results

The side-slope infiltration modeling indicates that an average of 0.113 inches per year (0.286 cm/yr) would infiltrate through the Class A South cell side slope under long-term quasi-steady state conditions, for the base case side slope model (18-inch thick Type-B filter).

3.4.3 Sensitivity Analyses

Sensitivity analyses were performed using a range of thicknesses for the lower (Type B) filter in both the top slope and the side slope. The infiltration results are shown in Table 11 and the complete water balance results for each case are shown in Table 12. The conclusions from the sensitivity analyses are as follows:

- A thicker Type-B Filter layer in the top slope area had no effect on infiltration, because no head build up occurs as water flows laterally in the filter layer. Modeling results based on a 12-inch and 18-inch thick filter layer were essentially identical to those based on a 6-inch thick filter layer (0.109 in/yr, 0.276 cm/yr).
- The thickness of the Type-B Filter layer in the side slope area significantly affects infiltration through the cell, because the model predicts that a build up of water can occur in thinner filter layers, slowing down the lateral transport of water off the cell and allowing greater infiltration to occur. A thinner (6-inch) Type-B Filter layer results in 2.4 times more infiltration than in the base case (18-inch thick filter) model run. Based on a precipitation rate of 8.72 inches/yr, the HELP model indicates that 0.253 inches/yr (0.643 cm/yr) would infiltrate through the side slope having a 6-inch thick Type-B filter.
- Decreasing the thickness of Type-B Filter to 12 inches (compared to a base case of 18-inches) would results in 2.1 times more infiltration. The HELP model indicates that 0.235 inches/yr (0.595 cm/yr) would infiltrate through the side slope having a 12-inch thick Type-B filter.

The sensitivity analyses performed on the Class A South cell, coupled with previous sensitivity analyses, provide satisfactory assurance that the predicted infiltration is reasonable estimate of the future conditions.

4. MOISTURE CONTENT (UNSAT-H) MODELING

The UNSAT-H model was used to predict the moisture content and time of travel in the radon barrier, waste, clay liner, and Unit 3 sand to the top of the aquifer. The final moisture content from UNSAT-H is used as input to the contaminant transport modeling (PATHRAE). Although the HELP model does report the final moisture content in each model layer for each simulation, the UNSAT-H model is considered to be more accurate with regard to predicting moisture content.

Version 2.05 of the UNSAT-H code was used. The code was written by Dr. Michael J. Fayer, at Pacific Northwest Laboratories. Dr. Fayer dimensioned the MATN variable to 10, in order to accommodate up to ten material layers. The six material layers modeled in the Class A South cell UNSAT-H model are shown in Table 15 and described below. The UNSAT-H model input and output files are provided in Attachment 2.

4.1 UNSAT-H Node Geometry

The UNSAT-H model node geometry for the top slope area started at the top of the radon barrier and included 45 feet of waste above the clay liner and the Unit 3 sand. In the side-slope area, the waste layer was modeled with a thickness of 18.5 feet (the average waste height). The node spacing was arranged such that the distance between discontinuities (layer boundaries) was 0.1 cm, and the spacing between adjacent nodes did not exceed about a factor of 2.

4.1.1 Waste Thickness

The waste height under the top slope was based on Energy*Solutions* engineering drawing 07021 V3. The waste layer will reach a maximum thickness of approximately 53 feet above the top of the clay bottom liner at the crest. The height of waste at the shoulder of the top slope (the contact between the top slope and side slope) will be approximately 37 feet, and the average waste height will be approximately 45 feet in the top slope area ((53+37)/2).

The waste height under the side-slope was also based on Energy*Solutions* engineering drawing 07021 V3. The thickness of waste will range from zero at the edge of the cell to approximately 37 feet at the shoulder, for an average waste height of 18.5 feet ((0+37)/2). The waste under the side-slope was modeled in UNSAT-H using this 18.5-ft average thickness.

4.1.2 Unit 3 Sand Thickness

The Unit 3 sand underlying the Class A South cell was modeled with a thickness of 10.8 feet, which is intended to represent the distance from the base of the clay liner to the top of the aquifer. Although the actual distance is 11.1 feet, using 10.8 feet in the UNSAT-H model is adequate for the purpose of determining a steady state moisture in the Unit 3 Sand. The base of the clay liner occurs at an average design elevation of 4,262.4 ft. The top of the aquifer (adjusted to freshwater head) occurred at an average elevation of 4,251.3 ft during the four quarters of 1998 (Table 13). This water level elevation was used in the modeling for consistency with previous work, and subsequent data from 1999 and 2000 (Figure 7, Table 14) indicated that water level elevations were relatively stable in the 11e.(2) / Class A South area, with an average elevation of 4251.4 from January 1999 to April 2000.

The water level elevation used in calculating the Unit 3 Sand thickness in the model is higher than the average elevation (4250.1) measured from 1991 to 1996. It is also slightly higher (0.12 ft) than the natural saline (non-adjusted) head, and is therefore considered to be conservative. The length of the capillary zone calculated by UNSAT-H was subtracted from the vertical transport distance in the PATHRAE model, thus decreasing the vertical transport distance even further.

Table 13. Water Level Elevations used in Calculating the Thickness of the Unsaturated Unit 3 Sand

WELL ID	1ST QTR FW ELEVATION (feet)	2ND QTR FW ELEVATION (feet)	3RD QTR FW ELEVATION (feet)	4TH QTR FW ELEVATION (feet)	
GW-19A	4252.23	4254.25	4255.45	4254.59	
GW-20	4250.80	4251.19	4251.08	4250.57	
GW-24	4250.54	4250.17	4250.33	4250.75	
GW-25	4251.62	4251.87	4251.95	4251.92	
GW-26	4251.26	4251.49	4251.33	4251.36	
GW-27	4249.51	4249.53	4249.72	4249.97	
GW-28	4250.76	4250.94	4250.31	4251.34	
GW-29	4250.60	4250.69	4250.76	4250.82	
GW-36	4251.46	4251.55	4251.74	4251.67	
GW-37	4251.68	4251.75	4251.98	4251.83	
GW-38	4251.22	4251.54	4251.71	4251.48	
GW-57	4249.88	4250.13	4250.68	4251.11	
GW-58	4250.98	4251.36	4251.49	4251.67	
GW-60	4251.05	4251.09	4251.23	4251.32	
GW-63	4251.39	4251.48	4251.93	4251.66	
Maximum	**4252.23**	**4254.25**	**4255.45**	**4254.59**	**4254.13**
Minimum	**4249.51**	**4249.53**	**4249.72**	**4249.97**	**4249.68**
Average	**4251.00**	**4251.27**	**4251.45**	**4251.47**	**4251.30**

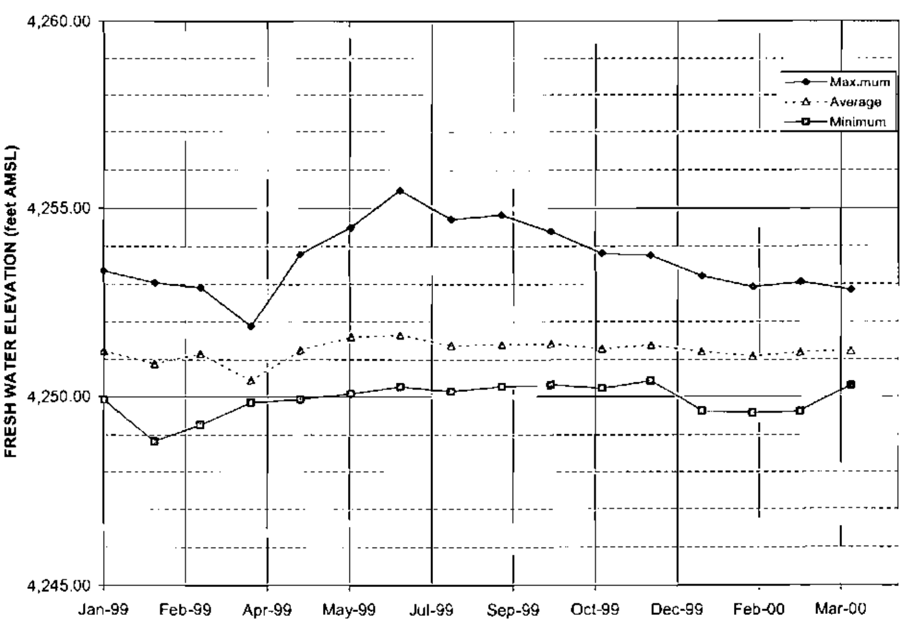


Figure 7. Water Level Elevations in 11e.(2) Cell Monitoring Wells Completed in the Unconfined Shallow Aquifer, January 1999 – April 2000

Table 14. January 1999 – April 2000 Water Level Elevations used in Calculating the Thickness of the Unsaturated Unit 3 Sand

	Jan-99	Feb-99	Mar-99	Apr-99	May-99	Jun-99	Jul-99	Aug-99	Sep-99	Oct-99	Nov-99
GW-19A	4,253.35	4,253.03	4,252.91	4,251.88	4,253.78	4,254.49	4,255.46	4,254.71	4,254.83	4,254.39	4,253.82
GW-20	4,250.90	4,250.91	4,251.05	4,250.15	4,250.96	n/a	4,251.00	4,250.93	4,250.96	4,250.99	4,250.88
GW-24	4,250.50	4,250.74	4,250.67	4,249.85	4,250.67	n/a	4,250.75	4,250.57	4,250.57	4,250.52	4,250.48
GW-25	4,250.79	n/a	4,250.86	4,250.07	4,250.90	n/a	4,252.09	4,250.99	4,250.98	4,250.90	4,250.82
GW-26	4,250.28	n/a	4,250.89	4,250.08	4,250.80	n/a	4,251.72	4,250.62	4,250.67	4,250.66	4,250.56
GW-27	4,249.91	4,248.83	4,249.26	4,249.96	4,249.93	4,250.07	4,250.27	4,250.14	4,250.28	4,250.31	4,250.22
GW-28	4,251.31	n/a	4,251.17	4,250.20	4,251.20	n/a	4,251.42	4,251.16	4,251.41	4,251.39	4,251.25
GW-29	n/a	n/a	n/a	n/a	4,250.88	4,250.94	4,250.91	4,250.87	4,250.87	4,250.89	4,250.82
GW-36	4,251.67	n/a	4,251.69	4,250.86	4,251.65	4,251.67	4,251.75	4,251.75	4,251.81	4,251.74	4,251.63
GW-37	4,251.66	n/a	4,251.70	4,250.76	4,251.56	4,251.54	4,251.88	4,251.68	4,251.80	4,251.83	4,251.64
GW-38	n/a	n/a	n/a	n/a	4,251.27	4,251.29	4,251.48	4,251.41	4,251.44	4,251.47	4,251.28
GW-57	4,251.21	n/a	4,250.28	4,250.09	4,251.06	n/a	4,251.28	4,251.12	4,251.37	4,251.33	4,251.16
GW-58	4,251.83	n/a	4,251.83	4,250.94	4,251.74	4,251.78	4,251.92	4,251.88	4,251.30	4,251.98	4,251.97
GW-60	4,251.09	n/a	4,251.16	4,250.27	4,251.08	4,251.09	4,251.16	4,251.17	4,251.19	4,251.18	4,251.15
GW-63	4,251.48	n/a	4,251.48	4,250.63	4,251.35	4,251.49	4,251.68	4,251.61	4,251.70	4,251.67	4,251.61
Average	4,251.23	4,250.88	4,251.15	4,250.44	4,251.25	4,251.59	4,251.65	4,251.38	4,251.41	4,251.42	4,251.29
Maximum	4,253.35	4,253.03	4,252.91	4,251.88	4,253.78	4,254.49	4,255.46	4,254.71	4,254.83	4,254.39	4,253.82
Minimum	4,249.91	4,248.83	4,249.26	4,249.85	4,249.93	4,250.07	4,250.27	4,250.14	4,250.28	4,250.31	4,250.22

	Dec-99	Jan-00	Feb-00	Mar-00	Apr-00	
GW-19A	4,253.75	4,253.21	4,252.92	4,253.05	4,252.84	
GW-20	4,250.95	4,250.90	4,250.89	4,251.31	4,251.07	
GW-24	4,250.57	4,250.48	4,250.40	4,251.14	4,250.67	
GW-25	4,250.88	4,251.07	4,250.69	4,250.71	4,250.80	
GW-26	4,250.68	4,249.64	4,249.59	4,249.62	4,250.74	
GW-27	4,250.42	4,250.33	4,250.28	4,250.25	4,250.29	
GW-28	4,251.37	4,251.19	4,251.15	4,251.18	4,251.09	
GW-29	4,250.91	4,250.97	4,250.89	4,251.09	4,250.98	
GW-36	4,251.67	4,251.56	4,251.47	4,251.51	4,251.57	
GW-37	4,251.66	4,251.61	4,251.51	4,251.48	4,251.69	
GW-38	4,251.37	4,251.32	4,251.17	4,251.38	4,251.46	
GW-57	4,251.46	4,251.11	4,251.00	4,251.00	4,250.93	
GW-58	4,252.07	4,252.05	4,251.78	4,251.72	4,251.61	
GW-60	4,251.25	4,251.10	4,251.06	4,251.07	4,251.07	
GW-63	4,251.69	4,251.52	4,251.46	4,251.38	4,251.47	
Average	4,251.38	4,251.20	4,251.08	4,251.19	4,251.22	4,251.24
Maximum	4,253.75	4,253.21	4,252.92	4,253.05	4,252.84	4,253.65
Minimum	4,250.42	4,249.64	4,249.59	4,249.62	4,250.29	4,249.91

The thicknesses of the upper radon barrier, lower radon barrier, top slope waste, and clay liner used in the UNSAT-H top slope model are 12 inches, 12 inches, 540 inches, and 24 inches, respectively, as shown in Table 15. Similarly, the thicknesses of the upper radon barrier, lower radon barrier, top slope waste, and clay liner used in the UNSAT-H side slope model are 12 inches, 12 inches, 222 inches, and 24 inches, respectively, as shown in Table 15. With the exception of the waste layers[2], all layer thicknesses in UNSAT-H are identical to those used in the HELP modeling.

4.1.3 Boundary Conditions

The lower boundary of the model was set to a constant head of zero cm, to represent the top of the water table. The upper boundary is represents the top of the radon barrier, which is located below the zone of evaporative and drainage. Therefore, evaporation at the upper boundary was set to zero and precipitation was set to the percolation rate predicted by the HELP model.

The upper boundary of the model received moisture as a constant, steady-state "precipitation" onto the top of the radon barrier. The average annual infiltration predicted by HELP was distributed over 24 hours per day, 365 days per year. All of the applied water infiltrates into the radon barrier, and percolates vertically through the profile.

4.1.4 Initial Head Conditions

The suction head (Ψ) was iterated to quasi-steady state, in order to predict the long-term moisture content and velocity in the cover, waste, liner, and underlying soil. The suction head from each run was used as input to the next simulation. Each series was run for an adequate time (50 - 250 years), until quasi-steady state head conditions were achieved.

4.2 Material Properties

The UNSAT-H model, with the van Genuchten option, required the input of θ_r, θ_s, K_s, α, n, and m for each material modeled. These include the radon barrier, waste, clay liner, and Unit 3 sand. The values were identical to those used in the previous 11e.(2) modeling. The material properties are given in Table 15.

The saturated hydraulic conductivity used for the Unit 3 Sand in the UNSAT-H model matches that used in previous 11e.(2) modeling. The geometric mean hydraulic conductivity of the shallow aquifer (6.09×10^{-4} cm/sec) was based on data from 96 wells across the site (Table 16). The site-wide statistics were calculated for all wells, without differentiating between hydrostratigraphic units[3].

[2] The waste layers in the HELP model were set to a uniform thickness of 100 inches, because the HELP model is not sensitive to the waste thickness.

[3] DRC (May 2000) recommended that the model not differentiate between the Unit 2 Clay and the Unit 3 Sand, because the hydraulic conductivity data did not indicate a clear correlation in the two units.

Table 15. UNSAT-H Model Input Parameters: Layer Thicknesses and Material Properties

Model	Van Genuchten Parameter	Upper Radon Barrier	Lower Radon Barrier	Waste	Clay Liner	Unit 3 Sand
Moisture Retention	θ_s	0.432	0.432	0.35	0.432	0.34
	θ_r	0.1	0.1	0.02	0.100	0.02
	α	0.003	0.003	0.115	0.003	0.055
	N	1.172	1.172	2.013	1.172	2.518
	m	Mualem	Mualem	Mualem	Mualem	Mualem
Conductivity	K_s (cm/sec)	5.00E-08	1.00E-06	5.00E-04	1.00E-06	6.09E-04
	α	0.003	0.003	0.115	0.003	0.055
	N	1.172	1.172	2.013	1.172	2.518
	M	Mualem	Mualem	Mualem	Mualem	Mualem
	L	4.5	4.5	0.5	4.5	0.5
Layer Thickness	Top Slope (in)	12	12	540	24	129.6
	Top Slope (cm)	30.5	30.5	1371.6	61.0	329.2
	Side Slope (in)	12	12	222	24	129.6
	Side Slope (cm)	30.5	30.5	563.9	61.0	329.2

NOTES:
θ_s = saturated moisture content (vol/vol)
θ_r – residual moisture content (vol/vol)
θ = air entry pressure (bubbling pressure)
n = van Genuchten's n, fitting parameter
K_s = saturated hydraulic conductivity (cm/sec)
m = Mualem's m
l – pore connectivity parameter

Table 16. Site-Wide Hydraulic Conductivity Test Results

(See large tables at end of report document)

4.3 UNSAT-H Modeling Results

The UNSAT-H model for each case was run daily in 50 year-increments for up to 250 years to reach quasi-steady-state conditions. Quasi-steady-state is achieved by running the model for sufficient time that moisture contents stabilize, and water is not taken into or released from storage. These moisture contents represent the long-term expected moisture contents in the Class A South cell materials and the underlying subsurface.

4.3.1 Moisture Content

The moisture content with depth for the Class A South cell top slope is listed in Table 17, and is shown graphically in Figure 8. The clay layers in the cover and liner of the Class A South cell retain high moisture contents (approximately 0.42) while the waste and native soil layers have relatively low moisture contents. Based on 0.244 cm/yr infiltration, the moisture contents stabilized at 0.0575 in the waste and 0.045 in the native soil below the cell (Table 18).

The predicted moisture content for the Class A South cell side slope is slightly higher than for the top slope, due to higher infiltration rates through the side slope. The moisture contents with depth for three side slope simulations are listed in Table 17, and shown graphically in Figure 9. The results are summarized in Table 18. Based on 0.641 cm/yr infiltration, the moisture contents stabilized at 0.066 in the waste and 0.050 in the native soil below the cell. Based on 0.507 cm/yr infiltration, the moisture contents stabilized at 0.064 in the waste and 0.049 in the native soil below the cell. Based on 0.451 cm/yr infiltration, the moisture contents stabilized at 0.063 in the waste and 0.048 in the native soil below the cell. The soil suction heads with depth for the three side slope simulations are also shown in Figure 9.

4.3.2 Capillary Fringe

The moisture content of the Unit 3 sand was determined for the zone from the bottom of the clay liner to the top of the capillary fringe. This approach is conservative because 1) a higher vadose zone velocity is calculated using the lower moisture content ($v_v=q/n_e$) and 2) the length of the vertical path was decreased in the PATHRAE model to exclude the capillary fringe.

The UNSAT-H results for both the top slope (Figure 8) and side slope (Figure 9) areas illustrate that the capillary fringe may extend as far as 35 cm above the water table. To account for this phenomenon, the distance from the bottom of the waste to the water table was decreased by 1.17 feet in PATHRAE runs, and the moisture contents from the vadose zone (omitting the capillary fringe) were used.

Table 17. Moisture Content vs. Depth - UNSAT-H Results for Class A South Cell

TOP SLOPE		0.276 cm/yr		Unit /
NODE NUMBER	DEPTH	θ	Average θ	Material
1	0.0	0.4279		Upper Radon Barrier
2	0.1	0.4279		Upper Radon Barrier
3	0.3	0.4279		Upper Radon Barrier
4	0.6	0.4278		Upper Radon Barrier
5	1.1	0.4278		Upper Radon Barrier
6	2.0	0.4277		Upper Radon Barrier
7	3.3	0.4275		Upper Radon Barrier
8	5.6	0.4273		Upper Radon Barrier
9	6.9	0.4271		Upper Radon Barrier
10	7.8	0.4270		Upper Radon Barrier
11	8.3	0.4269		Upper Radon Barrier
12	8.6	0.4269		Upper Radon Barrier
13	8.8	0.4268		Upper Radon Barrier
14	8.9	0.4268		Upper Radon Barrier
15	9.0	0.4268		Upper Radon Barrier
16	9.2	0.4268		Upper Radon Barrier
17	9.5	0.4267		Upper Radon Barrier
18	10.0	0.4267		Upper Radon Barrier
19	10.9	0.4265		Upper Radon Barrier
20	13.1	0.4262		Upper Radon Barrier
21	16.4	0.4256		Upper Radon Barrier
22	21.5	0.4245		Upper Radon Barrier
23	24.8	0.4237		Upper Radon Barrier
24	27.0	0.4230		Upper Radon Barrier
25	28.5	0.4226		Upper Radon Barrier
26	29.4	0.4223		Upper Radon Barrier
27	29.9	0.4221		Upper Radon Barrier
28	30.2	0.4220		Upper Radon Barrier
29	30.4	0.4219		Upper Radon Barrier
30	30.5	0.4219	0.4253	Upper Radon Barrier
31	30.6	0.4219		Lower Radon Barrier
32	30.8	0.4219		Lower Radon Barrier
33	31.1	0.4219		Lower Radon Barrier
34	31.6	0.4220		Lower Radon Barrier
35	32.3	0.4221		Lower Radon Barrier
36	33.3	0.4221		Lower Radon Barrier
37	34.8	0.4223		Lower Radon Barrier
38	37.0	0.4225		Lower Radon Barrier
39	39.7	0.4227		Lower Radon Barrier
40	42.7	0.4230		Lower Radon Barrier
41	45.7	0.4232		Lower Radon Barrier
42	48.7	0.4235		Lower Radon Barrier
43	51.7	0.4238		Lower Radon Barrier
44	54.5	0.4240		Lower Radon Barrier
45	56.7	0.4242		Lower Radon Barrier
46	58.2	0.4244		Lower Radon Barrier
47	59.2	0.4245		Lower Radon Barrier
48	59.9	0.4245		Lower Radon Barrier
49	60.4	0.4246		Lower Radon Barrier
50	60.7	0.4246		Lower Radon Barrier
51	60.9	0.4246		Lower Radon Barrier
52	61.0	0.4246	0.4261	Lower Radon Barrier
53	61.1	0.0587		Waste
54	61.3	0.0587		Waste
55	61.6	0.0587		Waste
56	62.1	0.0587		Waste
57	63.0	0.0587		Waste
58	64.5	0.0587		Waste
59	67.5	0.0587		Waste
60	72.5	0.0587		Waste
61	82.5	0.0587		Waste
62	102.5	0.0587		Waste
63	132.5	0.0587		Waste
64	177.5	0.0587		Waste
65	242.5	0.0587		Waste
66	342.5	0.0587		Waste
67	502.5	0.0587		Waste
68	746.8	0.0587		Waste
69	991.1	0.0587		Waste
70	1151.1	0.0587		Waste
71	1251.1	0.0587		Waste
72	1316.1	0.0587		Waste
73	1361.1	0.0586		Waste
74	1391.1	0.0580		Waste
75	1411.1	0.0555		Waste
76	1421.1	0.0520		Waste
77	1426.1	0.0487		Waste
78	1429.1	0.0456		Waste
79	1430.6	0.0433		Waste
80	1431.5	0.0416		Waste

SIDE SLOPE.		0.286 cm/yr		0.595 cm/yr		Unit / ·
NODE NUMBER	DEPTH	θ	Average θ	θ	Average θ	Material
1	0.0	0.4281		0.4315		Upper Radon Barrier
2	0.1	0.4281		0.4315		Upper Radon Barrier
3	0.3	0.4281		0.4315		Upper Radon Barrier
4	0.6	0.4281		0.4314		Upper Radon Barrier
5	1.1	0.4280		0.4314		Upper Radon Barrier
6	2.0	0.4279		0.4314		Upper Radon Barrier
7	3.3	0.4278		0.4313		Upper Radon Barrier
8	5.6	0.4275		0.4311		Upper Radon Barrier
9	6.9	0.4273		0.4310		Upper Radon Barrier
10	7.8	0.4272		0.4309		Upper Radon Barrier
11	8.3	0.4271		0.4308		Upper Radon Barrier
12	8.6	0.4271		0.4308		Upper Radon Barrier
13	8.8	0.4271		0.4307		Upper Radon Barrier
14	8.9	0.4271		0.4307		Upper Radon Barrier
15	9.0	0.4270		0.4307		Upper Radon Barrier
16	9.2	0.4270		0.4307		Upper Radon Barrier
17	9.5	0.4270		0.4307		Upper Radon Barrier
18	10.0	0.4269		0.4306		Upper Radon Barrier
19	10.9	0.4268		0.4305		Upper Radon Barrier
20	13.1	0.4264		0.4301		Upper Radon Barrier
21	16.4	0.4258		0.4295		Upper Radon Barrier
22	21.5	0.4247		0.4281		Upper Radon Barrier
23	24.8	0.4238		0.4269		Upper Radon Barrier
24	27.0	0.4232		0.4258		Upper Radon Barrier
25	28.5	0.4227		0.4250		Upper Radon Barrier
26	29.4	0.4224		0.4244		Upper Radon Barrier
27	29.9	0.4222		0.4241		Upper Radon Barrier
28	30.2	0.4221		0.4239		Upper Radon Barrier
29	30.4	0.4220		0.4237		Upper Radon Barrier
30	30.5	0.4220	0.42545	0.4237	0.42873	Upper Radon Barrier
31	30.6	0.4220		0.4237		Lower Radon Barrier
32	30.8	0.4220		0.4237		Lower Radon Barrier
33	31.1	0.4220		0.4237		Lower Radon Barrier
34	31.6	0.4221		0.4237		Lower Radon Barrier
35	32.3	0.4221		0.4238		Lower Radon Barrier
36	33.3	0.4222		0.4238		Lower Radon Barrier
37	34.8	0.4224		0.4239		Lower Radon Barrier
38	37.0	0.4225		0.4241		Lower Radon Barrier
39	39.7	0.4228		0.4243		Lower Radon Barrier
40	42.7	0.4230		0.4245		Lower Radon Barrier
41	45.7	0.4233		0.4247		Lower Radon Barrier
42	48.7	0.4236		0.4249		Lower Radon Barrier
43	51.7	0.4238		0.4252		Lower Radon Barrier
44	54.5	0.4241		0.4254		Lower Radon Barrier
45	56.7	0.4243		0.4256		Lower Radon Barrier
46	58.2	0.4244		0.4257		Lower Radon Barrier
47	59.2	0.4245		0.4258		Lower Radon Barrier
48	59.9	0.4246		0.4258		Lower Radon Barrier
49	60.4	0.4246		0.4258		Lower Radon Barrier
50	60.7	0.4247		0.4259		Lower Radon Barrier
51	60.9	0.4247		0.4259		Lower Radon Barrier
52	61.0	0.4247	0.42621	0.4259	0.42762	Lower Radon Barrier
53	61.1	0.0590		0.0659		Waste
54	61.3	0.0590		0.0659		Waste
55	61.6	0.0590		0.0659		Waste
56	62.1	0.0590		0.0659		Waste
57	63.0	0.0590		0.0659		Waste
58	64.5	0.0590		0.0659		Waste
59	67.5	0.0590		0.0659		Waste
60	72.5	0.0590		0.0659		Waste
61	82.5	0.0590		0.0659		Waste
62	102.5	0.0590		0.0659		Waste
63	132.5	0.0590		0.0659		Waste
64	182.5	0.0590		0.0659		Waste
65	272.5	0.0590		0.0659		Waste
66	413.4	0.0590		0.0659		Waste
67	503.4	0.0590		0.0659		Waste
68	553.4	0.0584		0.0660		Waste
69	583.4	0.0558		0.0659		Waste
70	603.4	0.0590		0.0660		Waste
71	613.4	0.0523		0.0593		Waste
72	618.4	0.0490		0.0554		Waste
73	621.4	0.0458		0.0516		Waste
74	622.9	0.0436		0.0488		Waste
75	623.8	0.0418		0.0467		Waste
76	624.3	0.0407		0.0452		Waste
77	624.6	0.0399		0.0442		Waste
78	624.8	0.0393		0.0434		Waste
79	624.9	0.0390	0.05897	0.0430	0.06599	Waste
80	625.0	0.4167		0.4194		Clay Liner

Table 17. Moisture Content vs. Depth - UNSAT-H Results for Class A South Cell (Part 2)

TOP SLOPE		0.276 cm/yr		Unit /
NODE NUMBER	DEPTH	θ	Average θ	Material
81	1432.0	0.0405		Waste
82	1432.3	0.0397		Waste
83	1432.5	0.0391		Waste
84	1432.6	0.0388	0.0585	Clay Liner
85	1432.7	0.4166		Clay Liner
86	1432.9	0.4166		Clay Liner
87	1433.2	0.4166		Clay Liner
88	1433.7	0.4166		Clay Liner
89	1434.4	0.4167		Clay Liner
90	1435.4	0.4167		Clay Liner
91	1436.9	0.4168		Clay Liner
92	1439.1	0.4170		Clay Liner
93	1443.1	0.4173		Clay Liner
94	1450.1	0.4177		Clay Liner
95	1463.1	0.4187		Clay Liner
96	1476.1	0.4197		Clay Liner
97	1483.1	0.4202		Clay Liner
98	1487.1	0.4205		Clay Liner
99	1489.3	0.4207		Clay Liner
100	1490.8	0.4208		Clay Liner
101	1491.8	0.4209		Clay Liner
102	1492.5	0.4210		Clay Liner
103	1493.0	0.4210		Clay Liner
104	1493.3	0.4210		Clay Liner
105	1493.5	0.4211		Clay Liner
106	1493.6	0.4211	0.41902	Clay Liner
107	1493.7	0.0424		Unit 3 Sand
108	1493.9	0.0424		Unit 3 Sand
109	1494.2	0.0424		Unit 3 Sand
110	1494.7	0.0424		Unit 3 Sand
111	1495.4	0.0424		Unit 3 Sand
112	1496.4	0.0424		Unit 3 Sand
113	1497.9	0.0424		Unit 3 Sand
114	1499.7	0.0424		Unit 3 Sand
115	1503.7	0.0424		Unit 3 Sand
116	1509.7	0.0424		Unit 3 Sand
117	1519.7	0.0424		Unit 3 Sand
118	1533.7	0.0424		Unit 3 Sand
119	1553.7	0.0424		Unit 3 Sand
120	1582.7	0.0424		Unit 3 Sand
121	1625.7	0.0424		Unit 3 Sand
122	1690.7	0.0424		Unit 3 Sand
123	1733.7	0.0502		Unit 3 Sand
124	1762.7	0.0710	0.0467	Unit 3 Sand
125	1782.7	0.1093		Unit 3 Sand
126	1796.7	0.1708		Unit3 Sand-Capillary Frng
127	1806.7	0.2495		Unit3 Sand-Capillary Frng
128	1812.7	0.3028		Unit3 Sand-Capillary Frng
129	1816.7	0.3283		Unit3 Sand-Capillary Frng
130	1818.5	0.3350		Unit3 Sand-Capillary Frng
131	1820.0	0.3383		Unit3 Sand-Capillary Frng
132	1821	0.3394		Unit3 Sand-Capillary Frng
133	1821.7	0.3398		Unit3 Sand-Capillary Frng
134	1822.2	0.3400		Unit3 Sand-Capillary Frng
135	1822.5	0.3400		Unit3 Sand-Capillary Frng
136	1822.7	0.3400		Unit3 Sand-Capillary Frng
137	1822.8	0.3400		Unit3 Sand-Capillary Frng

SIDE SLOPE,		0.286 cm/yr		0.595 cm/yr		Unit /
NODE NUMBER	DEPTH	θ	Average θ	θ	Average θ	Material
81	625.2	0.4167		0.4194		Clay Liner
82	625.5	0.4167		0.4194		Clay Liner
83	626.0	0.4168		0.4194		Clay Liner
84	626.7	0.4168		0.4194		Clay Liner
85	627.7	0.4169		0.4195		Clay Liner
86	629.2	0.4170		0.4195		Clay Liner
87	631.4	0.4171		0.4196		Clay Liner
88	635.4	0.4174		0.4198		Clay Liner
89	642.4	0.4178		0.4201		Clay Liner
90	655.4	0.4188		0.4208		Clay Liner
91	668.4	0.4197		0.4215		Clay Liner
92	675.4	0.4203		0.4219		Clay Liner
93	679.4	0.4206		0.4221		Clay Liner
94	681.6	0.4208		0.4222		Clay Liner
95	683.1	0.4209		0.4223		Clay Liner
96	684.1	0.4210		0.4224		Clay Liner
97	684.8	0.4211		0.4224		Clay Liner
98	685.3	0.4211		0.4225		Clay Liner
99	685.6	0.4211		0.4225		Clay Liner
100	685.8	0.4211		0.4225		Clay Liner
101	685.9	0.4211	0.41911	0.4225	0.42103	Clay Liner
102	686.0	0.0426		0.0474		Unit 3 Sand
103	686.2	0.0426		0.0474		Unit 3 Sand
104	686.5	0.0426		0.0474		Unit 3 Sand
105	687.0	0.0426		0.0474		Unit 3 Sand
106	687.7	0.0426		0.0474		Unit 3 Sand
107	688.7	0.0426		0.0474		Unit 3 Sand
108	690.2	0.0426		0.0474		Unit 3 Sand
109	692.0	0.0426		0.0474		Unit 3 Sand
110	696.0	0.0426		0.0474		Unit 3 Sand
111	702.0	0.0426		0.0474		Unit 3 Sand
112	712.0	0.0426		0.0474		Unit 3 Sand
113	726.0	0.0426		0.0474		Unit 3 Sand
114	746.0	0.0426		0.0474		Unit 3 Sand
115	775.0	0.0426		0.0474		Unit 3 Sand
116	818.0	0.0426		0.0476		Unit 3 Sand
117	883.0	0.0426		0.0470		Unit 3 Sand
118	926.0	0.0503		0.0521		Unit 3 Sand
119	955.0	0.0710	0.04691	0.0715	0.05069	Unit 3 Sand
120	975.0	0.1093		0.1093		Unit 3 Sand
121	989.0	0.1708		0.1708		Unit 3 Sand – Capillary Fringe
122	999.0	0.2495		0.2495		Unit 3 Sand – Capillary Fringe
123	1005.0	0.3028		0.3028		Unit 3 Sand – Capillary Fringe
124	1009.0	0.3283		0.3283		Unit 3 Sand – Capillary Fringe
125	1010.8	0.3350		0.3350		Unit 3 Sand – Capillary Fringe
126	1012.3	0.3383		0.3383		Unit 3 Sand – Capillary Fringe
127	1013.3	0.3394		0.3394		Unit 3 Sand – Capillary Fringe
128	1014.0	0.3398		0.3398		Unit 3 Sand – Capillary Fringe
129	1014.5	0.3400		0.3400		Unit 3 Sand – Capillary Fringe
130	1014.8	0.3400		0.3400		Unit 3 Sand – Capillary Fringe
131	1015.0	0.3400		0.3400		Unit 3 Sand – Capillary Fringe
132	1015.1	0.3400		0.3400		Unit 3 Sand – Capillary Fringe

Table 18. UNSAT-H Model Results – Moisture Content in Waste, Clay Liner, and Unit 3 Sand

UNSAT-H Model Run			Volumetric Moisture Content (v/v)				
Run Name	Description	Infiltration (cm/yr)	Radon Barrier (Upper)	Radon Barrier (Lower)	Waste	Clay Liner	Unit 3 Sand
CAS-T27e	Top Slope, 0.276 cm/yr	0.276	0.4253	0.4261	0.0585	0.4190	0.0467
CAS-28c	Side Slope, 0.286 cm/yr	0.286	0.4254	0.4262	0.0590	0.4191	0.0469
CAS-59c	Side Slope, 0.595 cm/yr	0.595	0.4287	0.4276	0.0660	0.4210	0.0507

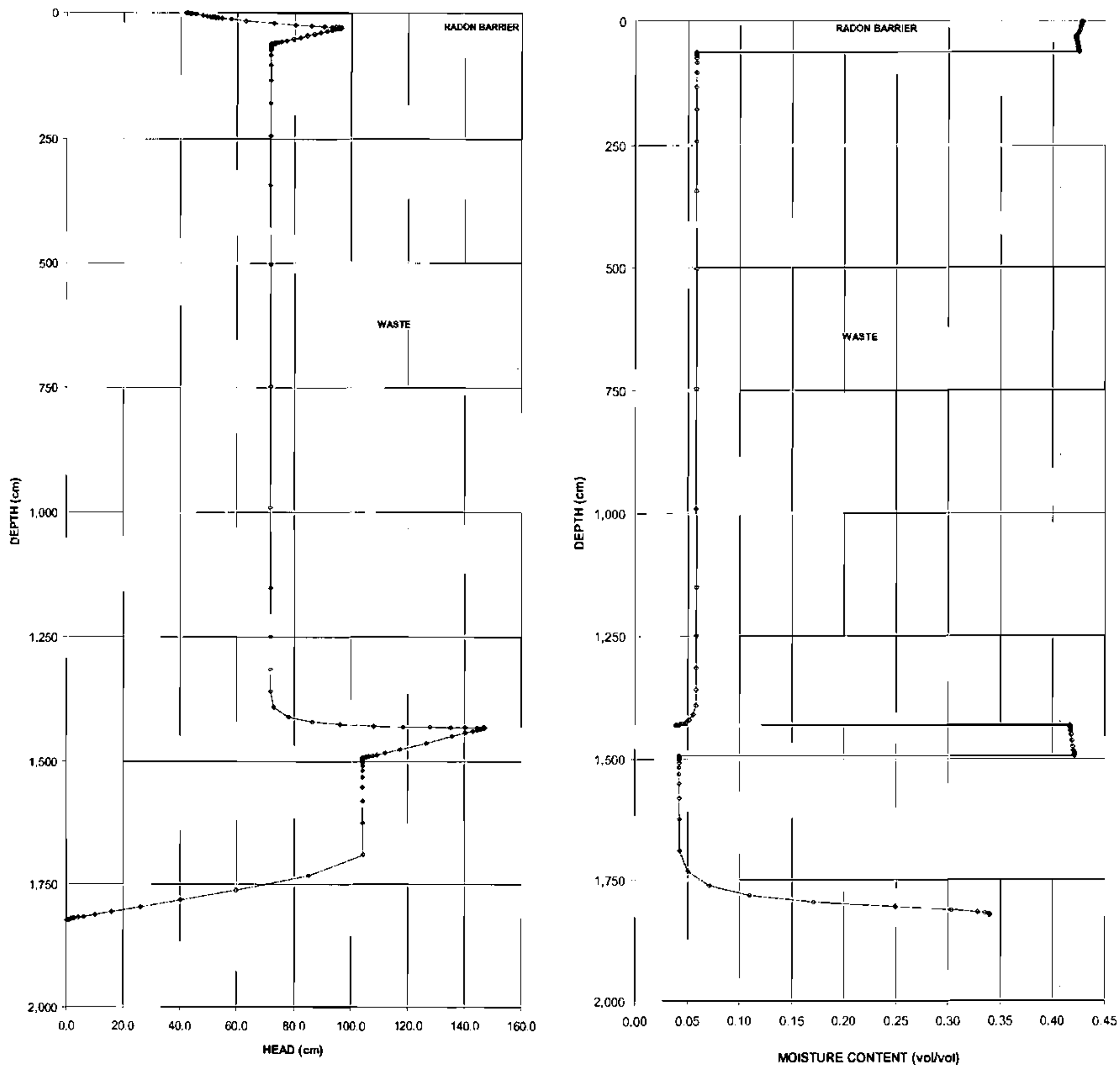


Figure 8. Suction Head and Moisture Content vs. Depth Below Top of Radon Barrier – UNSAT-H Top Slope Model Results

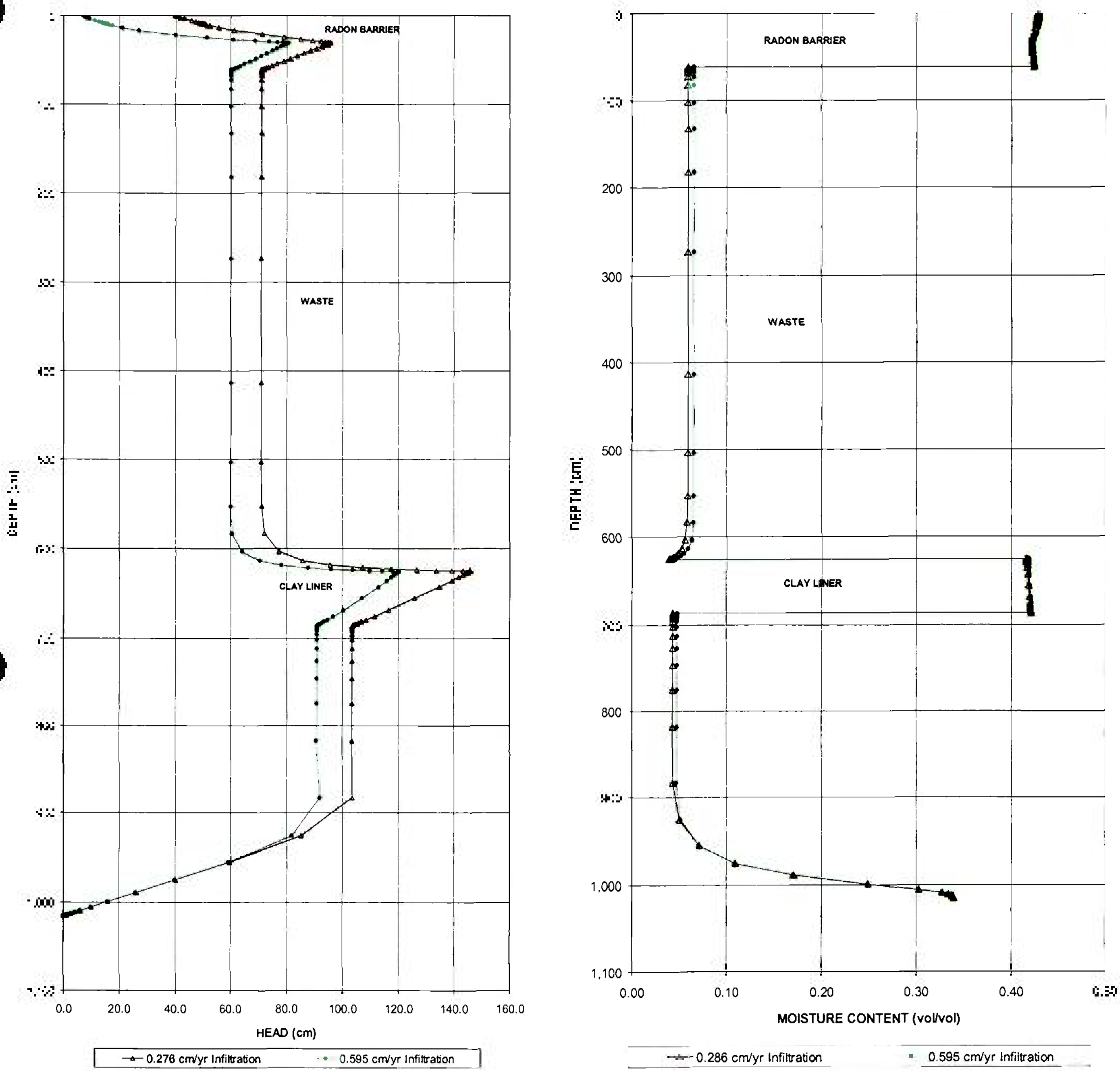


Figure 9. Suction Head and Moisture Content vs. Depth Below Top of Radon Barrier – UNSAT-H Side Slope Model Results

5. VERTICAL PATHRAE FATE AND TRANSPORT MODELING

5.1 PATHRAE Code

Transport modeling was performed using the PATHRAE-RAD Performance Assessment Code for the Land Disposal of Radioactive Wastes (Merrell, et. al, 1995). The PATHRAE code was first developed for the US EPA in the 1980s, for use in assessing the maximum annual dose to a critical population group resulting from the disposal of "below regulatory concern" (BRC) wastes. The Class A South cell modeling used the PATHRAE-RAD version of the code, which was released on February 9, 1995 (code) and March 1995 (documentation). A modification to the code to allow for more than 10 output times was made by Adrian Brown Consultants in 1997, and is documented in Appendix M of Envirocare's 1998 license renewal application.

The PATHRAE code is generally made up of three components: release, transport, and uptake solutions. The model calculates a closed form solution for dose (or concentration) at a point in each pathway at a user-specified set of times. The code can be used to simulate multiple transport/receptor pathways. In the Class A South cell model, the groundwater to a river pathway was applied, in order to determine the concentration at a compliance point located 90 feet from the edge of the disposal cell. The three PATHRAE components are described below:

- *Release.* PATHRAE uses a constant rate for predicting the release of contaminants from the waste, in the current modeling exercise. That is, the model assumes that the quantity of contaminant released each year is a constant fraction of the amount of waste initially present[4].
- *Transport.* The transport component of PATHRAE is similar to that in many other groundwater contaminant transport models. PATHRAE solves the advection/dispersion equation, includes aquifer diffusion, assumes that diffusion is Fickian, allows for retardation of contaminants using a blanket K_d (retardation coefficient), and includes radioactive decay.
- *Uptake.* PATHRAE also calculates the maximum annual doses to a receptor consuming river or well water and crops grown using that water. However, the groundwater protection levels for the Energy*Solutions* site are given as concentrations derived from dose/uptake conversions. Therefore, PATHRAE was used to determine concentrations, rather than dose.

Both a vertical transport path and a horizontal transport path were modeled. The vertical model was run first, to determine the arrival time and concentrations of constituents at the water table. The output from the vertical model was then input into the horizontal model, using the discrete dispersed source method.

The discrete dispersed source method involves a vertically dispersed source term which is discretized over time and space. The PATHRAE transport model was run first for the dispersive vertical (unsaturated zone) solution. The procedure for applying the discrete dispersed source method is described in detail in previous reports. Concentration output was obtained for 116 output times and the total mass (or activity) of each constituent at the water table during a given time "slice" was summed from the output file. The time of arrival was converted to a distance by which to shorten (or lengthen) the vertical path as a result of positive (or negative) dispersion and retardation (Figure 10). The horizontal model was then run 115 times, using the initial concentration and distance for each time "slice". The 115 resulting concentrations at the compliance point were summed, to determine total concentration, which was then compared to the groundwater protection levels established for the applicable monitoring wells.

[4] The assumption that the release rate (leach rate) is constant over time is conservative. The release rate would actually decrease over time as the source term concentration decreases.

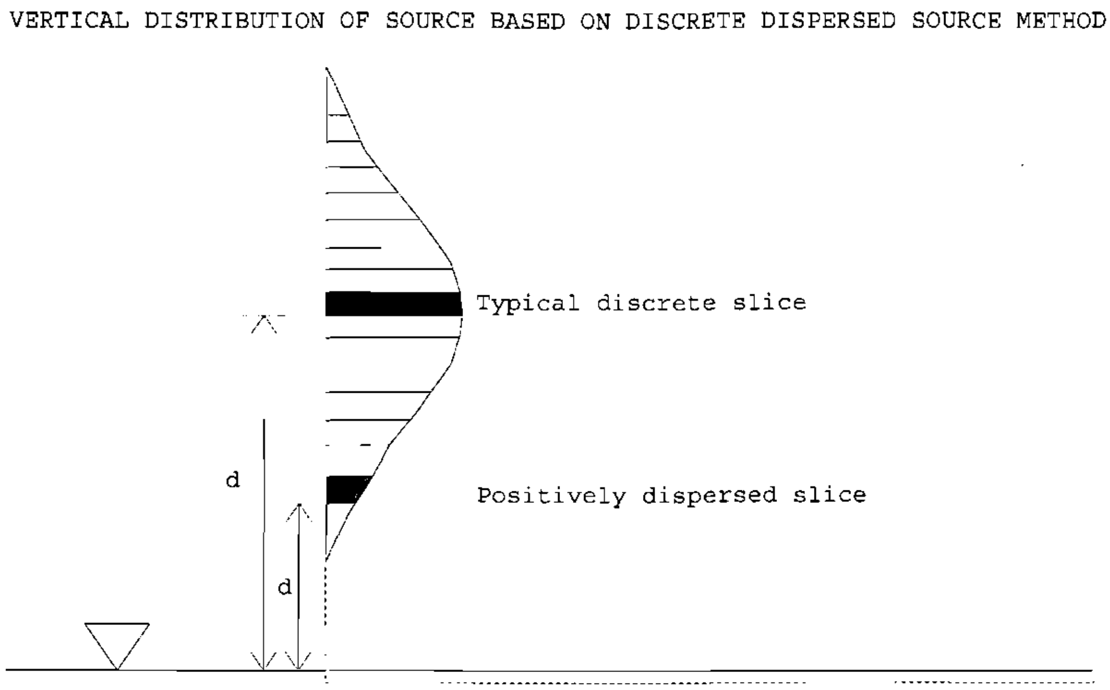


Figure 10. Vertical Distribution of Source Term Based on the Discrete Dispersed Source Method

5.2 Groundwater Protection Levels

The final output from the PATHRAE model was compared to the Groundwater Protection Levels (GWPLs) to determine the year in which the GWPL is first exceeded. The year to exceed is conservatively reported as the next *lowest* model output time.

GWPLs are listed in Table 19, for all constituents modeled. The GWPL values were derived from several sources (including UDEQ and EPA), which are also listed in Table 19. These sources include:

- Maximum contaminant levels (MCLs) and secondary MCLs (SMCLs) in drinking water established by UDEQ and the US EPA.
- Proposed drinking water standards for alpha emitters, as published in the EPA 1991 Proposed Rules, Federal Register, Vol. 56, No. 138, 40 CFR Parts 141 and 142, Appendix C - Alpha Emitters. The EPA's proposed standards for beta, gamma, and alpha emitters were also published in the Federal Register on April 21, 2000.
- Proposed drinking water standards for beta emitters, as published in the - EPA 1991 Proposed Rules, Federal Register, Vol. 56, No. 138, 40 CFR Parts 141 and 142, Appendix B - Beta Particle and Photon Emitters.
- Site specific GWPLs established by UDEQ for the existing LARW cell monitoring wells. These standards are listed in Table 1B of EnergySolutions' GWDP.
- GWPLs used in previous modeling performed by UDEQ DRC.

- Calculated values using FGR 11 or FGR 13. The most conservative (lowest) value calculated by Loren Morton (UDEQ DRC) were selected for nuclides which were not included in EPA's proposed rules or for which background GWPLs had not been established. GWPLs for two nuclides that were not were provided in the spreadsheet from Loren Morton were calculated by Wayne Johns using FGR 11. Both Loren Morton and Wayne Johns calculated the GWPL using the following equation:

$$GWPL = \frac{4mrem(CEDE)}{Year} \times \frac{1ALI(\mu Ci)}{5000mrem} \times \frac{10^6 pCi}{\mu Ci} \times \frac{1year}{365days} \times \frac{1day}{2Liters} = \frac{pCi}{Liter}$$

- The GWPL for Nb-94 was also used for Nb-91 and Nb-92, because no values for these two nuclides are listed in MCLs, FGR 11, or FGR 13. The Nb-94 GWPL would be lower than those of Nb-91, Nb-92 based on radioactive half-life, decay products, and decay energies.
- GWPLs estimated using ICRP 30 (for Po-208, Po-209).

Table 19. Ground Water Protection Levels (GWPLs) for Class A South Cell Monitoring Wells

Radiological Constituents:

PARAMETER		GWPL (pCi/L)	GWPL (Ci/m^3)	Ref.
Actinium	Ac-227	1.27E+00	1.27E-09	2
Silver-108m	Ag-108m	7.23E+02	7.23E-07	2
Silver-110m	Ag-110m	5.12E+02	5.12E-07	2
Aluminum-26	Al-26	4.38E+02	4.38E-07	8
Americium-241	Am-241	6.45E+00	6.45E-09	1
Americium-242m	Am-242m	1.27E+00	1.27E-09	2
Americium-243	Am-243	6.49E+00	6.49E-09	1
Barium-133	Ba-133	1.52E+03	1.52E-06	2
Beryllium-7	Be-7	4.35E+04	4.35E-05	2
Beryllium-10	Be-10	1.10E+03	1.10E-06	8
Bismuth-207	Bi-207	1.01E+03	1.01E-06	2
Bismuth-210m	Bi-210m	3.46E+01	3.46E-08	7
Berkelium-247	Bk-247	5.48E-01	5.48E-10	7
Carbon-14	C-14	3.20E+03	3.20E-06	2
Calcium-41	Ca-41	3.29E+03	3.29E-06	8
Calcium-45	Ca-45	1.73E+03	1.73E-06	2
Cadmium-109	Cd-109	2.27E+02	2.27E-07	2
Cadmium-113	Cd-113	2.19E+01	2.19E-08	8
Cadmium-113m	Cd-113m	2.19E+01	2.19E-08	7
Californium-249	Cf-249	5.48E-01	5.48E-10	7
Californium-250	Cf-250	1.10E+00	1.10E-09	7
Californium-251	Cf-251	5.48E-01	5.48E-10	7
Californium-252	Cf-252	1.70E+01	1.70E-08	1
Chlorine-36	Cl-36	1.85E+03	1.85E-06	2
Curium-242	Cm-242	1.45E+02	1.45E-07	1
Curium-243	Cm-243	8.47E+00	8.47E-09	1
Curium-244	Cm-244	1.00E+01	1.00E-08	1
Curium-245	Cm-245	6.35E+00	6.35E-09	1
Curium-246	Cm-246	6.38E+00	6.38E-09	1
Curium-247	Cm-247	6.93E+00	6.93E-09	1
Curium-248	Cm-248	1.71E+00	1.71E-09	1
Cobalt-57	Co-57	4.87E+03	4.87E-06	2
Cobalt-60	Co-60	2.18E+02	2.18E-07	2
Cesium-134	Cs-134	8.13E+01	8.13E-08	2
Cesium-135	Cs-135	7.94E+02	7.94E-07	2
Cesium-137	Cs-137	1.19E+02	1.19E-07	2
Europium-152	Eu-152	8.41E+02	8.41E-07	2
Europium-154	Eu-154	5.73E+02	5.73E-07	2
Europium-155	Eu-155	3.59E+03	3.59E-06	2
Iron-55	Fe-55	9.25E+03	9.25E-06	2
Iron-60	Fe-60	7.96E+00	7.96E-09	7
Gadolinium-148	Gd-148	1.10E+01	1.10E-08	7
Tritium H-3	H-3	6.09E+04	6.09E-05	2
Mercury-194	Hg-194	2.19E+01	2.19E-08	7
Holmium-166m	Ho-166m	6.58E+02	6.58E-07	8
Iodine-129	I-129	2.10E+01	2.10E-08	2
Potassium-40	K-40	5.60E+02	5.60E-07	3
Manganese-53	Mn-53	5.48E+04	5.48E-05	8
Sodium-22	Na-22	4.66E+02	4.66E-07	2
Niobium-91	Nb-91	7.07E+02	7.07E-07	9
Niobium-92	Nb-92	7.07E+02	7.07E-07	9
Niobium-93m	Nb-93m	1.05E+04	1.05E-05	2
Niobium-94	Nb-94	7.07E+02	7.07E-07	2
Nickel-59	Ni-59	2.70E+04	2.70E-05	2
Nickel-63	Ni-63	9.91E+03	9.91E-06	2
Neptunium-237	Np-237	7.19E+00	7.19E-09	1
Osmium-194	Os-194	1.28E+02	1.28E-07	7
Protactinium-231	Pa-231	1.02E+01	1.02E-08	1
Pb-202	Pb-202	5.48E+00	5.48E-09	8
Pb-203	Pb-203	5.05E+03	5.05E-06	2
Pb-210	Pb-210	1.01E+00	1.01E-09	2
Palladium=107	Pd-107	3.66E+04	3.66E-05	2
Promethium-145	Pm-145	1.10E+04	1.10E-05	8
Promethium-147	Pm-147	5.24E+03	5.24E-06	2
Polonium-208	Po-208	1.64E+00	1.64E-09	10
Polonium-209	Po-209	1.48E+00	1.48E-09	7
Platinum-193	Pt-193	4.61E+04	4.61E-05	2
Plutonium-236	Pu-236	3.33E+01	3.33E-08	1

Non-radiological Constituents:

PARAMETER	GWPL (mg/l)	GWPL (kg/m^3)
Arsenic	0.05	5.00E-05
Barium	2	2.00E-03
Beryllium	0.004	4.00E-06
Cadmium	0.005	5.00E-06
Chromium	0.1	1.00E-04
Copper	1.3	1.30E-03
Lead	0.015	1.50E-05
Mercury	0.002	2.00E-06
Molybdenum	0.04	4.00E-05
Nickel	0.1	1.00E-04
Selenium	0.05	5.00E-05
Silver	0.1	1.00E-04
Zinc	5	5.00E-03

Formerly Characteristic (D-Code) Waste:

PARAMETER	Regulatory Level (mg/l)	Regulatory Level (kg/m^3)
D004 Arsenic	5	5.00E-03
D005 Barium	100	1.00E-01
D018 Benzene	0.5	5.00E-04
D006 Cadmium	1	1.00E-03
D019 Carbon tetrachloride	0.5	5.00E-04
D020 Chlordane	0.03	3.00E-05
D021 Chlorobenzene	100	1.00E-01
D022 Chloroform	6	6.00E-03
D007 Chromium	5	5.00E-03
D023 o-Cresol	200	2.00E-01
D024 m-Cresol	200	2.00E-01
D025 p-Cresol	200	2.00E-01
D026 Cresol	200	2.00E-01
D016 2,4-D	10	1.00E-02
D027 1,4-Dichlorobenzene	7.5	7.50E-03
D028 1,2-Dichloroethane	0.5	5.00E-04
D029 1,1-Dichloroethylene	0.7	7.00E-04
D030 2,4-Dinitrotoluene	0.13	1.30E-04
D012 Endrin	0.02	2.00E-05
D031 Heptachlor	0.008	8.00E-06
D032 Hexachlorobenzene	0.13	1.30E-04
D033 Hexachlorobutadiene	0.5	5.00E-04
D034 Hexachloroethane	3	3.00E-03
D008 Lead	5	5.00E-03
D013 Lindane	0.4	4.00E-04
D009 Mercury	0.2	2.00E-04
D014 Methoxychlor	10	1.00E-02
D035 Methyl ethyl ketone	200	2.00E-01
D036 Nitrobenzene	2	2.00E-03
D037 Pentrachlorophenol	100	1.00E-01
D038 Pyridine	5	5.00E-03
D010 Selenium	1	1.00E-03
D011 Silver	5	5.00E-03
D039 Tetrachloroethylene	0.7	7.00E-04
D015 Toxaphene	0.5	5.00E-04
D040 Trichloroethylene	0.5	5.00E-04
D041 2,4,5-Trichlorophenol	400	4.00E-01
D042 2,4,6-Trichlorophenol	2	2.00E-03
D017 2,4,5-TP (Silvex)	1	1.00E-03

Table 19. Ground Water Protection Levels (GWPLs) for Class A South Cell Monitoring Wells (Continued)

PARAMETER		GWPL (pCi/L)	GWPL (Ci/m³)	Ref.
Plutonium-236	Pu-236	3.33E+01	3.33E-08	1
Plutonium-238	Pu-238	7.15E+00	7.15E-09	1
Plutonium-239	Pu-239	6.49E+01	6.49E-08	1
Plutonium-240	Pu-240	6.49E+01	6.49E-08	1
Plutonium-241	Pu-241	1.60E+03	1.60E-06	6
Plutonium-242	Pu-242	6.83E+01	6.83E-08	1
Plutonium-244	Pu-244	7.02E+00	7.02E-09	1
Radium-226 + Radium-228	Ra-226	5.30E+00	5.30E-09	4
Rhenium-187	Re-187	5.82E+05	5.82E-04	2
Rubidium-83	Rb-83	6.58E+02	6.58E-07	8
Ruthenium-106	Ru-106	2.03E+02	2.03E-07	2
Selenium-79	Se-79	2.16E+02	2.16E-07	7
Silicon-32	Si-32	5.65E+02	5.65E-07	7
Samarium-151	Sm-151	1.41E+04	1.41E-05	2
Tin-121m	Sn-121m	2.26E+03	2.26E-06	2
Tin-126	Sn-126	2.29E+02	2.29E-07	2
Strontium-90	Sr-90	4.20E+01	4.20E-08	2
Tantalum-182	Ta-182	8.42E+02	8.42E-07	2
Terbium-157	Tb-157	2.19E+03	2.19E-06	8
Terbium-158	Tb-158	1.25E+03	1.25E-06	2
Technicium-99	Tc-99	3.79E+03	3.79E-06	2
Tellurium-123	Te-123	5.48E+02	5.48E-07	8
Thorium-229	Th-229	6.58E-01	6.58E-10	7
Thorium-230	Th-230	6.50E+00	6.50E-09	5
Thorium-232	Th-232	9.18E+01	9.18E-08	1
Titanium-44	Ti-44	7.26E+01	7.26E-08	7
Thallium-204	Tl-204	1.68E+03	1.68E-06	2
Thulium-170	Tm-170	1.03E+03	1.03E-06	2
Uranium-232	U-232	1.02E+01	1.02E-08	1
Uranium-233	U-233	2.56E+01	2.56E-08	1
Uranium-234	U-234	2.59E+01	2.59E-08	1
Uranium-235	U-235	2.65E+01	2.65E-08	1
Uranium-236	U-236	2.74E+01	2.74E-08	1
Uranium-238	U-238	2.62E+01	2.62E-08	1
Vanadium-50	V-50	2.19E+03	2.19E-06	8
Yttrium-88	Y-88	1.60E+02	1.60E-07	6
Zirconium-93	Zr-93	5.09E+03	5.09E-06	2
Zirconium-95	Zr-95	1.46E+03	1.32E-06	8

References:
1- EPA 1991 Proposed Rules, Federal Register, Vol. 56, No. 138, 40 CFR Parts 141 and 142, Appendix C - Alpha Emitters.
2- EPA 1991 Proposed Rules, Federal Register, Vol. 56, No. 138, 40 CFR Parts 141 and 142, Appendix B - Beta Particle and Photon Emitters.
3- State Standard Groundwater Protection Level Exceptions - LARW Wells, Table 1B, Permit No. UGW450005. Lowest value at well I-2-30.
4- State Standard Groundwater Protection Level Exceptions - LARW Wells, Table 1B, Permit No. UGW450005. Lowest value at well GW-24.
5- State Standard Groundwater Protection Level Exceptions - LARW Wells, Table 1B, Permit No. UGW450005. Lowest value at well GW-16R.
6- Used in previous modeling by UDEQ DRC.
7- Most conservative (lowest) value provided in spreadsheet from Loren Morton (UDEQ DRC).
8- Calculated based on FGR-11
9- Not listed in MCLs, FGR 11, or FGR 13. The Ni-94 GWPL was used, and would be lower than Ni-91, -92 based on radioactive half-life, decay products, and decay energies.
10- Calculated using ICRP 30.

5.3 Vertical Input Parameters for Contaminant Release

The transport of constituents from the waste to the water table was modeled using PATHRAE. The input parameters for the vertical model are shown in the model output (Attachment 3) and are described in detail below. The vertical model results (Section 5.5) serve as input to the horizontal PATHRAE model (Section 6.1.)

5.3.1 Waste Source Term Constituents

The Class A South cell will receive Class A low-level radioactive waste, D-Code (Formerly Characteristic) waste, and metals. Radionuclide waste concentrations are input to the PathRAE model in Ci/m³, while organic and metals concentrations are input in kg/m³.

5.3.2 Waste Source Term Concentrations

A total of 261 isotopes were evaluated. Table 21 provides source concentrations, half lives, and K_d values for each nuclide.

The waste source term concentrations for the Class A South cell were identical to those used in previous modeling of the Class A cell (Whetstone, 2000e) and were developed from data supplied by the Manifest Information Management System (MIMS). MIMS is managed by the Department of Energy (DOE), and is a summary of national low-level radioactive waste disposal information.

The initial information supplied by MIMS consisted of disposal data from 1986 to 2000. This data was compiled from the disposal facilities at Barnwell, South Carolina, Beatty, Nevada and Richland, Washington. This spreadsheet, WasteClAcVolBC (original), was divided into various waste classes, i.e., Class A-stable, Class B, etc. Each waste class or combination of waste classes was further delineated by radioisotope, volume in cubic feet and activity in curies.

Due to limitations with MIMS, it is not possible to divide the waste classes for received material that was manifested with multiple waste classes, i.e., A-stable, A-unstable, B and C. Therefore, some combined categories, such as, A-stable/B or A-unstable/A-stable/C were deleted. The deleted portions comprised only 2.5% of the total volume of waste disposed (14,774,626 cubic feet) from 1986 to 2000. The radioisotopes, volumes, and activities were arranged into two categories, Class A, which includes stable and unstable, and Class B/C. This was the natural break between stable and unstable waste forms.

The spreadsheet WasteClAcVolBC (original) was edited as follows:

1) Obvious typographical errors, such as, radioisotopes listed by atomic mass number only with no element identification were deleted.
2) Radioisotopes with a half-life less than five years were deleted. The exception to this was radioisotopes that decayed to daughters with half-lives greater than five years. In addition, radioisotopes that are included on Table I or Table II of Utah Radiation Control Rule R313-15-1008, Classification of Radioactive Waste for Land Disposal, were not deleted.
3) Certain conservative assumptions were used, such as:
   a) The activity for "Pu-239+" was combined with the Pu-239 activity. It was unclear what the "+" defined. This occurred also with "Cm-243+."
   b) The activity of Nb-93 was added to Nb-93m since Nb-93 is stable.
   c) The activity for natural thorium was added to the activity for Th-232 since natural thorium is essentially 100% Th-232.
   d) The activities for depleted uranium and natural uranium were added to the activity of U-238 since both are essentially 100% U-238.
   e) The activities for Nb-94 AM and Ni-63 AM were each added to their respective radioisotopes, Nb-94 and Ni-63. The annotation of "AM" is indicative of activated metals, which have specific waste class categories in Table I and II of R313-15-1008.
   f) The activity for Ba-137 was added to the activity of Ba-137m since Ba-137 is stable.

The list of the remaining radioisotopes established by the above criteria was then classified by R313-15-1008 and their respective maximum Class A concentrations determined. If a radioisotope was not listed on Table I or Table II, it is Class A in accordance with R313-15-1008(2)(f). In these cases, the waste source term in the model was set at the specific activity. The specific activity, in pCi/g, was calculated for 46 nuclides using the following formula:

$$SA = \frac{\ln(2)}{t_{1/2}}\left(6.02x10^{23}\ \frac{molecules}{Mole}\right)\left(\frac{1}{GMW_{g/m}}\right) \div \left(3.7x10^{-2}\right)$$

where SA = Specific activity in pCi/g
$t_{1/2}$ = Half life in seconds
GMW= Gram molecular weight in grams per mole

Four isotopes have allowable concentrations that are less than the Class A limits or Specific Activity in the top slope area while five isotopes have limited allowable concentrations under the 0.286 cm/yr side slope and eight isotopes have limited allowable concentrations under the 0.595 cm/yr side slope. For these constituents, the PATHRAE model was used to calculate the highest concentrations that would meet GWPLs at the compliance well for 500 years. The acceptable concentrations of Bk-247, Ca-41, Cl-36, and Re-187 in the top slope area were calculated from PATHRAE fate and transport modeling using an infiltration rate of 0.276 cm/yr and a distance of 76.2 meters (250 ft) to the compliance well.

The acceptable concentrations of Bk-247, Ca-41, Cl-36, Re-187, and Tc-99 in the 0.286 cm/yr side slope area were calculated from PATHRAE fate and transport modeling using an infiltration rate of 0.286 cm/yr and a distance of 27.4 meters (90 ft) to the compliance well. The acceptable concentrations of Bk-247, Ca-41, Cl-36, I-129, K-40, Re-187, Sr-90, and Tc-99 in the 0.595 cm/yr side slope area were calculated using PATHRAE with an infiltration rate of 0.595 cm/yr and a distance of 27.4 meters (90 ft) to the compliance well. The limiting concentrations for top slope and two side slope simulations are shown in Table 20.

Table 20. Limiting Radionuclide Concentrations in Class A South Disposal Cell Top Slope, 0.286 cm/yr Side Slope, and 0.595 cm/yr Side Slope (based on Waste Bulk Density of 1.80 g/cm³)

	Class A South Disposal Cell Top Slope Limiting Concentrations Based on 0.276 cm/yr Infiltration		
ISOTOPE	(pCi/gm)	(Ci/m³)	Source
Bk-247	0.00009833	1.77E-10	Model
Ca-41	2.06	3.70E-06	Model
Cl-36	0.286	5.14E-07	Model
Re-187	17,860	3.21E-02	Model

	Class A South Disposal Cell Side Slope Limiting Concentrations Based on 0.286 cm/yr Infiltration		
ISOTOPE	(pCi/gm)	(Ci/m³)	Source
Bk-247	0.0000906	1.63E-10	Model
Ca-41	1.322	2.38E-06	Model
Cl-36	0.268	4.83E-07	Model
Re-187	5,556	1.00E-02	Model
Tc-99	77,778	1.40E-01	Model

ISOTOPE	Class A South Disposal Cell Side Slope Limiting Concentrations Based on 0.595 cm/yr Infiltration (pCi/gm)	(Ci/m^3)	Source
Bk-247	0.00009111	1.64E-10	Model
Ca-41	1.328	2.39E-06	Model
Cl-36	0.2706	4.87E-07	Model
I-129	0.0667	1.20E-07	Model
K-40	45.0	8.10E-05	Model
Re-187	1.039	1.87E-06	Model
Sr-90	80.0	1.44E-04	Model
Tc-99	2.922	5.26E-06	Model

The 93 nuclides selected for modeling are indicated with a check-mark listed in Table 21. Nuclides that are not modeled directly are represented by a synthetic (dummy) surrogate nuclide. The surrogates are not real nuclides, but have the K_d, half life, and concentration properties appropriate for a conservative surrogate for the real nuclide.

Table 21. List of Class A Radionuclides and Model Surrogates

ELEMENT	NUCLIDE	Maximum Concent. (pCi/gm)	Maximum Concentration (Ci/m3)	Concentration Data Source	Distribution Coefficient (Kd) (L/Kg)	1/2 life		1/2 life (Years)	Isotope to be Modeled	Model Surrogate
Actinium	Ac-225	440000000	488.4	Class A	4.5	10	d	2.74E-02		Ks-23
Actinium	Ac-227	72300000000000	80253000	SA	4.5	21.77	y	2.18E+01	✓	
Silver	Ag-105	440000000	488.4	Class A	2.7	41.3	d	1.13E-01		Ks-23
Silver	Ag-108	440000000	488.4	Class A	2.7	2.37	m	4.51E-06		Ks-23
Silver	Ag-108m	26081000000000	28949910	SA	2.7	418	y	4.18E+02	✓	
Silver	Ag-110m	440000000	488.4	Class A	2.7	249.8	d	6.84E-01		Ks-23
Silver	Ag-111	440000000	488.4	Class A	2.7	7.45	d	2.04E-02		Ks-23
Aluminum	Al-26	18600000000	20646	SA	15	740000	y	7.40E+05	✓	
Americium	Am-241	10000	0.0111	Class A	1	432.2	y	4.32E+02	✓	
Americium	Am-242	440000000	488.4	Class A	1	0.67	d	1.83E-03		Ks-23
Americium	Am-242m	10000	0.0111	Class A	1	141	y	1.41E+02	✓	
Americium	Am-243	10000	0.0111	Class A	1	7370	y	7.37E+03	✓	
Americium	Am-244	440000000	488.4	Class A	1	10.1	h	1.15E-03		Ks-23
Americium	Am-245	440000000	488.4	Class A	1	2.05	h	2.34E-04		Ks-23
Arsenic	As-73	440000000	488.4	Class A	1	80.3	d	2.20E-01		Ks-23
Arsenic	As-74	440000000	488.4	Class A	1	17.77	d	4.87E-02		Ks-23
Gold	Au-195	440000000	488.4	Class A	0.25	186.1	d	5.10E-01		Ks-22
Gold	Au-198	440000000	488.4	Class A	0.25	2.695	d	7.38E-03		Ks-22
Gold	Au-199	440000000	488.4	Class A	0.25	3.14	d	8.60E-03		Ks-22
Barium	Ba-133	256160000000000	284337600	SA	10	10.51	y	1.05E+01	✓	
Barium	Ba-140	440000000	488.4	Class A	10	12.75	d	3.49E-02		Ks-22
Beryllium	Be-10	22000000000	24420	SA	2.5	1510000	y	1.51E+06	✓	
Beryllium	Be-7	440000000	488.4	Class A	2.5	53.29	d	1.46E-01		Ks-23
Bismuth	Bi-205	440000000	488.4	Class A	1	15.31	d	4.19E-02		Ks-23
Bismuth	Bi-206	440000000	488.4	Class A	1	6.243	d	1.71E-02		Ks-23
Bismuth	Bi-207	53670000000000	59573700	SA	1	31.55	y	3.16E+01	✓	
Bismuth	Bi-210m	567820000	630.2802	SA	1	3040000	y	3.04E+06	✓	
Bismuth	Bi-214	440000000	488.4	Class A	1	19.9	m	3.79E-05		Ks-23
Berkelium	Bk-247	0.0001518	1.68E-10	Model	0.001	1400	y	1.40E+03	✓	
Berkelium	Bk-249	440000000	488.4	Class A	0.001	320	d	8.77E-01		Ks-20
Berkelium	Bk-250	440000000	488.4	Class A	0.001	0.134	d	3.68E-04		Ks-20
Carbon	C-14	7207207.21	8.000	Class A	8.52	5730	y	5.73E+03	✓	
Calcium	Ca-41	440000000	488.4	Class A	0.05	103000	y	1.03E+05	✓	
Calcium	Ca-45	440000000	488.4	Class A	0.05	162.61	d	4.46E-01		Ks-21
Calcium	Ca-47	440000000	488.4	Class A	0.05	4.536	d	1.24E-02		Ks-21
Cadmium	Cd-105	440000000	488.4	Class A	1	55.5	m	1.06E-04		Ks-23
Cadmium	Cd-107	440000000	488.4	Class A	1	6.5	h	7.42E-04		Ks-23
Cadmium	Cd-109	440000000	488.4	Class A	1	462.6	d	1.27E+00		Ks-26
Cadmium	Cd-113	0.4303	4.78E-07	SA	1	9.3E+15	y	9.30E+15	✓	
Cadmium	Cd-113m	224520000000000	249217200	SA	1	14.1	y	1.41E+01	✓	
Cerium	Ce-129	440000000	488.4	Class A	1	3.5	m	6.66E-06	✓	Ks-23
Cerium	Ce-133	440000000	488.4	Class A	1	1.6167	h	1.85E-04		Ks-23
Cerium	Ce-137	440000000	488.4	Class A	1	9	h	1.03E-03		Ks-23
Cerium	Ce-139	440000000	488.4	Class A	1	137.6	d	3.77E-01		Ks-23
Cerium	Ce-141	440000000	488.4	Class A	1	32.5	d	8.90E-02		Ks-23
Cerium	Ce-143	440000000	488.4	Class A	1	1.377	d	3.77E-03		Ks-23
Cerium	Ce-144	440000000	488.4	Class A	1	284.9	d	7.81E-01		Ks-23
Cerium	Ce-147	440000000	488.4	Class A	1	56.44944	s	1.79E-06		Ks-23
Californium	Cf-248	440000000	488.4	Class A	2	333.5	d	9.14E-01		Ks-20
Californium	Cf-249	10000	0.011	Class A	2	351	y	3.51E+02	✓	
Californium	Cf-250	500	0.000555	Class A	2	13.08	y	1.31E+01	✓	
Californium	Cf-251	10000	0.0111	Class A	2	898	d	2.46E+00	✓	
Californium	Cf-252	440000000	488.4	Class A	2	2.65	y	2.65E+00	✓	
Chlorine	Cl-36	0.4055	4.50E-07	Model	0.0025	301000	y	3.01E+05	✓	
Curium	Cm-241	440000000	488.4	Class A	93.3	32.8	d	8.99E-02		Ks-24
Curium	Cm-242	440000000	488.4	Class A	93.3	162.8	d	4.46E-01		Ks-24
Curium	Cm-243	10000	0.0111	Class A	93.3	29.1	y	2.91E+01	✓	
Curium	Cm-244	10000	0.0111	Class A	93.3	18.1	y	1.81E+01	✓	
Curium	Cm-245	10000	0.0111	Class A	93.3	8500	y	8.50E+03	✓	
Curium	Cm-246	10000	0.0111	Class A	93.3	4730	y	4.73E+03	✓	
Curium	Cm-247	10000	0.0111	Class A	93.3	1.56E+07	y	1.56E+07	✓	
Curium	Cm-248	10000	0.0111	Class A	93.3	340000	y	3.40E+05	✓	
Curium	Cm-249	440000000	488.4	Class A	93.3	1.07	h	1.22E-04		Ks-23
Cobalt	Co-56	440000000	488.4	Class A	370	77.3	d	2.12E-01		Ks-25
Cobalt	Co-57	440000000	488.4	Class A	370	271.8	d	7.45E-01		Ks-25
Cobalt	Co-58	440000000	488.4	Class A	370	70.86	d	1.94E-01		Ks-25
Cobalt	Co-60	440000000	488.4	Class A	370	5.27	y	5.27E+00	✓	
Cobalt	Co-63	440000000	488.4	Class A	370	27.4	s	8.69E-07		Ks-25
Chromium	Cr-51	440000000	488.4	Class A	1	27.7	d	7.59E-02		Ks-23
Cesium	Cs-134	440000000	488.4	Class A	133	2.065	y	2.07E+00		Ks-25
Cesium	Cs-135	1152100000	1278.831	SA	133	2300000	y	2.30E+06	✓	
Cesium	Cs-136	440000000	488.4	Class A	133	13.16	d	3.61E-02		Ks-25
Cesium	Cs-137	630000	0.6993	Class A	133	30.07	y	3.01E+01	✓	
Copper	Cu-67	440000000	488.4	Class A	1	61.83	d	1.69E-01		Ks-23
Dysprosium	Dy-166	440000000	488.4	Class A	6.5	3.4	d	9.32E-03		Ks-23
Einsteinium	Es-253	440000000	488.4	Class A	0.001	20.47	d	5.61E-02		Ks-20
Einsteinium	Es-254	440000000	488.4	Class A	0.001	275.7	d	7.55E-01		Ks-20
Europium	Eu-152	173050000000000	192085500	SA	6.5	13.54	y	1.35E+01	✓	
Europium	Eu-154	270420000000000	300166200	SA	6.5	8.59	y	8.59E+00	✓	
Europium	Eu-155	440000000	488.4	Class A	6.5	4.76	y	4.76E+00	✓	

Table 21. List of Class A Radionuclides and Model Surrogates (Part 2)

ELEMENT	NUCLIDE	Maximum Concent. (pCi/gm)	Maximum Concentration (Ci/m3)	Concentration Data Source	Distribution Coefficient (Kd) (L/Kg)	1/2 life		1/2 life (Years)	Isotope to be Modeled	Model Surrogate
Europium	Eu-156	440000000	488.4	Class A	6.5	15.2	d	4.16E-02		Ks-23
Iron	Fe-52	440000000	488.4	Class A	1.4	0.345	d	9.45E-04		Ks-23
Iron	Fe-53	440000000	488.4	Class A	1.4	8.51	m	1.62E-05		Ks-23
Iron	Fe-55	440000000	488.4	Class A	1.4	2.73	y	2.73E+00	✓	
Iron	Fe-59	440000000	488.4	Class A	1.4	44.5	d	1.22E-01		Ks-23
Iron	Fe-60	3974800000	4412.028	SA	1.4	1500000	y	1.50E+06	✓	
Fermium	Fm-252	440000000	488.4	Class A	0.001	1.058	d	2.90E-03		Ks-20
Gallium	Ga-67	440000000	488.4	Class A	15	3.26	d	8.93E-03		Ks-23
Gadolinium	Gd-148	32228000000000	35773080	SA	6.5	74.6	y	7.46E+01	✓	
Gadolinium	Gd-151	440000000	488.4	Class A	6.5	124	d	3.40E-01		Ks-23
Gadolinium	Gd-153	440000000	488.4	Class A	6.5	241.6	d	6.62E-01		Ks-23
Germanium	Ge-68	440000000	488.4	Class A	0.25	270.8	d	7.42E-01		Ks-20
Hydrogen	H-3	25000000	27.75	Class A	0.04	12.33	y	1.23E+01	✓	
Hafnium	Hf-172	440000000	488.4	Class A	4.5	1.87	y	1.87E+00		Ks-26
Hafnium	Hf-175	440000000	488.4	Class A	4.5	70	d	1.92E-01		Ks-23
Hafnium	Hf-181	440000000	488.4	Class A	4.5	42.4	d	1.16E-01		Ks-23
Mercury	Hg-194	3546100000000	3936171	SA	10	444	y	4.44E+02	✓	
Mercury	Hg-203	440000000	488.4	Class A	10	46.6	d	1.28E-01		Ks-23
Holmium	Ho-166	440000000	488.4	Class A	2.5	1.115	d	3.05E-03		Ks-23
Holmium	Ho-166m	1800000000000	1998000	SA	2.5	1200	y	1.20E+03	✓	
Iodine	I-123	440000000	488.4	Class A	0.12	13.3	h	1.52E-03		Ks-22
Iodine	I-125	440000000	488.4	Class A	0.12	59.4	d	1.63E-01		Ks-22
Iodine	I-126	440000000	488.4	Class A	0.12	13.11	d	3.59E-02		Ks-22
Iodine	I-129	5000	0.00555	Class A	0.12	15700000	y	1.57E+07	✓	
Iodine	I-131	440000000	488.4	Class A	0.12	8.02	d	2.20E-02		Ks-22
Iodine	I-133	440000000	488.4	Class A	0.12	0.867	d	2.37E-03		Ks-22
Iodine	I-135	440000000	488.4	Class A	0.12	6.57	h	7.50E-04		Ks-22
Iodine	I-137	440000000	488.4	Class A	0.12	24.5	s	7.77E-07		Ks-22
Indium	In-111	440000000	488.4	Class A	15	2.8047	d	7.68E-03		Ks-23
Indium	In-113m	440000000	488.4	Class A	15	0.069	d	1.89E-04		Ks-23
Indium	In-114	440000000	488.4	Class A	15	0.00083	d	2.28E-06		Ks-23
Indium	In-114m	440000000	488.4	Class A	15	49.51	d	1.36E-01		Ks-23
Iridium	Ir-192	440000000	488.4	Class A	1.5	73.8	d	2.02E-01		Ks-23
Potassium	K-40	7003370	7.7737407	SA	0.15	1277000000	y	1.28E+09	✓	
Lanthanum	La-140	440000000	488.4	Class A	6.5	1.678	d	4.60E-03		Ks-23
Manganese	Mn-52	440000000	488.4	Class A	6.4	5.591	d	1.53E-02		Ks-23
Manganese	Mn-52m	440000000	488.4	Class A	6.4	0.0147	d	4.01E-05		Ks-23
Manganese	Mn-53	1800000000	1998	SA	6.4	3740000	y	3.74E+06	✓	
Manganese	Mn-54	440000000	488.4	Class A	6.4	312.3	d	8.56E-01		Ks-23
Molybdenum	Mo-99	440000000	488.4	Class A	1	2.748	d	7.53E-03		Ks-23
Sodium	Na-22	440000000	488.4	Class A	1	2.602	y	2.60E+00	✓	
Niobium	Nb-91	5780000000000	6415800	SA	1.6	680	y	6.80E+02	✓	
Niobium	Nb-92	112000000	124.32	SA	1.6	34700000	y	3.47E+07	✓	
Niobium	Nb-93m	263460000000000	292440600	SA	1.6	16.13	y	1.61E+01	✓	
Niobium	Nb-94	13000	0.01443	Class A	1.6	20300	y	2.03E+04	✓	
Neodymium	Nd-144	4.27	4.74322E-06	SA	6.5	2.29E+15	y	2.29E+15		stable
Neodymium	Nd-147	440000000	488.4	Class A	6.5	10.98	d	3.01E-02		Ks-23
Nickel	Ni-59	14000000	15.54	Class A	10	76000	y	7.60E+04	✓	
Nickel	Ni-63	2200000	2.442	Class A	10	100.1	y	1.00E+02	✓	
Neptunium	Np-235	440000000	488.4	Class A	3	1.085	y	1.09E+00		Ks-26
Neptunium	Np-237	10000	0.0111	Class A	3	2144000	y	2.14E+06	✓	
Osmium	Os-191	440000000	488.4	Class A	4.5	15.4	d	4.22E-02		Ks-23
Osmium	Os-191m	440000000	488.4	Class A	4.5	0.546	d	1.50E-03		Ks-23
Osmium	Os-194	307330000000000	341136300	SA	4.5	6	y	6.00E+00	✓	
Phosphorous	P-32	440000000	488.4	Class A	0.035	14.26	d	3.91E-02		Ks-21
Phosphorous	P-33	440000000	488.4	Class A	0.035	25.3	d	6.93E-02		Ks-21
Protactinium	Pa-231	47000000000	52170	SA	5.5	32760	y	3.28E+04	✓	
Protactinium	Pa-233	440000000	488.4	Class A	5.5	26.967	d	7.39E-02		Ks-23
Protactinium	Pa-234	440000000	488.4	Class A	5.5	6.7014	h	7.65E-04		Ks-23
Protactinium	Pa-234m	440000000	488.4	Class A	5.5	1.172088	m	2.23E-06		Ks-23
Lead	Pb-202	3400000000	3774	SA	19	52500	y	5.25E+04	✓	
Lead	Pb-203	440000000	488.4	Class A	19	2.1614	d	5.92E-03		Ks-23
Lead	Pb-210	76000000000000	84360000	SA	19	22.3	y	2.23E+01	✓	
Lead	Pb-214	440000000	488.4	Class A	19	26.8	m	5.10E-05		Ks-23
Palladium	Pd-103	440000000	488.4	Class A	0.55	16.991	d	4.66E-02		Ks-22
Palladium	Pd-107	510000000	566.1	SA	0.55	6500000	y	6.50E+06	✓	
Promethium	Pm-143	440000000	488.4	Class A	6.5	265	d	7.26E-01		Ks-23
Promethium	Pm-145	140000000000000	155400000	SA	6.5	17.7	y	1.77E+01	✓	
Promethium	Pm-147	440000000	488.4	Class A	6.5	2.6234	y	2.62E+00	✓	
Polonium	Po-208	440000000	488.4	Class A	9	2.9	y	2.90E+00	✓	
Polonium	Po-209	16781000000000	18626910	SA	9	102	y	1.02E+02	✓	
Polonium	Po-210	440000000	488.4	Class A	9	138.4	d	3.79E-01		Ks-23
Polonium	Po-214	440000000	488.4	Class A	9	164.3	us	5.21E-12		Ks-23
Platinum	Pt-193	37000000000000	41070000	SA	0.9	50	y	5.00E+01	✓	
Plutonium	Pu-236	500	0.000555	Class A	10	2.86	y	2.86E+00	✓	
Plutonium	Pu-238	10000	0.0111	Class A	10	87.7	y	8.77E+01	✓	
Plutonium	Pu-239	10000	0.0111	Class A	10	24110	y	2.41E+04	✓	
Plutonium	Pu-240	10000	0.0111	Class A	10	6564	y	6.56E+03	✓	
Plutonium	Pu-241	350000	0.3885	Class A	10	14.35	y	1.44E+01	✓	
Plutonium	Pu-242	10000	0.0111	Class A	10	373300	y	3.73E+05	✓	
Plutonium	Pu-243	500	0.000555	Class A	10	4.956	h	5.66E-04		Ks-23

Table 21. List of Class A Radionuclides and Model Surrogates (Part 3)

ELEMENT	NUCLIDE	Maximum Concent. (pCi/gm)	Maximum Concentration (Ci/m3)	Concentration Data Source	Distribution Coefficient (Kd) (L/Kg)	1/2 life		1/2 life (Years)	Isotope to be Modeled	Model Surrogate
Plutonium	Pu-244	500	0.000555	Class A	10	8.08E+07	y	8.08E+07	✓	
Radium	Ra-225	440000000	488.4	Class A	10	14.9	d	4.08E-02		Ks-23
Radium	Ra-226	10000	0.0111	Class A	10	1600	y	1.60E+03	✓	
Radium	Ra-228	272396000000000	302359560	SA	10	5.75	y	5.75E+00	✓	
Rubidium	Rb-82	440000000	488.4	Class A	0.55	0.0009	d	2.38E-06		Ks-22
Rubidium	Rb-83	440000000	488.4	Class A	0.55	86.2	d	2.36E-01		Ks-22
Rubidium	Rb-84	440000000	488.4	Class A	0.55	32.8	d	8.99E-02		Ks-22
Rubidium	Rb-86	440000000	488.4	Class A	0.55	18.63	d	5.10E-02		Ks-22
Rhenium	Re-183	440000000	488.4	Class A	0.075	70	d	1.92E-01		Ks-21
Rhenium	Re-184	440000000	488.4	Class A	0.075	38	d	1.04E-01		Ks-21
Rhenium	Re-184m	440000000	488.4	Class A	0.075	169	d	4.63E-01		Ks-21
Rhenium	Re-186	440000000	488.4	Class A	0.075	3.719	d	1.02E-02		Ks-21
Rhenium	Re-187	38000	0.04218	Class A	0.075	43500000000	y	4.35E+10	✓	
Rhenium	Re-188	440000000	488.4	Class A	0.075	0.709	d	1.94E-03		Ks-21
Rhodium	Rh-103m	440000000	488.4	Class A	0.001	0.039	d	1.07E-04		Ks-20
Ruthenium	Ru-103	440000000	488.4	Class A	5	39.26	d	1.08E-01		Ks-23
Ruthenium	Ru-106	440000000	488.4	Class A	5	1.02	y	1.02E+00		Ks-26
Sulfur	S-35	440000000	488.4	Class A	0.075	87.5	d	2.40E-01		Ks-21
Antimony	Sb-122	440000000	488.4	Class A	100	2.7	d	7.40E-03		Ks-25
Antimony	Sb-124	440000000	488.4	Class A	100	60.2	d	1.65E-01		Ks-25
Antimony	Sb-125	440000000	488.4	Class A	100	2.76	y	2.76E+00		Ks-25
Antimony	Sb-126	440000000	488.4	Class A	100	12.5	d	3.42E-02		Ks-25
Antimony	Sb-126m	440000000	488.4	Class A	100	0.013	d	3.61E-05		Ks-25
Antimony	Sb-129	440000000	488.4	Class A	100	4.4	h	5.02E-04		Ks-25
Scandium	Sc-41	440000000	488.4	Class A	10	0.596	s	1.89E-08		Ks-23
Scandium	Sc-44	440000000	488.4	Class A	10	0.164	d	4.48E-04		Ks-23
Scandium	Sc-46	440000000	488.4	Class A	10	83.8	d	2.30E-01		Ks-23
Scandium	Sc-47	440000000	488.4	Class A	10	3.349	d	9.18E-03		Ks-23
Selenium	Se-75	440000000	488.4	Class A	1	119.8	d	3.28E-01		Ks-23
Selenium	Se-79	69700000000	77367	SA	1	65000	y	6.50E+04	✓	
Selenium	Se-85	440000000	488.4	Class A	1	31.7	s	1.01E-06		Ks-23
Silicon	Si-32	65000000000000	72150000	SA	0.35	172	y	1.72E+02	✓	
Samarium	Sm-145	440000000	488.4	Class A	2.45	340	d	9.32E-01		Ks-23
Samarium	Sm-151	26320000000000	29215200	SA	2.45	90	y	9.00E+01	✓	
Samarium	Sm-153	440000000	488.4	Class A	2.45	1.928	d	5.28E-03		Ks-23
Tin	Sn-113	440000000	488.4	Class A	50	115.1	d	3.15E-01		Ks-24
Tin	Sn-117m	440000000	488.4	Class A	50	13.6	d	3.73E-02		Ks-24
Tin	Sn-119m	440000000	488.4	Class A	50	293.1	d	8.03E-01		Ks-24
Tin	Sn-121	440000000	488.4	Class A	50	1.128	d	3.09E-03		Ks-24
Tin	Sn-121m	53754000000000	59666940	SA	50	55	y	5.50E+01	✓	
Tin	Sn-126	28391000000	31514.01	SA	50	100000	y	1.00E+05	✓	
Strontium	Sr-81	440000000	488.4	Class A	0.05	22.3	m	4.24E-05		Ks-21
Strontium	Sr-82	440000000	488.4	Class A	0.05	25.55	d	7.00E-02		Ks-21
Strontium	Sr-85	440000000	488.4	Class A	0.05	64.8	d	1.78E-01		Ks-21
Strontium	Sr-87m	440000000	488.4	Class A	0.05	168.18	m	3.20E-04		Ks-21
Strontium	Sr-89	440000000	488.4	Class A	0.05	50.53	d	1.38E-01		Ks-21
Strontium	Sr-90	25000	0.02775	Class A	0.05	28.78	y	2.88E+01	✓	
Tantalum	Ta-182	440000000	488.4	Class A	2.2	114.43	d	3.14E-01		Ks-23
Terbium	Tb-157	15000000000000	16650000	SA	6.5	71	y	7.10E+01	✓	
Terbium	Tb-158	15000000000000	16650000	SA	6.5	180	y	1.80E+02	✓	
Terbium	Tb-160	440000000	488.4	Class A	6.5	72.3	d	1.98E-01		Ks-23
Technetium	Tc-95	440000000	488.4	Class A	0.11	0.833	d	2.28E-03		Ks-22
Technetium	Tc-95m	440000000	488.4	Class A	0.11	61	d	1.67E-01		Ks-22
Technetium	Tc-99	187500	0.208125	Class A	0.11	211100	y	2.11E+05	✓	
Technetium	Tc-99m	440000000	488.4	Class A	0.11	0.250	d	6.86E-04		Ks-22
Tellurium	Te-123	291	0.00032301	SA	1.25	1E+13	y	1.00E+13	✓	
Tellurium	Te-123m	440000000	488.4	Class A	1.25	119.7	d	3.28E-01		Ks-23
Tellurium	Te-125m	440000000	488.4	Class A	1.25	57.4	d	1.57E-01		Ks-23
Tellurium	Te-129	440000000	488.4	Class A	1.25	0.048	d	1.32E-04		Ks-23
Tellurium	Te-129m	440000000	488.4	Class A	1.25	33.6	d	9.21E-02		Ks-23
Thorium	Th-229	212830000000	236241.3	SA	10	7880	y	7.88E+03	✓	
Thorium	Th-230	20628000000	22897.08	SA	10	75380	y	7.54E+04	✓	
Thorium	Th-231	440000000	488.4	Class A	10	1.063	d	2.91E-03		Ks-23
Thorium	Th-232	110000	0.1221	SA	10	14050000000	y	1.41E+10	✓	
Thorium	Th-234	440000000	488.4	Class A	10	24.1	d	6.60E-02		Ks-23
Titanium	Ti-44	156350000000000	173548500	SA	10	63	y	6.30E+01	✓	
Thallium	Tl-201	440000000	488.4	Class A	0.15	3.038	d	8.32E-03		Ks-22
Thallium	Tl-202	440000000	488.4	Class A	0.15	12.23	d	3.35E-02		Ks-22
Thallium	Tl-204	440000000	488.4	Class A	0.15	3.78	y	3.78E+00	✓	
Thallium	Tl-210	440000000	488.4	Class A	0.15	1.3	m	2.47E-06		Ks-22
Thulium	Tm-170	440000000	488.4	Class A	6.5	128.6	d	3.52E-01	✓	
Thulium	Tm-171	440000000	488.4	Class A	6.5	1.92	y	1.92E+00		Ks-26
Uranium	U-228	440000000	488.4	Class A	6	9.1	m	1.73E-05		Ks-23
Uranium	U-230	440000000	488.4	Class A	6	20.8	d	5.70E-02		Ks-23
Uranium	U-232	22028000000000	24451080	SA	6	68.9	y	6.89E+01	✓	
Uranium	U-233	75000	0.08325	Class A	6	159200	y	1.59E+05	✓	
Uranium	U-234	6210000000	6893.1	SA	6	245500	y	2.46E+05	✓	
Uranium	U-235	1900	0.002109	Class A	6	703800000	y	7.04E+08	✓	
Uranium	U-236	64720000	71.8392	SA	6	23420000	y	2.34E+07	✓	
Uranium	U-238	336260	0.3732486	SA	6	4470000000	y	4.47E+09	✓	
Uranium	U-depleted	370000	0.4107	A~ (Class A)	6					U-isotopes

Table 21. List of Class A Radionuclides and Model Surrogates (Part 4)

ELEMENT	NUCLIDE	Maximum Concent. (pCi/gm)	Maximum Concentration (Ci/m3)	Concentration Data Source	Distribution Coefficient (Kd) (L/Kg)	1/2 life		1/2 life (Years)	Isotope to be Modeled	Model Surrogate
Uranium	U-natural	680000	0.7548	SA	6					U-isotopes
Vanadium	V-48	440000000	488.4	Class A	10	15.98	d	4.38E-02		Ks-23
Vanadium	V-50	0.0511	5.6721E-08	SA	10	1.4E+17	y	1.40E+17	✓	
Tungsten	W-181	440000000	488.4	Class A	1.5	121.2	d	3.32E-01		Ks-23
Tungsten	W-185	440000000	488.4	Class A	1.5	75.1	d	2.06E-01		Ks-23
Tungsten	W-187	440000000	488.4	Class A	1.5	23.72	h	2.71E-03		Ks-23
Tungsten	W-188	440000000	488.4	Class A	1.5	69.4	d	1.90E-01		Ks-23
Xenon	Xe-127	440000000	488.4	Class A	0.001	36.4	d	9.97E-02		Ks-20
Xenon	Xe-131m	440000000	488.4	Class A	0.001	11.934	d	3.27E-02		Ks-20
Xenon	Xe-133	440000000	488.4	Class A	0.001	5.245	d	1.44E-02		Ks-20
Xenon	Xe-133m	440000000	488.4	Class A	0.001	2.19	d	6.00E-03		Ks-20
Yttrium	Y-88	440000000	488.4	Class A	1.7	106.7	d	2.92E-01		Ks-23
Yttrium	Y-91	440000000	488.4	Class A	1.7	58.5	d	1.60E-01		Ks-23
Yttrium	Y-99	440000000	488.4	Class A	1.7	1.47	s	4.66E-08		Ks-23
Ytterbium	Yb-169	440000000	488.4	Class A	6.5	32.03	d	8.78E-02		Ks-23
Zinc	Zn-65	440000000	488.4	Class A	0.1	244.3	d	6.69E-01		Ks-22
Zirconium	Zr-88	440000000	488.4	Class A	10	83.4	d	2.28E-01		Ks-23
Zirconium	Zr-93	2514100000	2790.651	SA	10	1530000	y	1.53E+06	✓	
Zirconium	Zr-95	440000000	488.4	Class A	10	64.02	d	1.75E-01		Ks-23
SYNTHETIC (DUMMY) NUCLIDES:										
Surrogate	Ks-20	440000000	488.4		0.001	1	y	1.00E+00	✓	
Surrogate	Ks-21	440000000	488.4		0.01	1	y	1.00E+00	✓	
Surrogate	Ks-22	440000000	488.4		0.1	1	y	1.00E+00	✓	
Surrogate	Ks-23	440000000	488.4		1	1	y	1.00E+00	✓	
Surrogate	Ks-24	440000000	488.4		50	4	y	4.00E+00	✓	
Surrogate	Ks-25	440000000	488.4		100	4	y	4.00E+00	✓	
Surrogate	Ks-26	440000000	488.4		1	2	y	2.00E+00	✓	

NOTES: Class A = Class A limits
SA = Concentration represents the Specific Activity (maximum possible concentration) of the nuclide, rounded to ≈4 significant digits
Model = Maximum concentration of Bk-247 and Cl-36 are calculated to meet the GWPL for 500 years, under the CAC cell top slope
Concentrations in Ci/m3 are based on Class A waste density of 1.11 g/cm^3.

The radionuclide concentrations in picoCuries per gram (pCi/g)) were converted to Ci/m^3 using the waste bulk density of 1.8 gm/cm^3 for input to the PATHRAE model. Since the average bulk density of Class A waste is 1.1 g/cm^3 and the bulk density of EnergySolutions' waste is 1.8 g/cm^3, the modeled concentrations in Ci/m^3 were 63.6% higher than those shown in Table 21. The initial source term concentrations for the top slope, 0.507 cm/yr side slope, and 0.451 cm/yr side slope models are shown in Table 22, Table 23, and Table 24, respectively.

Table 22. Waste Maximum Radionuclide Source Concentrations, K_ds, and Fractional Release Rates, based on 0.276 cm/year Infiltration

Waste Characteristics:	Infiltration Rate:	0.00276	m/yr
	Waste Thickness:	1	m
	Waste Moisture Content:	0.059	cm^3/cm^3
	Waste Bulk Density:	1.8	gm/cm^3
Soil Characteristics:	Soil Thickness:	0.392	m
	Soil Moisture Content:	0.1055	cm^3/cm^3
	Soil Bulk Density:	1.558	gm/cm^3
Aquifer Characteristics:	Aquifer Porosity	0.290	cm^3/cm^3
	Hydraulic Conductivity:	7.78E-04	cm/sec
	Gradient:	3.29E-03	m/m
	Aquifer Velocity:	2.744	m/yr
	Aquifer Flux Rate:	0796	$m^3/m^2/yr$

Pathrae Isotope Number	ELEMENT	NUCLIDE	Maximum Concentration (pCi/gm)	Maximum Concentr. (Ci/m3)	Distribution Coefficient (Kd) (L/Kg)	Fractional Release Rate (1/yr)	Soil Retardation Factor	1/2 life		1/2 life (Years)
101	Actinium	Ac-227	72,300,000,000,000	1.30E+08	4.5	3.38E-04	67.455	21.77	y	2.18E+01
102	Silver	Ag-108m	26,081,000,000,000	4.69E+07	2.7	5.61E-04	40.873	418	y	4.18E+02
103	Aluminum	Al-26	20,646	3.72E-02	15	1.02E-04	222.517	740000	y	7.40E+05
48	Americium	Am-241	10,000	1.80E-02	1	1.48E-03	15.768	432	y	4.32E+02
104	Americium	Am-242m	10,000	1.80E-02	1	1.48E-03	15.768	141	y	1.41E+02
105	Americium	Am-243	10,000.00000	1.80E-02	1	1.48E-03	15.768	7370	y	7.37E+03
106	Barium	Ba-133	256,160,000,000,000	4.61E+08	10	1.53E-04	148.678	11	y	1.05E+01
107	Beryllium	Be-10	22,000,000,000	3.96E+04	2.5	6.05E-04	37.919	1,510,000	y	1.51E+06
108	Bismuth	Bi-207	53,670,000,000,000	9.66E+07	1	1.48E-03	15.768	31.55	y	3.16E+01
109	Bismuth	Bi-210m	567,820,000	1.02E+03	1	1.48E-03	15.768	3040000	y	3.04E+06
110	Berkelium	Bk-247	0.00009833	1.77E-10	0.001	4.54E-02	1.015	1400	y	1.40E+03
111	Carbon	C-14	7207207.21	1.30E+01	8.52	1.79E-04	126.821	5730	y	5.73E+03
112	Calcium	Ca-41	2.06	3.70E-06	0.05	1.85E-02	1.738	103,000	y	1.03E+05
113	Cadmium	Cd-113	0.430	7.75E-07	1	1.48E-03	15.768	9.3.E+15	y	9.30E+15
114	Cadmium	Cd-113m	224,520,000,000,000	4.04E+08	1	1.48E-03	15.768	14.1	y	1.41E+01
115	Californium	Cf-249	10,000	1.80E-02	2	7.54E-04	30.536	351	y	3.51E+02
116	Californium	Cf-250	500	9.00E-04	2	7.54E-04	30.536	13.08	y	1.31E+01
117	Californium	Cf-251	10,000	1.80E-02	2	7.54E-04	30.536	898	y	8.98E+02
118	Californium	Cf-252	440,000,000	7.92E+02	2	7.54E-04	30.536	2.65	y	2.65E+00
119	Chlorine	Cl-36	0.286	5.14E-07	0.0025	4.35E-02	1.037	301,000	y	3.01E+05
120	Curium	Cm-243	10,000	1.80E-02	93.3	1.64E-05	1378.833	29	y	2.91E+01
50	Curium	Cm-244	10,000	1.80E-02	93.3	1.64E-05	1378.833	18	y	1.81E+01
121	Curium	Cm-245	10,000	1.80E-02	93.3	1.64E-05	1378.833	8,500	y	8.50E+03
122	Curium	Cm-246	10,000	1.80E-02	93.3	1.64E-05	1378.833	4730	y	4.73E+03
123	Curium	Cm-247	10,000	1.80E-02	93.3	1.64E-05	1378.833	15600000	y	1.56E+07
124	Curium	Cm-248	10,000	1.80E-02	93.3	1.64E-05	1378.833	340000	y	3.40E+05
125	Cobalt	Co-60	440,000,000	7.92E+02	370	4.14E-06	5465.076	5	y	5.27E+00
126	Cesium	Cs-135	1,152,100,000	2.07E+03	133	1.15E-05	1965.114	2,300,000	y	2.30E+06
127	Cesium	Cs-137	630,000	1.13E+00	133	1.15E-05	1965.114	30.07	y	3.01E+01
128	Europium	Eu-152	173,050,000,000,000	3.11E+08	6.5	2.35E-04	96.991	14	y	1.35E+01
129	Europium	Eu-154	270,420,000,000,000	4.87E+08	6.5	2.35E-04	96.991	9	y	8.59E+00
130	Europium	Eu-155	440,000,000	7.92E+02	6.5	2.35E-04	96.991	4.76	y	4.76E+00
131	Iron	Fe-55	440,000,000	7.92E+02	1.4	1.07E-03	21.675	2.73	y	2.73E+00
132	Iron	Fe-60	3,974,800,000	7.15E+03	1.4	1.07E-03	21.675	1500000	y	1.50E+06
133	Gadolinium	Gd-148	32,228,000,000,000	5.80E+07	6.5	2.35E-04	96.991	75	y	7.46E+01
134	Hydrogen	H-3	25,000,000	4.50E+01	0.04	2.11E-02	1.591	12	y	1.23E+01
135	Mercury	Hg-194	3,546,100,000,000	6.38E+06	10	1.53E-04	148.678	444	y	4.44E+02
136	Holmium	Ho-166m	1,800,000,000,000	3.24E+06	2.5	6.05E-04	37.919	1,200	y	1.20E+03
137	Iodine	I-129	5,000	9.00E-03	0.12	1.00E-02	2.772	15,700,000	y	1.57E+07
138	Potassium	K-40	7,003,370	1.26E+01	0.15	8.39E-03	3.215	1,277,000,000	y	1.28E+09
139	Manganese	Mn-53	1,800,000,000	3.24E+03	6.4	2.38E-04	95.514	3,740,000.00	y	3.74E+06
140	Sodium	Na-22	440,000,000	7.92E+02	1	1.48E-03	15.768	3	y	2.60E+00
141	Niobium	Nb-91	5,780,000,000,000	1.04E+07	1.6	9.39E-04	24.628	680	y	6.80E+02
142	Niobium	Nb-92	112,000,000	2.02E+02	1.6	9.39E-04	24.628	34,700,000	y	3.47E+07
143	Niobium	Nb-93m	263,460,000,000,000	4.74E+08	1.6	9.39E-04	24.628	16.13	y	1.61E+01
144	Niobium	Nb-94	13,000	2.34E-02	1.6	9.39E-04	24.628	20300	y	2.03E+04
146	Nickel	Ni-59	14,000,000	2.52E+01	10	1.53E-04	148.678	76000	y	7.60E+04
147	Nickel	Ni-63	2,200,000	3.96E+00	10	1.53E-04	148.678	100.1	y	1.00E+02
42	Neptunium	Np-237	10,000	1.80E-02	3	5.06E-04	45.303	2144000	y	2.14E+06
148	Osmium	Os-194	307,330,000,000,000	5.53E+08	4.5	3.38E-04	67.455	6	y	6.00E+00
149	Protactinium	Pa-231	47,000,000,000	8.46E+04	5.5	2.77E-04	82.223	32760	y	3.28E+04

Table 22. Waste Maximum Radionuclide Source Concentrations, Kds, and Fractional Release Rates, based on 0.276 cm/year Infiltration (Part 2)

Pathrae Isotope Number	ELEMENT	NUCLIDE	Maximum Concentration (pCi/gm)	Maximum Concentr. (Ci/m3)	Distribution Coefficient (Kd) (L/Kg)	Fractional Release Rate (1/yr)	Soil Retardation Factor	1/2 life		1/2 life (Years)
150	Lead	Pb-202	3,400,000,000	6.12E−03	19	8.06E-05	281.588	52500	y	5.25E+04
151	Lead	Pb-210	76,000,000,000,000	1.37E−08	19	8.06E-05	281.588	22.3	y	2.23E−01
152	Palladium	Pd-107	510,000,000	9.18E−02	0.55	2.63E-03	9.122	6500000	y	6.50E−06
153	Promethium	Pm-145	140,000,000,000,000	2.52E−08	6.5	2.35E-04	96.991	17.7	y	1.77E−01
154	Promethium	Pm-147	440,000,000	7.92E+02	6.5	2.35E-04	96.991	2.6234	y	2.62E+00
155	Polonium	Po-208	440,000,000	7.92E+02	9	1.70E-04	133.910	2.9	y	2.90E+00
156	Polonium	Po-209	16,781,000,000,000	3.02E+07	9	1.70E-04	133.910	102	y	1.02E+02
157	Platinum	Pt-193	37,000,000,000,000	6.66E+07	0.9	1.64E-03	14.291	50	y	5.00E+01
158	Plutonium	Pu-236	500	9.00E-04	10	1.53E-04	148.678	2.86	y	2.86E+00
159	Plutonium	Pu-238	10,000	1.80E-02	10	1.53E-04	148.678	87.7	y	8.77E+01
160	Plutonium	Pu-239	10,000	1.80E-02	10	1.53E-04	148.678	24110	y	2.41E+04
45	Plutonium	Pu-240	10,000	1.80E-02	10	1.53E-04	148.678	6564	y	6.56E−03
46	Plutonium	Pu-241	350,000	6.30E-01	10	1.53E-04	148.678	14.35	y	1.44E+01
161	Plutonium	Pu-242	10,000	1.80E-02	10	1.53E-04	148.678	373300	y	3.73E−05
162	Plutonium	Pu-244	500	9.00E-04	10	1.53E-04	148.678	80800000	y	8.08E+07
55	Radium	Ra-226	10,000	1.80E-02	10	1.53E-04	148.678	1600	y	1.60E+03
163	Radium	Ra-228	272,396,000,000,000	4.90E+08	10	1.53E-04	148.678	5.75	y	5.75E+00
164	Rhenium	Re-187	17,860	3.21E-02	0.075	1.42E-02	2.108	43500000000	y	4.35E+10
165	Selenium	Se-79	69,700,000,000	1.25E+05	1	1.48E-03	15.768	65000	y	6.50E+04
166	Silicon	Si-32	65,000,000,000,000	1.17E+08	0.35	4.01E-03	6.169	172	y	1.72E+02
167	Samarium	Sm-151	26,320,000,000,000	4.74E+07	2.45	6.18E-04	37.181	90	y	9.00E+01
168	Tin	Sn-121m	53,754,000,000,000	9.68E+07	50	3.06E-05	739.389	55	y	5.50E+01
169	Tin	Sn-126	28,391,000,000	5.11E+04	50	3.06E-05	739.389	100000	y	1.00E+05
170	Strontium	Sr-90	25,000	4.50E-02	0.05	1.85E-02	1.738	28.78	y	2.88E+01
171	Terbium	Tb-157	15,000,000,000,000	2.70E+07	6.5	2.35E-04	96.991	71	y	7.10E+01
172	Terbium	Tb-158	15,000,000,000,000	2.70E+07	6.5	2.35E-04	96.991	180	y	1.80E+02
173	Technetium	Tc-99	187,500	3.38E-01	0.11	1.07E-02	2.624	211100	y	2.11E+05
174	Tellurium	Te-123	291	5.24E-04	1.25	1.20E-03	19.460	1E+13	y	1.00E+13
175	Thorium	Th-229	212,830,000,000	3.83E+05	10	1.53E-04	148.678	7880	y	7.88E+03
36	Thorium	Th-230	20,628,000,000	3.71E+04	10	1.53E-04	148.678	75380	y	7.54E+04
176	Thorium	Th-232	110,000	1.98E-01	10	1.53E-04	148.678	14050000000	y	1.41E+10
177	Titanium	Ti-44	156,350,000,000,000	2.81E+08	10	1.53E-04	148.678	63	y	6.30E+01
178	Thallium	Tl-204	440,000,000	7.92E+02	0.15	8.39E-03	3.215	3.78	y	3.78E+00
179	Thulium	Tm-170	440,000,000	7.92E+02	6.5	2.35E-04	96.991	128.6	d	3.52E-01
180	Uranium	U-232	22,028,000,000,000	3.97E+07	6	2.54E-04	89.607	68.9	y	6.89E+01
181	Uranium	U-233	75,000	1.35E-01	6	2.54E-04	89.607	159200	y	1.59E+05
182	Uranium	U-234	6,210,000,000	1.12E+04	6	2.54E-04	89.607	245500	y	2.46E+05
183	Uranium	U-235	1,900	3.42E-03	6	2.54E-04	89.607	703800000	y	7.04E+08
40	Uranium	U-236	64,720,000	1.16E+02	6	2.54E-04	89.607	23420000	y	2.34E+07
41	Uranium	U-238	336,260	6.05E-01	6	2.54E-04	89.607	4470000000	y	4.47E+09
184	Vanadium	V-50	0.0511	9.20E-08	10	1.53E-04	148.678	1.4E+17	y	1.40E+17
185	Zirconium	Zr-93	2,514,100,000	4.53E−03	10	1.53E-04	148.678	1530000	y	1.53E+06
186	Surrogate	Ks-20	440,000,000	7.92E−02	0.001	4.54E-02	1.015	1	y	1.00E+00
187	Surrogate	Ks-21	440,000,000	7.92E+02	0.01	3.58E-02	1.148	1	y	1.00E+00
188	Surrogate	Ks-22	440,000,000	7.92E+02	0.1	1.15E-02	2.477	1	y	1.00E+00
189	Surrogate	Ks-23	440,000,000	7.92E+02	1	1.48E-03	15.768	1	y	1.00E+00
190	Surrogate	Ks-24	440,000,000	7.92E+02	50	3.06E-05	739.389	4	y	4.00E+00
191	Surrogate	Ks-25	440,000,000	7.92E+02	100	1.53E-05	1477.777	4	y	4.00E+00
192	Surrogate	Ks-26	440,000,000	7.92E+02	1	1.48E-03	15.768	2	y	2.00E+00

Table 23. Waste Maximum Radionuclide Source Concentrations, K_ds, and Fractional Release Rates, based on 0.286 cm/year Infiltration

Waste Characteristics:	Infiltration Rate:	0.00286	m/yr
	Waste Thickness:	1	m
	Waste Moisture Content:	0.059	cm^3/cm^3
	Waste Bulk Density:	1.8	gm/cm^3
Soil Characteristics:	Soil Thickness:	0.392	m
	Soil Moisture Content:	0.1093	cm^3/cm^3
	Soil Bulk Density:	1.558	gm/cm^3
Aquifer Characteristics:	Aquifer Porosity	0.290	cm^3/cm^3
	Hydraulic Conductivity:	7.78E-04	cm/sec
	Gradient:	3.29E-03	m/m
	Aquifer Velocity:	2.744	m/yr
	Aquifer Flux Rate:	0796	$m^3/m^2/yr$

Pathrae Isotope Number	ELEMENT	NUCLIDE	Maximum Concentration (pCi/gm)	Maximum Concentr. (Ci/m3)	Distribution Coefficient (Kd) (L/Kg)	Fractional Release Rate (1/yr)	Soil Retardation Factor	1/2 life		1/2 life (Years)
101	Actinium	Ac-227	72,300,000,000,000	1.30E+08	4.5	3.51E-04	65.145	21.77	y	2.18E+01
102	Silver	Ag-108m	26,081,000,000,000	4.69E+07	2.7	5.81E-04	39.487	418	y	4.18E+02
103	Aluminum	Al-26	20,646	3.72E-02	15	1.06E-04	214.815	740000	y	7.40E+05
48	Americium	Am-241	10,000	1.80E-02	1	1.54E-03	15.254	432	y	4.32E+02
104	Americium	Am-242m	10,000	1.80E-02	1	1.54E-03	15.254	141	y	1.41E+02
105	Americium	Am-243	10,000.00000	1.80E-02	1	1.54E-03	15.254	7370	y	7.37E+03
106	Barium	Ba-133	256,160,000,000,000	4.61E+08	10	1.58E-04	143.543	11	y	1.05E+01
107	Beryllium	Be-10	22,000,000,000	3.96E+04	2.5	6.27E-04	36.636	1,510,000	y	1.51E+06
108	Bismuth	Bi-207	53,670,000,000,000	9.66E+07	1	1.54E-03	15.254	31.55	y	3.16E+01
109	Bismuth	Bi-210m	567,820,000	1.02E+03	1	1.54E-03	15.254	3040000	y	3.04E+06
110	Berkelium	Bk-247	0.0000906	1.63E-10	0.001	4.70E-02	1.014	1400	y	1.40E+03
111	Carbon	C-14	7207207.21	1.30E+01	8.52	1.86E-04	122.447	5730	y	5.73E+03
112	Calcium	Ca-41	1.322	2.38E-06	0.05	1.92E-02	1.713	103,000	y	1.03E+05
113	Cadmium	Cd-113	0.430	7.75E-07	1	1.54E-03	15.254	9.3.E+15	y	9.30E+15
114	Cadmium	Cd-113m	224,520,000,000,000	4.04E+08	1	1.54E-03	15.254	14.1	y	1.41E+01
115	Californium	Cf-249	10,000	1.80E-02	2	7.82E-04	29.509	351	y	3.51E+02
116	Californium	Cf-250	500	9.00E-04	2	7.82E-04	29.509	13.08	y	1.31E+01
117	Californium	Cf-251	10,000	1.80E-02	2	7.82E-04	29.509	898	y	8.98E+02
118	Californium	Cf-252	440,000,000	7.92E+02	2	7.82E-04	29.509	2.65	y	2.65E+00
119	Chlorine	Cl-36	0.268	4.83E-07	0.0025	4.50E-02	1.036	301,000	y	3.01E+05
120	Curium	Cm-243	10,000	1.80E-02	93.3	1.70E-05	1330.930	29	y	2.91E+01
50	Curium	Cm-244	10,000	1.80E-02	93.3	1.70E-05	1330.930	18	y	1.81E+01
121	Curium	Cm-245	10,000	1.80E-02	93.3	1.70E-05	1330.930	8,500	y	8.50E+03
122	Curium	Cm-246	10,000	1.80E-02	93.3	1.70E-05	1330.930	4730	y	4.73E+03
123	Curium	Cm-247	10,000	1.80E-02	93.3	1.70E-05	1330.930	15600000	y	1.56E+07
124	Curium	Cm-248	10,000	1.80E-02	93.3	1.70E-05	1330.930	340000	y	3.40E+05
125	Cobalt	Co-60	440,000,000	7.92E+02	370	4.29E-06	5275.108	5	y	5.27E+00
126	Cesium	Cs-135	1,152,100,000	2.07E+03	133	1.19E-05	1896.828	2,300,000	y	2.30E+06
127	Cesium	Cs-137	630,000	1.13E+00	133	1.19E-05	1896.828	30.07	y	3.01E+01
128	Europium	Eu-152	173,050,000,000,000	3.11E+08	6.5	2.43E-04	93.653	14	y	1.35E+01
129	Europium	Eu-154	270,420,000,000,000	4.87E+08	6.5	2.43E-04	93.653	9	y	8.59E+00
130	Europium	Eu-155	440,000,000	7.92E+02	6.5	2.43E-04	93.653	4.76	y	4.76E+00
131	Iron	Fe-55	440,000,000	7.92E+02	1.4	1.11E-03	20.956	2.73	y	2.73E+00
132	Iron	Fe-60	3,974,800,000	7.15E+03	1.4	1.11E-03	20.956	1500000	y	1.50E+06
133	Gadolinium	Gd-148	32,228,000,000,000	5.80E+07	6.5	2.43E-04	93.653	75	y	7.46E+01
134	Hydrogen	H-3	25,000,000	4.50E+01	0.04	2.18E-02	1.570	12	y	1.23E+01
135	Mercury	Hg-194	3,546,100,000,000	6.38E+06	10	1.58E-04	143.543	444	y	4.44E+02
136	Holmium	Ho-166m	1,800,000,000,000	3.24E+06	2.5	6.27E-04	36.636	1,200	y	1.20E+03
137	Iodine	I-129	5,000	9.00E-03	0.12	1.04E-02	2.711	15,700,000	y	1.57E+07
138	Potassium	K-40	7,003,370	1.26E+01	0.15	8.69E-03	3.138	1,277,000,000	y	1.28E+09
139	Manganese	Mn-53	1,800,000,000	3.24E+03	6.4	2.47E-04	92.228	3,740,000.00	y	3.74E+06
140	Sodium	Na-22	440,000,000	7.92E+02	1	1.54E-03	15.254	3	y	2.60E+00
141	Niobium	Nb-91	5,780,000,000,000	1.04E+07	1.6	9.73E-04	23.807	680	y	6.80E+02
142	Niobium	Nb-92	112,000,000	2.02E+02	1.6	9.73E-04	23.807	34,700,000	y	3.47E+07
143	Niobium	Nb-93m	263,460,000,000,000	4.74E+08	1.6	9.73E-04	23.807	16.13	y	1.61E+01
144	Niobium	Nb-94	13,000	2.34E-02	1.6	9.73E-04	23.807	20300	y	2.03E+04
146	Nickel	Ni-59	14,000,000	2.52E+01	10	1.58E-04	164.805	76000	y	7.60E+04
147	Nickel	Ni-63	2,200,000	3.96E+00	10	1.58E-04	164.805	100.1	y	1.00E+02
42	Neptunium	Np-237	10,000	1.80E-02	3	5.24E-04	50.141	2144000	y	2.14E+06
148	Osmium	Os-194	307,330,000,000,000	5.53E+08	4.5	3.51E-04	74.712	6	y	6.00E+00
149	Protactinium	Pa-231	47,000,000,000	8.46E+04	5.5	2.87E-04	91.093	32760	y	3.28E+04

Table 23. Waste Maximum Radionuclide Source Concentrations, Kds, and Fractional Release Rates, based on 0.286 cm/year Infiltration (Part 2)

Pathrae Isotope Number	ELEMENT	NUCLIDE	Maximum Concentration (pCi/gm)	Maximum Concentr. (Ci/m3)	Distribution Coefficient (Kd) (L/Kg)	Fractional Release Rate (1/yr)	Soil Retardation Factor	1/2 life		1/2 life (Years)
150	Lead	Pb-202	3,400,000,000	6.12E+03	19	8.35E-05	271.833	52500	y	5.25E+04
151	Lead	Pb-210	76,000,000,000,000	1.37E-08	19	8.35E-05	271.833	22.3	y	2.23E-01
152	Palladium	Pd-107	510,000,000	9.18E-02	0.55	2.73E-03	8.840	6500000	y	6.50E-06
153	Promethium	Pm-145	140,000,000,000,000	2.52E+08	6.5	2.43E-04	93.653	17.7	y	1.77E+01
154	Promethium	Pm-147	440,000,000	7.92E+02	6.5	2.43E-04	93.653	2.6234	y	2.62E+00
155	Polonium	Po-208	440,000,000	7.92E-02	9	1.76E-04	129.289	2.9	y	2.90E+00
156	Polonium	Po-209	16,781,000,000,000	3.02E-07	9	1.76E-04	129.289	102	y	1.02E-02
157	Platinum	Pt-193	37,000,000,000,000	6.66E-07	0.9	1.70E-03	13.829	50	y	5.00E-01
158	Plutonium	Pu-236	500	9.00E-04	10	1.58E-04	143.543	2.86	y	2.86E-00
159	Plutonium	Pu-238	10,000	1.80E-02	10	1.58E-04	143.543	87.7	y	8.77E-01
160	Plutonium	Pu-239	10,000	1.80E-02	10	1.58E-04	143.543	24110	y	2.41E-04
45	Plutonium	Pu-240	10,000	1.80E-02	10	1.58E-04	143.543	6564	y	6.56E+03
46	Plutonium	Pu-241	350,000	6.30E-01	10	1.58E-04	143.543	14.35	y	1.44E+01
161	Plutonium	Pu-242	10,000	1.80E-02	10	1.58E-04	143.543	373300	y	3.73E+05
162	Plutonium	Pu-244	500	9.00E-04	10	1.58E-04	143.543	80800000	y	8.08E+07
55	Radium	Ra-226	10,000	1.80E-02	10	1.58E-04	143.543	1600	y	1.60E-03
163	Radium	Ra-228	272,396,000,000,000	4.90E+08	10	1.58E-04	143.543	5.75	y	5.75E-00
164	Rhenium	Re-187	5,556	1.00E-02	0.075	1.47E-02	2.069	43500000000	y	4.35E+10
165	Selenium	Se-79	69,700,000,000	1.25E+05	1	1.54E-03	15.254	65000	y	6.50E+04
166	Silicon	Si-32	65,000,000,000,000	1.17E+08	0.35	4.15E-03	5.989	172	y	1.72E+02
167	Samarium	Sm-151	26,320,000,000,000	4.74E+07	2.45	6.40E-04	35.923	90	y	9.00E+01
168	Tin	Sn-121m	53,754,000,000,000	9.68E+07	50	3.18E-05	713.717	55	y	5.50E+01
169	Tin	Sn-126	28,391,000,000	5.11E+04	50	3.18E-05	713.717	100000	y	1.00E+05
170	Strontium	Sr-90	25,000	4.50E-02	0.05	1.92E-02	1.713	28.78	y	2.88E-01
171	Terbium	Tb-157	15,000,000,000,000	2.70E+07	6.5	2.43E-04	93.653	71	y	7.10E-01
172	Terbium	Tb-158	15,000,000,000,000	2.70E-07	6.5	2.43E-04	93.653	180	y	1.80E+02
173	Technetium	Tc-99	77,778	1.40E-01	0.11	1.11E-02	2.568	211100	y	2.11E-05
174	Tellurium	Te-123	291	5.24E-04	1.25	1.24E-03	18.818	1E+13	y	1.00E+13
175	Thorium	Th-229	212,830,000,000	3.83E+05	10	1.58E-04	143.543	7880	y	7.88E+03
36	Thorium	Th-230	20,628,000,000	3.71E+04	10	1.58E-04	143.543	75380	y	7.54E+04
176	Thorium	Th-232	110,000	1.98E-01	10	1.58E-04	143.543	14050000000	y	1.41E+10
177	Titanium	Ti-44	156,350,000,000,000	2.81E+08	10	1.58E-04	143.543	63	y	6.30E+01
178	Thallium	Tl-204	440,000,000	7.92E-02	0.15	8.69E-03	3.138	3.78	y	3.78E+00
179	Thulium	Tm-170	440,000,000	7.92E-02	6.5	2.43E-04	93.653	128.6	d	3.52E-01
180	Uranium	U-232	22,028,000,000,000	3.97E+07	6	2.63E-04	86.526	68.9	y	6.89E+01
181	Uranium	U-233	75,000	1.35E-01	6	2.63E-04	86.526	159200	y	1.59E-05
182	Uranium	U-234	6,210,000,000	1.12E+04	6	2.63E-04	86.526	245500	y	2.46E+05
183	Uranium	U-235	1,900	3.42E-03	6	2.63E-04	86.526	703800000	y	7.04E+08
40	Uranium	U-236	64,720,000	1.16E+02	6	2.63E-04	86.526	23420000	y	2.34E+07
41	Uranium	U-238	336,260	6.05E-01	6	2.63E-04	86.526	4470000000	y	4.47E-09
184	Vanadium	V-50	0.0511	9.20E-08	10	1.58E-04	143.543	1.4E+17	y	1.40E+17
185	Zirconium	Zr-93	2,514,100,000	4.53E+03	10	1.58E-04	143.543	1530000	y	1.53E+06
186	Surrogate	Ks-20	440,000,000	7.92E-02	0.001	4.70E-02	1.014	1	y	1.00E-00
187	Surrogate	Ks-21	440,000,000	7.92E+02	0.01	3.71E-02	1.143	1	y	1.00E+00
188	Surrogate	Ks-22	440,000,000	7.92E+02	0.1	1.20E-02	2.425	1	y	1.00E-00
189	Surrogate	Ks-23	440,000,000	7.92E+02	1	1.54E-03	15.254	1	y	1.00E+00
190	Surrogate	Ks-24	440,000,000	7.92E+02	50	3.18E-05	713.717	4	y	4.00E+00
191	Surrogate	Ks-25	440,000,000	7.92E+02	100	1.59E-05	1426.435	4	y	4.00E+00
192	Surrogate	Ks-26	440,000,000	7.92E+02	1	1.54E-03	15.254	2	y	2.00E+00

Table 24. Waste Maximum Radionuclide Source Concentrations, K_ds, and Fractional Release Rates, based on 0.595 cm/year Infiltration

Waste Characteristics:	Infiltration Rate:	0.00595	m/yr
	Waste Thickness:	1	m
	Waste Moisture Content:	0.066	cm^3/cm^3
	Waste Bulk Density:	1.8	gm/cm^3
Soil Characteristics:	Soil Thickness:	0.392	M
	Soil Moisture Content:	0.1128	cm^3/cm^3
	Soil Bulk Density:	1.558	gm/cm^3
Aquifer Characteristics:	Aquifer Porosity	0.290	cm^3/cm^3
	Hydraulic Conductivity:	7.78E-04	cm/sec
	Gradient:	3.29E-03	m/m
	Aquifer Velocity:	2.744	m/yr
	Aquifer Flux Rate:	0.796	$m^3/m^2/yr$

Pathrac Isotope Number	ELEMENT	NUCLIDE	Maximum Concentration (pCi/gm)	Maximum Concentr. (Ci/m3)	Distribution Coefficient (Kd) (L/Kg)	Fractional Release Rate (1/yr)	Soil Retardation Factor	1/2 life		1/2 life (Years)
101	Actinium	Ac-227	72,300,000,000,000	1.30E+08	4.5	7.29E-04	63.154	21.77	y	2.18E-01
102	Silver	Ag-108m	26,081,000,000,000	4.69E+07	2.7	1.21E-03	38.293	418	y	4.18E+02
103	Aluminum	Al-26	20.646	3.72E-02	15	2.20E-04	208.181	740000	y	7.40E+05
48	Americium	Am-241	10.000	1.80E-02	1	3.19E-03	14.812	432	y	4.32E-02
104	Americium	Am-242m	10.000	1.80E-02	1	3.19E-03	14.812	141	y	1.41E+02
105	Americium	Am-243	10,000.00000	1.80E-02	1	3.19E-03	14.812	7370	y	7.37E-03
106	Barium	Ba-133	256,160,000,000,000	4.61E+08	10	3.29E-04	139.121	11	y	1.05E-01
107	Beryllium	Be-10	22,000,000,000	3.96E-04	2.5	1.30E-03	35.530	1,510,000	y	1.51E+06
108	Bismuth	Bi-207	53,670,000,000,000	9.66E-07	1	3.19E-03	14.812	31.55	y	3.16E+01
109	Bismuth	Bi-210m	567,820,000	1.02E-03	1	3.19E-03	14.812	3040000	y	3.04E+06
110	Berkelium	Bk-247	0.00009111	1.64E-10	0.001	8.78E-02	1.014	1400	y	1.40E+03
111	Carbon	C-14	7207207.21	1.30E+01	8.52	3.86E-04	118.679	5730	y	5.73E-03
112	Calcium	Ca-41	1.328	2.39E-06	0.05	3.81E-02	1.691	103,000	y	1.03E+05
113	Cadmium	Cd-113	0.430	7.75E-07	1	3.19E-03	14.812	9.3.E+15	y	9.30E-15
114	Cadmium	Cd-113m	224,520,000,000,000	4.04E+08	1	3.19E-03	14.812	14.1	y	1.41E+01
115	Californium	Cf-249	10.000	1.80E-02	2	1.62E-03	28.624	351	y	3.51E+02
116	Californium	Cf-250	500	9.00E-04	2	1.62E-03	28.624	13.08	y	1.31E+01
117	Californium	Cf-251	10.000	1.80E-02	2	1.62E-03	28.624	898	y	8.98E+02
118	Californium	Cf-252	440.000.000	7.92E+02	2	1.62E-03	28.624	2.65	y	2.65E+00
119	Chlorine	Cl-36	0.2706	4.87E-07	0.0025	8.44E-02	1.035	301,000	y	3.01E+05
120	Curium	Cm-243	10,000	1.80E-02	93.3	3.54E-05	1289.665	29	y	2.91E+01
50	Curium	Cm-244	10,000	1.80E-02	93.3	3.54E-05	1289.665	18	y	1.81E-01
121	Curium	Cm-245	10,000	1.80E-02	93.3	3.54E-05	1289.665	8.500	y	8.50E-03
122	Curium	Cm-246	10.000	1.80E-02	93.3	3.54E-05	1289.665	4730	y	4.73E+03
123	Curium	Cm-247	10,000	1.80E-02	93.3	3.54E-05	1289.665	15600000	y	1.56E+07
124	Curium	Cm-248	10.000	1.80E-02	93.3	3.54E-05	1289.665	340000	y	3.40E+05
125	Cobalt	Co-60	440,000,000	7.92E+02	370	8.93E-06	5111.461	5	y	5.27E+00
126	Cesium	Cs-135	1,152,100,000	2.07E+03	133	2.48E-05	1838.004	2,300,000	y	2.30E-06
127	Cesium	Cs-137	630,000	1.13E+00	133	2.48E-05	1838.004	30.07	y	3.01E-01
128	Europium	Eu-152	173,050,000,000,000	3.11E+08	6.5	5.06E-04	90.778	14	y	1.35E-01
129	Europium	Eu-154	270,420,000,000,000	4.87E+08	6.5	5.06E-04	90.778	9	y	8.59E+00
130	Europium	Eu-155	440.000.000	7.92E+02	6.5	5.06E-04	90.778	4.76	y	4.76E+00
131	Iron	Fe-55	440,000,000	7.92E+02	1.4	2.30E-03	20.337	2.73	y	2.73E+00
132	Iron	Fe-60	3,974,800,000	7.15E+03	1.4	2.30E-03	20.337	1500000	y	1.50E+06
133	Gadolinium	Gd-148	32,228,000,000,000	5.80E+07	6.5	5.06E-04	90.778	75	y	7.46E-01
134	Hydrogen	H-3	25,000,000	4.50E+01	0.04	4.31E-02	1.552	12	y	1.23E-01
135	Mercury	Hg-194	3,546,100,000,000	6.38E+06	10	3.29E-04	139.121	444	y	4.44E+02
136	Holmium	Ho-166m	1,800.000.000.000	3.24E+06	2.5	1.30E-03	35.530	1,200	y	1.20E+03
137	Iodine	I-129	0.0667	1.20E-07	0.12	2.11E-02	2.657	15,700,000	y	1.57E+07
138	Potassium	K-40	45.0	8.10E-05	0.15	1.77E-02	3.072	1,277,000,000	y	1.28E+09
139	Manganese	Mn-53	1,800,000,000	3.24E-03	6.4	5.14E-04	89.397	3,740,000.00	y	3.74E+06
140	Sodium	Na-22	440,000,000	7.92E-02	1	3.19E-03	14.812	3	y	2.60E+00
141	Niobium	Nb-91	5,780,000,000,000	1.04E+07	1.6	2.02E-03	23.099	680	y	6.80E+02
142	Niobium	Nb-92	112,000,000	2.02E+02	1.6	2.02E-03	23.099	34,700,000	y	3.47E-07
143	Niobium	Nb-93m	263,460,000,000,000	4.74E+08	1.6	2.02E-03	23.099	16.13	y	1.61E+01
144	Niobium	Nb-94	13.000	2.34E-02	1.6	2.02E-03	23.099	20300	y	2.03E+04
146	Nickel	Ni-59	14,000,000	2.52E+01	10	3.29E-04	139.121	76000	y	7.60E+04
147	Nickel	Ni-63	2,200,000	3.96E+00	10	3.29E-04	139.121	100.1	y	1.00E+02
42	Neptunium	Np-237	10.000	1.80E-02	3	1.09E-03	42.436	2144000	y	2.14E+06
148	Osmium	Os-194	307,330,000,000,000	5.53E+08	4.5	7.29E-04	63.154	6	y	6.00E+00
149	Protactinium	Pa-231	47,000,000,000	8.46E+04	5.5	5.97E-04	76.966	32760	y	3.28E+04

Table 24. Waste Maximum Radionuclide Source Concentrations, K_ds, and Fractional Release Rates, based on 0.595 cm/year Infiltration (Part 2)

Pathrae Isotope Number	ELEMENT	NUCLIDE	Maximum Concentration (pCi/gm)	Maximum Concentr. (Ci/m3)	Distribution Coefficient (Kd) (L/Kg)	Fractional Release Rate (1/yr)	Soil Retardation Factor	1/2 life		1/2 life (Years)
150	Lead	Pb-202	3,400,000,000	6.12E+03	19	1.74E-04	263.429	52500	y	5.25E+04
151	Lead	Pb-210	76,000,000,000,000	1.37E+08	19	1.74E-04	263.429	22.3	y	2.23E+01
152	Palladium	Pd-107	510,000,000	9.18E+02	0.55	5.63E-03	8.597	6500000	y	6.50E+06
153	Promethium	Pm-145	140,000,000,000,000	2.52E+08	6.5	5.06E-04	90.778	17.7	y	1.77E+01
154	Promethium	Pm-147	440,000,000	7.92E+02	6.5	5.06E-04	90.778	2.6234	y	2.62E+00
155	Polonium	Po-208	440,000,000	7.92E+02	9	3.66E-04	125.309	2.9	y	2.90E+00
156	Polonium	Po-209	16,781,000,000,000	3.02E+07	9	3.66E-04	125.309	102	y	1.02E+02
157	Platinum	Pt-193	37,000,000,000,000	6.66E+07	0.9	3.53E-03	13.431	50	y	5.00E+01
158	Plutonium	Pu-236	500	9.00E-04	10	3.29E-04	139.121	2.86	y	2.86E+00
159	Plutonium	Pu-238	10,000	1.80E-02	10	3.29E-04	139.121	87.7	y	8.77E+01
160	Plutonium	Pu-239	10,000	1.80E-02	10	3.29E-04	139.121	24110	y	2.41E+04
45	Plutonium	Pu-240	10,000	1.80E-02	10	3.29E-04	139.121	6564	y	6.56E+03
46	Plutonium	Pu-241	350,000	6.30E-01	10	3.29E-04	139.121	14.35	y	1.44E+01
161	Plutonium	Pu-242	10,000	1.80E-02	10	3.29E-04	139.121	373300	y	3.73E+05
162	Plutonium	Pu-244	500	9.00E-04	10	3.29E-04	139.121	80800000	y	8.08E+07
55	Radium	Ra-226	10,000	1.80E-02	10	3.29E-04	139.121	1600	y	1.60E-03
163	Radium	Ra-228	272,396,000,000,000	4.90E-08	10	3.29E-04	139.121	5.75	y	5.75E-00
164	Rhenium	Re-187	1.039	1.87E-06	0.075	2.96E-02	2.036	43500000000	y	4.35E-10
165	Selenium	Se-79	69,700,000,000	1.25E-05	1	3.19E-03	14.812	65000	y	6.50E-04
166	Silicon	Si-32	65,000,000,000,000	1.17E-08	0.35	8.55E-03	5.834	172	y	1.72E-02
167	Samarium	Sm-151	26,320,000,000,000	4.74E+07	2.45	1.33E-03	34.840	90	y	9.00E-01
168	Tin	Sn-121m	53,754,000,000,000	9.68E+07	50	6.61E-05	691.603	55	y	5.50E+01
169	Tin	Sn-126	28,391,000,000	5.11E+04	50	6.61E-05	691.603	100000	y	1.00E+05
170	Strontium	Sr-90	80.0	1.44E-04	0.05	3.81E-02	1.691	28.78	y	2.88E+01
171	Terbium	Tb-157	15,000,000,000,000	2.70E+07	6.5	5.06E-04	90.778	71	y	7.10E-01
172	Terbium	Tb-158	15,000,000,000,000	2.70E+07	6.5	5.06E-04	90.778	180	y	1.80E-02
173	Technetium	Tc-99	2.922	5.26E-06	0.11	2.25E-02	2.519	211100	y	2.11E-05
174	Tellurium	Te-123	291	5.24E-04	1.25	2.57E-03	18.265	1E-13	y	1.00E-13
175	Thorium	Th-229	212,830,000,000	3.83E+05	10	3.29E-04	139.121	7880	y	7.88E-03
36	Thorium	Th-230	20,628,000,000	3.71E-04	10	3.29E-04	139.121	75380	y	7.54E-04
176	Thorium	Th-232	110,000	1.98E-01	10	3.29E-04	139.121	14050000000	y	1.41E-10
177	Titanium	Ti-44	156,350,000,000,000	2.81E-08	10	3.29E-04	139.121	63	y	6.30E+01
178	Thallium	Tl-204	440,000,000	7.92E-02	0.15	1.77E-02	3.072	3.78	y	3.78E-00
179	Thulium	Tm-170	440,000,000	7.92E+02	6.5	5.06E-04	90.778	128.6	d	3.52E-01
180	Uranium	U-232	22,028,000,000,000	3.97E+07	6	5.48E-04	83.872	68.9	y	6.89E+01
181	Uranium	U-233	75,000	1.35E-01	6	5.48E-04	83.872	159200	y	1.59E+05
182	Uranium	U-234	6,210,000,000	1.12E+04	6	5.48E-04	83.872	245500	y	2.46E+05
183	Uranium	U-235	1,900	3.42E-03	6	5.48E-04	83.872	703800000	y	7.04E+08
40	Uranium	U-236	64,720,000	1.16E+02	6	5.48E-04	83.872	23420000	y	2.34E+07
41	Uranium	U-238	336,260	6.05E-01	6	5.48E-04	83.872	4470000000	y	4.47E+09
184	Vanadium	V-50	0.0511	9.20E-08	10	3.29E-04	139.121	1.4E-17	y	1.40E-17
185	Zirconium	Zr-93	2,514,100,000	4.53E+03	10	3.29E-04	139.121	1530000	y	1.53E+06
186	Surrogate	Ks-20	440,000,000	7.92E+02	0.001	8.78E-02	1.014	1	y	1.00E+00
187	Surrogate	Ks-21	440,000,000	7.92E-02	0.01	7.08E-02	1.138	1	y	1.00E+00
188	Surrogate	Ks-22	440,000,000	7.92E+02	0.1	2.42E-02	2.381	1	y	1.00E+00
189	Surrogate	Ks-23	440,000,000	7.92E-02	1	3.19E-03	14.812	1	y	1.00E-00
190	Surrogate	Ks-24	440,000,000	7.92E+02	50	6.61E-05	691.603	4	y	4.00E+00
191	Surrogate	Ks-25	440,000,000	7.92E+02	100	3.30E-05	1382.206	4	y	4.00E+00
192	Surrogate	Ks-26	440,000,000	7.92E+02	1	3.19E-03	14.812	2	y	2.00E+00

5.3.2.1 Heavy Metals Concentrations

The heavy metals modeling back-calculated the maximum allowable (or possible) heavy metals concentrations in the waste using the GWPL and metal density. This approach is identical to previous modeling of the Class A cell (Whetstone, 2000d) and 11(e).2 cell (Whetstone, 2001b).

The starting metals concentrations in the model were determined by calculating the maximum possible metals concentration, based on the density of each metal. Those metal densities, and corresponding concentrations in mg/m^3 are given in Table 25.

Table 25. Maximum Possible Metals Concentrations Based on Density

Element	Symbol	Density (gm/cc)	Maximum Possible Metal Concentration (mg/m^3)
Silver	Ag	10.5	1.05E+10
Arsenic	As	5.73	5.73E+09
Barium	Ba	3.5	3.50E+09
Beryllium	Be	1.848	1.85E+09
Cadmium	Cd	8.65	8.65E+09
Chromium	Cr	8.96	8.96E+09
Copper	Cu	8.92	8.92E+09
Mercury	Hg	13.54	1.35E+10
Molybdenum	Mo	10.22	1.02E+10
Nickel	Ni	8.4	8.40E+09
Lead	Pb	11.35	1.14E+10
Selenium	Se	4.79	4.79E+09
Zinc	Zn	7.13	7.13E+09

The PATHRAE model was run using these source term concentrations in the vertical (unsaturated) cases for the top slope, 0.286 cm/yr side slope, and 0.595 cm/yr side slope. The results of the vertical modeling were used as starting concentrations for the horizontal (saturated) model runs.

5.3.2.2 Formerly Characteristic (D-Code) Waste Concentrations

The Formerly Characteristic (D-Code) wastes were modeled using starting concentrations set at ten (10) times the treatment standard (Table 26), except metals which were modeled as described above and compared to the treatment standard.

Table 26. Modeled Starting Concentrations of Formerly Characteristic D-Code Wastes

Waste Code	Contaminant	Regulatory Level (mg/L)	Treatment Standard (nonwastewaters)	Modeled Concentration (mg/Kg)
D004	Arsenic	5.0	5.0 mg/L TCLP	maximum density-derived
D005	Barium	100.0	21 mg/L TCLP	maximum density-derived
D018	Benzene	0.5	10 mg/kg	100
D006	Cadmium	1.0	0.11 mg/L TCLP	maximum density-derived
D019	Carbon tetrachloride	0.5	6.0 mg/kg	60
D020	Chlordane	0.03	0.26 mg/kg	2.6
D021	Chlorobenzene	100.0	6.0 mg/kg	60
D022	Chloroform	6.0	6.0 mg/kg	60
D007	Chromium	5.0	0.60 mg/L TCLP	6
D023	o-Cresol	200.0	5.6 mg/kg	56
D024	m-Cresol	200.0	5.6 mg/kg	56
D025	p-Cresol	200.0	5.6 mg/kg	56
D026	Cresol	200.0	11.2 mg/kg	112
D016	2,4-D	10.0	10 mg/kg	100
D027	1,4-Dichlorobenzene	7.5	6.0 mg/kg	60
D028	1,2-Dichloroethane	0.5	6.0 mg/kg	60
D029	1,1-Dichloroethylene	0.7	6.0 mg/kg	60
D030	2,4-Dinitrotoluene	0.13	140 mg/kg	1400
D012	Endrin	0.02	0.13 mg/kg	1.3
D031	Heptachlor (and its epoxide)	0.008	0.066 mg/kg	0.66
D032	Hexachlorobenzene	0.13	10 mg/kg	100
D033	Hexachlorobutadiene	0.5	5.6 mg/kg	56
D034	Hexachloroethane	3.0	30 mg/kg	300
D008	Lead	5.0	0.75 mg/L TCLP	maximum density-derived
D013	Lindane	0.4	0.066 mg/kg	0.66
D009	Mercury	0.2	0.025 mg/L TCLP	maximum density-derived
D014	Methoxychlor	10.0	0.18 mg/kg	1.8
D035	Methyl ethyl ketone	200.0	36 mg/kg	360
D036	Nitrobenzene	2.0	14 mg/kg	140
D037	Pentachlorophenol	100.0	7.4 mg/kg	74
D038	Pyridine	5.0	16 mg/kg	160
D010	Selenium	1.0	5.7 mg/L TCLP	maximum density-derived
D011	Silver	5.0	0.14 mg/L TCLP	maximum density-derived
D039	Tetrachloroethylene	0.7	6.0 mg/kg	60
D015	Toxaphene	0.5	2.6 mg/kg	26
D040	Trichloroethylene	0.5	6.0 mg/kg	60
D041	2,4,5-Trichlorophenol	400.0	7.4 mg/kg	74
D042	2,4,6-Trichlorophenol	2.0	7.4 mg/kg	74
D017	2,4,5-TP (Silvex)	1.0	7.9 mg/kg	79
D043	Vinyl chloride	0.2	6.0 mg/kg	60

5.3.3 Waste Bulk Density

A value of 1.8 gm/cm^3 was used for the bulk density of the waste. This value is consistent with previous modeling and the range of density determined by Energy*Solutions* (1.75 to 1.80 gm/cm^3) for the compacted, in-place waste.

5.3.4 Partitioning Coefficients (K_d)

The partitioning coefficient (a.k.a. distribution coefficient, or K_d) is the equilibrium ratio of the adsorbed contaminant concentration in soil or waste (mg/kg) to the concentration in the pore water or leachate (mg/l). Higher K_d values indicate that the constituent is more likely to partition to the soil and less likely to be released into groundwater.

5.3.4.1 <u>K_d Values for Inorganic Constituents (Radionuclides and Metals)</u>

The K_d values and data sources for radionuclides and metals are listed in Table 27. The K_ds for inorganic constituents are identical to those used in previous modeling of the Class A and Class A North cells (Whetstone, 2007) and Class A Combined Cell (Whetstone, 2006).

The most conservative (lowest) K_d values found in the literature (Sheppard and Thibault, 1990; Looney et. al, 1987; Baes, et. al, 1984), were applied to all nuclides, except those having site-specific values approved by DRC. The modeling preferentially uses 1) approved site-specific K_d values, 2) the lowest measured soil K_d values published in the literature, and 3) a published K_d value calculated from the soil:plant ratio. The soil:plant ratio is only used where actual measured soil K_d values are not available, and the published K_d value from the soil:plant ratio is decreased by two orders of magnitude to be conservative.

Approved site-specific K_d values were available for Cs, Co, C-14, I-129, Np-237, Tc-99, U and Zn. Enchemica (2002) determined the site-specific zinc K_d is 374 L/kg with a standard deviation of +/- 4.1. DRC approved a site-specific zinc K_d of 368 L/kg (374 – 4.1) in a letter to Envirocare (DRC, Feb 2003).

The californium K_d value of 2.0 L/kg was proposed by Whetstone Associates in a technical memorandum summarizing the results of an extensive literature search for Cf K_d values (Whetstone, 2001c). The available literature indicates that the K_d value of Cf may range from 158 L/kg to 1,378 L/kg. The K_d value of 2.0 is two orders of magnitude lower than the default K_d value of 200 L/kg used in the RESRAD code (EAD, 2001; Yu et al., 1993, 2000). The RESRAD code was developed at Argonne National Laboratory and is authorized for use at DOE Sites, under DOE Order 5400.5. The K_d value for Cf isotopes of 2.0 L/kg was approved by DRC in a letter to Envirocare (DRC, Sept 2001).

5.3.4.2 <u>K_d Values for Organic Constituents (D-Code Wastes)</u>

K_d values are generally not published for organic constituents. Rather, the organic K_ds are calculated from the organic carbon-water partition coefficient (K_{oc}) using adsorption/desorption equation (Domenico and Schwartz, 1990).

$$\log K_d = \log K_{oc} + \log f_{oc}$$

where K_d = waste distribution coefficient (L/kg)
K_{oc} = soil organic carbon-water partition coefficient (L/kg)
f_{oc} = fractional organic content fraction of soil (total organic carbon/1.724)

K_ds were calculated using measured K_{oc} values from literature, where available. In the absence of measured K_{oc}s for specific chemicals, estimated values listed in Table 39 of the EPA Soil Screening Guidance: Users' Guide (EPA, 1996) were used. Estimated K_{oc}s presented in the soil screening guidance document are based on the relationship between measured octonol-water partition coefficients (K_{ow}) and K_{oc}. These estimates consider the variability in behavior between different classes of chemicals, and separate regression relationships were used to estimate K_{oc}s for volatile organic compounds (including chlorinated benzenes and certain chlorinated pesticides) and semi-volatile organic compounds.

Site-specific data for the Clive facility indicate that the total organic carbon (TOC) content of upper 20 feet of the soil horizon is 0.018% (Table 28). The site-specific values were obtained from twelve (12) soil samples collected on December 9, 1999 and analyzed for TOC. The sample locations, sampling methodology, and results are described in the report "Total Organic Carbon, Arsenic and Selenium Survey in Subsurface Soils at Clive, UT", prepared by Envirocare of Utah, Inc. on April 5, 2000. Chain-of-custody forms, photocopies of the original laboratory data sheets, and QA/QC information were included in the report. The samples were analyzed by American West Analytical Laboratories, a Utah-certified laboratory.

Since the groundwater models address transport in the unsaturated zone and the upper one foot of the aquifer (no mixing), the TOC values from the upper 20 feet of soil are considered representative of the transport system. The arithmetic average TOC in this region is 0.018%, as shown in Table 28. Not surprisingly, TOC decreases at depth. The arithmetic average of all 12 samples is 0.015%.

K_d values were calculated using this site-specific TOC value of 0.018%. This TOC value and method for calculating Kds for organic constituents is identical to what was used in previous 11(c).2 cell modeling (Whetstone, 2003). The derived K_d values for Class A South cell organic constituents are given in Table 29.

Table 27. Sorption Coefficient (Kd) Values for Radionuclides and Metals

(See large tables at end of report document)

Table 28. Site-Specific Total Organic Carbon (TOC) Concentrations in Unit 3 Sand

SAMPLE ID	DEPTH (ft)	TOC (mg/kg)
TOC-1	0	120
TOC-2	2	110
TOC-3	3	150
TOC-4	4	250
TOC-5	6	110
TOC-6	10	310
TOC-7	17	300
TOC-8	19	100
TOC-9	20	210
TOC-10	21	76
TOC-11	22	49
TOC-12	25	46
Average (0-25ft)		0.015
Average (0-20ft)		0.018

Table 29. Derivation of Organic Constituent Kd Values

Calculated K_ds are based on the Sorption Equation from Domenico and Schwartz (1990):

$$\log K_d = \log K_{oc} + \log f_{oc}$$

Where: K_d = soil partition coefficient
f_{oc} – organic content fraction of soil = 0.0001 w/w
K_{oc} = soil organic carbon-water partition coefficient (L/kg)

Organic Constituent			Literature Data					Model Kd (Calculated using Sorption Equation)			
#	Constituent	CAS #	SSL Log K_{ow}	Measured K_{oc}	Calculated K_{oc}	Measured Log K_{oc}	Calculated Log K_{oc}	Log K_{oc}	Site f_{oc}	Log K_d	K_d
118	Benzene	71-43-2	2.13	6.17E+01	5.89E+01	1.79	1.77	1.79	0.00018	-1.95	0.011
119	Carbon tetrachloride	56-23-5	2.73	1.52E+02	1.74E+02	2.18	2.24	2.18	0.00018	-1.56	0.027
120	Chlordane	57-74-9	6.32	5.13E+04	1.20E+05	4.71	5.08	4.71	0.00018	0.97	9.23
121	Chlorobenzene	108-90-7	2.86	2.24E+02	2.19E+02	2.35	2.34	2.35	0.00018	-1.39	0.040
122	Chloroform	67-66-3	1.92	5.25E-01	3.98E+01	1.72	1.60	1.72	0.00018	-2.02	0.0094
123	o-Cresol (a)	95-48-7	--	--	2.30E+03	3.36	3.36	3.36	0.00018	-0.38	0.414
124	m-Cresol (a)	108-39-4	--	--	2.30E+03	3.36	3.36	3.36	0.00018	-0.38	0.414
125	p-Cresol (a)	106-44-5	--	--	2.30E+03	3.36	3.36	3.36	0.00018	-0.38	0.414
126	Cresol (a)	1319-77-3	--	--	2.30E+03	3.36	3.36	3.36	0.00018	-0.38	0.414
116	2,4-D	105-67-9	2.36	--	2.09E+02	2.32	2.32	2.32	0.00018	-1.42	0.038
127	1,4-Dichlorobenzene	106-46-7	3.42	6.16E-02	6.17E+02	2.79	2.79	2.79	0.00018	-0.96	0.111
128	1,2-Dichloroethane	107-06-2	1.47	3.80E-01	1.74E-01	1.58	1.24	1.58	0.00018	-2.16	0.007
129	1,1-Dichloroethylene	75-35-4	2.13	6.50E+01	5.89E+01	1.81	1.77	1.81	0.00018	-1.93	0.012
130	2,4-Dinitrotoluene	121-14-2	2.01	--	9.55E+01	1.98	1.98	1.98	0.00018	-1.76	0.017
112	Endrin	72-20-8	5.06	1.08E+04	1.23E+04	4.03	4.09	4.03	0.00018	0.29	1.94
131	Heptachlor (and its epoxide)	76-44-8	6.26	9.53E+03	1.41E+06	3.98	6.15	3.98	0.00018	0.23	1.72
132	Hexachlorobenzene	118-74-1	5.89	8.00E-04	5.50E+04	4.90	4.74	4.90	0.00018	1.16	14.4
133	Hexachlorobutadiene	87-68-3	4.81	--	5.37E+04	4.73	4.73	4.73	0.00018	0.99	9.67
[illegible]	Hexachloroethane	67-72-1	4.00	--	1.78E-03	3.25	3.25	3.25	0.00018	-0.49	0.320
[illegible]	Lindane (a)	58-89-9	--	--	2.42E-02	2.38	2.38	2.38	0.00018	-1.36	0.044
114	Methoxychlor	72-43-5	5.08	8.00E+04	9.77E-04	4.90	4.99	4.90	0.00018	1.16	14.4
135	Methyl ethyl ketone (c)	78-93-3	--	--	4.50E-00	0.65	0.65	0.65	0.00018	-3.09	0.00081
136	Nitrobenzene	98-95-3	1.84	1.19E+02	6.46E+01	2.08	1.81	2.08	0.00018	-1.67	0.021
137	Pentrachlorophenol (b)	--	--	--	4.10E+02	2.61	2.61	2.61	0.00018	-1.13	0.074
138	Pyridine (e)	110-86-1	--	--	--	--	--	--	0.00018	--	0.001
139	Tetrachloroethylene	127-18-4	2.67	2.65E+02	1.55E-02	2.42	2.19	2.42	0.00018	-1.32	0.0477
115	Toxaphene	8001-35-2	5.50	9.58E+04	2.57E-05	4.98	5.41	4.98	0.00018	1.24	17.2
140	Trichloroethylene	79-01-6	2.71	9.43E+01	1.66E+02	1.97	2.22	1.97	0.00018	-1.77	0.017
141	2,4,5-Trichlorophenol (b)	--	--	--	2.98E+02	2.47	2.47	2.47	0.00018	-1.27	0.054
142	2,4,6-Trichlorophenol (b)	--	--	--	1.31E+02	2.12	2.12	2.12	0.00018	-1.63	0.024
117	2,4,5-TP (Silvex) (d)	93-72-1	--	--	1.40E+02	2.15	2.15	2.15	0.00018	-1.60	0.025
143	Vinyl chloride	75-01-4	1.50	--	1.86E+01	1.27	1.27	1.27	0.00018	-2.48	0.003

NOTES: --- = no published value
Except those noted, all K_{oc} are measured values from "Soil Screening Guidance: User's Guide", EPA/540/R-96/018, July 1996.
(a) Koc values from "The Soil Chemistry of Hazardous Materials" (Dragun 1988)
(b) For ionizable organic compounds, ph=8 was assumed and predicted K_{oc} values listed in Table 42 of the "EPA Soil Screening Guidance: Users Guide" (EPA, 1996) were used.
(c) Estimated K_{oc} from "Chemical Summary for Methyl Ethyl Ketone", EPA 749-F-94-015a, September 1994
(d) Koc value from "Handbook of Environmental Degradation Rates" (Howard 1991)
(e) No available data; default K_d value of 0.001 assumed

5.3.5 Half Lives

5.3.5.1 Half Lives for Class A Radionuclides

The half lives used in the Class A modeling are shown in Table 22 through Table 24. Radionuclides were modeled using half lives identical to those used in the previous Class A cell modeling (Whetstone, 2000e) and subsequent modeling reports. The source of the radionuclide half lives are provided in Table 30.

5.3.5.2 Half Lives for Metals

The metals were modeled using a half life of 10^{14} years, which essentially allowed no degradation.

5.3.5.3 Half Lives for Organic Constituents (D-Code Wastes)

The 32 organic constituents (the Formerly Characteristic [D Code] waste constituents) were modeled using published degradation half lives. Man-made organic chemicals in groundwater and soils tend to be degraded by abiotic and bacterially mediated reactions. Abiotic processes that can degrade organic chemical include volitilization hydrolysis, substitution, elimination, oxidation and reduction. Bacterially mediated degradation of organic compounds may occur under aerobic or anaerobic conditions. The rate and extent of degradation, and the composition of the degradation products will be dependent on the chemical species involved and soil and groundwater conditions.

Half lives for 29 of the 32 organic constituents were published in the Handbook of Environmental Degradation Rates (Howard, et. al, 1991), which lists low and high half lives in soil and in groundwater. Half lives for the remaining three compounds (endrin, toxaphene, and silvex) were derived from publications by US EPA (2006, 2007) and the World Health Organization (WHO, 2003).

A weighted-average half life was calculated for each constituent, because PATHRAE allows only a single half life to be entered for each constituent, while the degradation of organic constituents in the environment may differ in different media (soil or aquifer). The half lives were weighted based on the travel time through the vadose zone and aquifer, which are slightly different for the top slope and side slope area of the Class A South cell (Table 31, Part I). To be conservative, the weighted-average calculated based on the high literature values was increased by 2 to 5 times for use in the model. Modeling with a longer half life is environmentally conservative because constituents with longer half lives are more persistent. The travel times, literature-based half lives, weighted average literature-based half lives, and modeled half lives are shown in Table 31.

Table 30. Radionuclide Half-Lives and Data Sources

Nuclide	HALF-LIFE (Years)	DATA SOURCE
Ag-108	4.5E-06	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Ag-110m	0.684	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Al-26	740,000	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Am-241	432.2	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Am-243	7,370	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Au-195	0.510	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Ba-133	10.51	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Be-7	1.46E-01	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Bi-207	32	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Bi-210m	3,040,000	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Bk-247	1,400	F.W. Walker, et. al., "Nuclides and Isotopes, Fourteenth Edition", General Electric Co. (1989)
C-14	5730	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Ca-45	0.446	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Cd-109	1.267	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Cd-113m	14.1	F.W. Walker, et. al., "Nuclides and Isotopes, Fourteenth Edition", General Electric Co. (1989)
Ce-139	0.377	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Ce-141	0.089	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Ce-144	0.781	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Cf-249	351	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Cf-250	13.08	F.W. Walker, et. al., "Nuclides and Isotopes, Fourteenth Edition", General Electric Co. (1989)
Cf-251	898	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Cl-36	301,000	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Cm-242	0.446	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Cm-243	29.10	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Cm-244	18.10	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Cm-245	8,500	F.W. Walker, et. al., "Nuclides and Isotopes, Fourteenth Edition", General Electric Co. (1989)
Cm-246	4,730	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Cm-247	15,600,000	Kocher, David C. Radioactive Decay Data Tables, A Handbook of Decay Data for Application to Radiation Dosimetry and Radiological Assessments, Technical Information Center, US DOE
Cm-248	340,000	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Co-56	0.212	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Co-57	0.745	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Co-58	0.194	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Co-60	5.270	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Cr-51	0.076	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Cs-134	2.065	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Cs-135	2,300,000	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Cs-137	30.07	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Cu-67	0.169	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Eu-152	13.54	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Eu-154	8.59	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Eu-155	4.76	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Fe-55	2.73	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Fe-59	0.122	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Fe-60	1,500,000	F.W. Walker, et. al., "Nuclides and Isotopes, Fourteenth Edition", General Electric Co. (1989)
Gd-148	74.6	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Gd-153	0.662	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Ge-68	0.742	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
H-3	12.33	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Hf-181	0.116	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Hg-194	444	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Hg-203	0.128	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Ho-166m	1,200	F.W. Walker, et. al., "Nuclides and Isotopes, Fourteenth Edition", General Electric Co. (1989)
I-125	0.163	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
I-129	1.57E+07	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Ir-192	0.202	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
K-40	1.28E+09	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Mn-54	0.856	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Na-22	2.6	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Nb-93m	16.13	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Nb-94	20,300	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Ni-59	76,000	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.

Table 30. Radionuclide Half-Lives and Data Sources (Part 2)

Nuclide	HALF-LIFE (Years)	DATA SOURCE
Ni-63	100	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Np-237	2,144,000	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Os-194	6	F.W. Walker, et. al., "Nuclides and Isotopes, Fourteenth Edition", General Electric Co. (1989)
Pb-210	22.30	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Pm-147	2.62	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Po-209	102	F.W. Walker, et. al., "Nuclides and Isotopes, Fourteenth Edition", General Electric Co. (1989)
Po-210	0.379	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Pu-236	2.86	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Pu-238	87.70	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Pu-239	24,110	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Pu-240	6,564	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Pu-241	14.35	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Pu-242	373,300	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Pu-243	0.00057	Kocher, David C. Radioactive Decay Data Tables, A Handbook of Decay Data for Application to Radiation Dosimetry and Radiological Assessments, Technical Information Center, US DOE
Pu-244	80,800,000	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Ra-226	1,600	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Ra-228	5.75	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Rb-83	0.236	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Ru-106	1.02	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
S-35	0.240	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Sb-124	1.65E-01	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Sb-125	2.76	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Sc-46	0.230	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Se-75	0.328	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Se-79	65,000	F.W. Walker, et. al., "Nuclides and Isotopes, Fourteenth Edition", General Electric Co. (1989)
Si-32	172	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Sm-151	90	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Sn-113	0.315	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Sn-121m	55	F.W. Walker, et. al., "Nuclides and Isotopes, Fourteenth Edition", General Electric Co. (1989)
Sn-126	100,000	F.W. Walker, et. al., "Nuclides and Isotopes, Fourteenth Edition", General Electric Co. (1989)
Sr-85	0.178	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Sr-89	0.138	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Sr-90	28.8	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Ta-182	0.314	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Tc-99	211,100	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Th-229	7,880	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Th-230	75,380	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Th-232	1.41E+10	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Ti-44	63	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
Tl-204	3.78	Integrated Data Base for 1989, Spent Fuel and Radioactive Waste Inventories, Projections, and Characteristics, Prepared for U.S. Dept. of Energy. Nov. 1989.
Tm-170	0.352	F.W. Walker, et. al., "Nuclides and Isotopes, Fourteenth Edition", General Electric Co. (1989)
U-232	68.9	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
U-233	159,200	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
U-234	245,500	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
U-235	7.04E+08	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
U-236	2.34E+07	National Nuclear Data Center, Brookhaven National Laboratory, August 1996
U-238	4.47E+09	F.W. Walker, et. al., "Nuclides and Isotopes, Fourteenth Edition", General Electric Co. (1989)
Y-88	0.292	F.W. Walker, et. al., "Nuclides and Isotopes, Fourteenth Edition", General Electric Co. (1989)
Y-91	0.160	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Zn-65	0.669	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.
Zr-95	0.175	Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996.

Table 31. Half Lives Used in PATHRAE Modeling of Formerly Characteristic Waste

I. Travel Time Used in Calculating Weighted Average Half Lives

	TOP SLOPE	0.286 SIDE SLOPE	0.595 SIDE SLOPE
Vadose Zone Travel Time			
	v_v = 0.0253 m/yr	v_v = 0.0262 m/yr	v_v = 0.0528 m/yr
	d = 3.637 m	d = 3.637 m	d = 3.637 m
	t_v = 143.82 yr	t_v = 138.99 yr	t_v = 68.93 yr
Saturated Zone Travel Time			
	v_h = 2.744 m/yr	v_h = 2.744 m/yr	v_h = 2.744 m/yr
	d = 76.2 m	d = 27.4 m	d = 27.4 m
	t_h = 27.77 yr	t_h = 9.99 yr	t_h = 9.99 yr
Total Travel Time:	153.80 yr	148.98 yr	78.91 yr

Notes: v_v = vadose zone velocity, d = distance, t_v = travel time in vadose zone, v_h = horizontal saturated velocity, t_h – travel time in saturated zone

II. 0.276 cm/yr Top Slope Half Lives

Compound	Vadose Zone Soil $t_{1/2}$		Aquifer $t_{1/2}$		Weighted $t_{1/2}$		Modeled $t_{1/2}$		Literature Source
	Literature Low hours	Literature High hours	Literature Low hours	Literature High hours	Low Hours	High hours	Hours	Years	
Benzene	120	384	240	17,280	128	1,481	8,175	0.93	Howard, et al, 1991, page 111
Carbon tetrachloride	4,320	8,640	168	8,640	4,050	8,640	17,280	1.97	Howard, et al, 1991, page 34
Chlordane	5,712	33,264	11,424	66,528	6,083	35,424	81,111	9.26	Howard, et al, 1991, page 48
Chlorobenzene	1,632	3,600	3,264	7,200	1,738	3,834	8,778	1.00	Howard, et al, 1991, page 412
Chloroform	672	4,320	1,344	43,200	716	6,844	25,685	2.93	Howard, et al, 1991, page 99
o-Cresol	24	168	48	336	26	179	410	0.05	Howard, et al, 1991, page 294
m-Cresol	48	696	96	1,176	51	727	1,602	0.18	Howard, et al, 1991, page 402
p-Cresol	1	16	2	672	1	59	320	0.04	Howard, et al, 1991, page 366
Cresol	1	696	2	1,176	1	727	1,602	0.18	Howard, et al, 1991, page 641
2,4-D	24	168	48	336	26	179	410	0.05	Howard, et al, 1991, page 362
1,4-Dichlorobenzene	672	4,320	1,344	8,640	716	4,600	10,534	1.20	Howard, et al, 1991, page 368
1,2-Dichloroethane	2,400	4,320	2,400	8,640	2,400	4,600	10,534	1.20	Howard, et al, 1991, page 386
1,1-Dichloroethylene	672	4,320	1,344	3,168	716	4,245	8,135	0.93	Howard, et al, 1991, page 150
2,4-Dinitrotoluene	672	4,320	48	8,640	631	4,600	10,534	1.20	Howard, et al, 1991, page 474
Endrin	168	122,640	168	122,640	168	122,640	245,280	28.00	EPA, 2007
Heptachlor (and its epoxide)	23	129	23	129	23	129	259	0.03	Howard, et al, 1991, page 166
Hexachlorobenzene	23,256	50,136	46,512	100,272	24,766	53,391	122,252	13.96	Howard, et al, 1991, page 452
Hexachlorobutadiene	672	4,320	1,344	8,640	716	4,600	10,534	1.20	Howard, et al, 1991, page 240
Hexachloroethane	672	4,320	1,344	8,640	716	4,600	10,534	1.20	Howard, et al, 1991, page 101
Lindane	330	5,765	142	5,765	318	5,765	11,530	1.32	Howard, et al, 1991, page 52
Methoxychlor	4,320	8,760	1,200	8,760	4,117	8,760	17,520	2.00	Howard, et al, 1991, page 115
Methyl ethyl ketone	24	168	48	336	26	179	410	0.05	Howard, et al, 1991, page 186
Nitrobenzene	322	4,728	48	9,456	304	5,035	11,529	1.32	Howard, et al, 1991, page 328
Pentachlorophenol	552	4,272	1,104	36,480	588	6,363	22,664	2.59	Howard, et al, 1991, page 242
Pyridine	24	168	48	336	26	179	410	0.05	Howard, et al, 1991, page 424
Tetrachloroethylene	4,320	8,640	8,640	17,280	4,600	9,201	21,068	2.40	Howard, et al, 1991, page 502
Toxaphene	122,640	122,640	1,008	1,008	114,743	114,743	191,957	21.91	EPA, 2006
Trichloroethylene	4,320	8,640	7,704	39,672	4,540	10,655	30,884	3.53	Howard, et al, 1991, page 190
2,4,5-Trichlorophenol	552	16,560	1,104	43,690	588	18,321	45,014	5.14	Howard, et al, 1991, page 306
2,4,6-Trichlorophenol	168	1,680	336	43,690	179	4,407	21,777	2.49	Howard, et al, 1991, page 244
2,4,5-TP (Silvex)	192	2,928	192	2,928	192	2,928	5,856	0.67	WHO/SDE/WSH/03.04/44
Vinyl chloride	672	4,320	1,344	69,000	716	8,519	36,996	4.22	Howard, et al, 1991, page 138

III. 0.286 cm/yr Side Slope Half Lives

Compound	Vadose Zone Soil $t_{1/2}$ Literature Low hours	Vadose Zone Soil $t_{1/2}$ Literature High hours	Aquifer $t_{1/2}$ Literature Low hours	Aquifer $t_{1/2}$ Literature High hours	Weighted $t_{1/2}$ Low Hours	Weighted $t_{1/2}$ High hours	Modeled $t_{1/2}$ Hours	Modeled $t_{1/2}$ Years	Literature Source
Benzene	120	384	240	17,280	128	1,516	8,175	0.93	Howard, et al, 1991, page 111
Carbon tetrachloride	4,320	8,640	168	8,640	4,042	8,640	17,280	1.97	Howard, et al, 1991, page 34
Chlordane	5,712	33,264	11,424	66,528	6,095	35,493	81,111	9.26	Howard, et al, 1991, page 48
Chlorobenzene	1,632	3,600	3,264	7,200	1,741	3,841	8,778	1.00	Howard, et al, 1991, page 412
Chloroform	672	4,320	1,344	43,200	717	6,926	25,685	2.93	Howard, et al, 1991, page 99
o-Cresol	24	168	48	336	26	179	410	0.05	Howard, et al, 1991, page 294
m-Cresol	48	696	96	1,176	51	728	1,602	0.18	Howard, et al, 1991, page 402
p-Cresol	1	16	2	672	1	60	320	0.04	Howard, et al, 1991, page 366
Cresol	1	696	2	1,176	1	728	1,602	0.18	Howard, et al, 1991, page 641
2,4-D	24	168	48	336	26	179	410	0.05	Howard, et al, 1991, page 362
1,4-Dichlorobenzene	672	4,320	1,344	8,640	717	4,610	10,534	1.20	Howard, et al, 1991, page 368
1,2-Dichloroethane	2,400	4,320	2,400	8,640	2,400	4,610	10,534	1.20	Howard, et al, 1991, page 386
1,1-Dichloroethylene	672	4,320	1,344	3,168	717	4,243	8,135	0.93	Howard, et al, 1991, page 150
2,4-Dinitrotoluene	672	4,320	48	8,640	630	4,610	10,534	1.20	Howard, et al, 1991, page 474
Endrin	168	122,640	168	122,640	168	122,640	245,280	28.00	EPA, 2007
Heptachlor (and its epoxide)	23	129	23	129	23	129	259	0.03	Howard, et al, 1991, page 166
Hexachlorobenzene	23,256	50,136	46,512	100,272	24,815	53,496	122,252	13.96	Howard, et al, 1991, page 452
Hexachlorobutadiene	672	4,320	1,344	8,640	717	4,610	10,534	1.20	Howard, et al, 1991, page 240
Hexachloroethane	672	4,320	1,344	8,640	717	4,610	10,534	1.20	Howard, et al, 1991, page 101
Lindane	330	5,765	142	5,765	317	5,765	11,530	1.32	Howard, et al, 1991, page 52
Methoxychlor	4,320	8,760	1,200	8,760	4,111	8,760	17,520	2.00	Howard, et al, 1991, page 115
Methyl ethyl ketone	24	168	48	336	26	179	410	0.05	Howard, et al, 1991, page 186
Nitrobenzene	322	4,728	48	9,456	304	5,045	11,529	1.32	Howard, et al, 1991, page 328
Pentachlorophenol	552	4,272	1,104	36,480	589	6,431	22,664	2.59	Howard, et al, 1991, page 242
Pyridine	24	168	48	336	26	179	410	0.05	Howard, et al, 1991, page 424
Tetrachloroethylene	4,320	8,640	8,640	17,280	4,610	9,219	21,068	2.40	Howard, et al, 1991, page 502
Toxaphene	122,640	122,640	1,008	1,008	114,488	114,488	191,957	21.91	EPA, 2006
Trichloroethylene	4,320	8,640	7,704	39,672	4,547	10,720	30,884	3.53	Howard, et al, 1991, page 190
2,4,5-Trichlorophenol	552	16,560	1,104	43,690	589	18,378	45,014	5.14	Howard, et al, 1991, page 306
2,4,6-Trichlorophenol	168	1,680	336	43,690	179	4,496	21,777	2.49	Howard, et al, 1991, page 244
2,4,5-TP (Silvex)	192	2,928	192	2,928	192	2,928	5,856	0.67	WHO/SDE/WSH/03.04/44
Vinyl chloride	672	4,320	1,344	69,000	717	8,655	36,996	4.22	Howard, et al, 1991, page 138

IV. 0.595 cm/yr Side Slope Half Lives

Compound	Vadose Zone Soil $t_{1/2}$		Aquifer $t_{1/2}$		Weighted $t_{1/2}$		Modeled $t_{1/2}$		Literature Source
	Literature Low hours	Literature High hours	Literature Low hours	Literature High hours	Low Hours	High hours	Hours	Years	
Benzene	120	384	240	17,280	135	2,522	8,175	0.93	Howard, et al, 1991, page 111
Carbon tetrachloride	4,320	8,640	168	8,640	3,795	8,640	17,280	1.97	Howard, et al, 1991, page 34
Chlordane	5,712	33,264	11,424	66,528	6,435	37,473	81,111	9.26	Howard, et al, 1991, page 48
Chlorobenzene	1,632	3,600	3,264	7,200	1,839	4,056	8,778	1.00	Howard, et al, 1991, page 412
Chloroform	672	4,320	1,344	43,200	757	9,240	25,685	2.93	Howard, et al, 1991, page 99
o-Cresol	24	168	48	336	27	189	410	0.05	Howard, et al, 1991, page 294
m-Cresol	48	696	96	1,176	54	757	1,602	0.18	Howard, et al, 1991, page 402
p-Cresol	1	16	2	672	1	99	320	0.04	Howard, et al, 1991, page 366
Cresol	1	696	2	1,176	1	757	1,602	0.18	Howard, et al, 1991, page 641
2,4-D	24	168	48	336	27	189	410	0.05	Howard, et al, 1991, page 362
1,4-Dichlorobenzene	672	4,320	1,344	8,640	757	4,867	10,534	1.20	Howard, et al, 1991, page 368
1,2-Dichloroethane	2,400	4,320	2,400	8,640	2,400	4,867	10,534	1.20	Howard, et al, 1991, page 386
1,1-Dichloroethylene	672	4,320	1,344	3,168	757	4,174	8,135	0.93	Howard, et al, 1991, page 150
2,4-Dinitrotoluene	672	4,320	48	8,640	593	4,867	10,534	1.20	Howard, et al, 1991, page 474
Endrin	168	122,640	168	122,640	168	122,640	245,280	28.00	EPA, 2007
Heptachlor (and its epoxide)	23	129	23	129	23	129	259	0.03	Howard, et al, 1991, page 166
Hexachlorobenzene	23,256	50,136	46,512	100,272	26,199	56,480	122,252	13.96	Howard, et al, 1991, page 452
Hexachlorobutadiene	672	4,320	1,344	8,640	757	4,867	10,534	1.20	Howard, et al, 1991, page 240
Hexachloroethane	672	4,320	1,344	8,640	757	4,867	10,534	1.20	Howard, et al, 1991, page 101
Lindane	330	5,765	142	5,765	306	5,765	11,530	1.32	Howard, et al, 1991, page 52
Methoxychlor	4,320	8,760	1,200	8,760	3,925	8,760	17,520	2.00	Howard, et al, 1991, page 115
Methyl ethyl ketone	24	168	48	336	27	189	410	0.05	Howard, et al, 1991, page 186
Nitrobenzene	322	4,728	48	9,456	287	5,326	11,529	1.32	Howard, et al, 1991, page 328
Pentachlorophenol	552	4,272	1,104	36,480	622	8,347	22,664	2.59	Howard, et al, 1991, page 242
Pyridine	24	168	48	336	27	189	410	0.05	Howard, et al, 1991, page 424
Tetrachloroethylene	4,320	8,640	8,640	17,280	4,867	9,733	21,068	2.40	Howard, et al, 1991, page 502
Toxaphene	122,640	122,640	1,008	1,008	107,249	107,249	191,957	21.91	EPA, 2006
Trichloroethylene	4,320	8,640	7,704	39,672	4,748	12,567	30,884	3.53	Howard, et al, 1991, page 190
2,4,5-Trichlorophenol	552	16,560	1,104	43,690	622	19,993	45,014	5.14	Howard, et al, 1991, page 306
2,4,6-Trichlorophenol	168	1,680	336	43,690	189	6,996	21,777	2.49	Howard, et al, 1991, page 244
2,4,5-TP (Silvex)	192	2,928	192	2,928	192	2,928	5,856	0.67	WHO/SDE/WSH/03.04/44
Vinyl chloride	672	4,320	1,344	69,000	757	12,504	36,996	4.22	Howard, et al, 1991, page 138

5.3.6 Fractional Release Rate

The annual fractional release rate, or "leach rate", was calculated using the following equation (Kozak 1990):

$$L = \frac{q_{in}}{d\theta\left(1 + \frac{\rho K_d}{\theta}\right)}$$

where L = fractional annual contaminant release rate (yr^{-1})

q_{in} = water infiltration rate (m/yr)

θ = volumetric moisture content of waste

d = waste layer thickness (meters)

ρ = waste density (g/cm^3)

K_d = waste distribution coefficient (ml/g)

This method of determining the leachate concentration is environmentally-conservative for several reasons. First, PATHRAE assumes that the release rate is constant throughout time. The constituent is leached from the waste at a constant rate, until the initial source concentration is totally mobilized. In reality, the leach rate will decrease as the source concentration decreases. Second, the use of K_d to determine contaminant release rates assumes that all of the constituent is adsorbed and will eventually be completely desorbed (or leached out) by percolating water. In reality, some of the constituent may occur in the refractory phase, which would render it less mobile. Last, the Class A South cell modeling used the lowest literature K_d values, for constituents without site-specific K_ds.

The annual fractional release rates from the waste (vertical simulation) were calculated based on the infiltration rate (q_{in}) from the HELP modeling and the moisture content (θ) from the UNSAT-H modeling. The annual fractional release rates for each nuclide, for the top slope and two side slope infiltration rates, are shown in Table 22 through Table 24.

5.3.7 Container Life

The container life was set to zero, in both the horizontal and vertical PATHRAE modeling. The Class A South Cell modeling disregards the time required for the water to percolate through the cover, and assumes that the clay cover is immediately degraded and that water moves through the cover instantaneously.

In reality, a significant delay will occur for the time required to wet the cover and the waste, to degrade the radon barrier, and for moisture to travel through the cell cover, waste, and liner. Although the initial waste moisture contents cannot be known with certainty due to the inherent variability in the waste and in climatic conditions while the cell is open, previous open-cell modeling suggests that drying of the waste may occur and that the moisture content in the waste at the time of cell closure may be well below the levels assumed at the start of the closed cell modeling.

The Class A South cell model disregards the time required for the water to percolate through the cover and assumes that water moves through the cover instantaneously.

5.3.8 Decay Chain Computation

The natural uranium decay chain (U-238→Th-230→U-234) and the plutonium-241 decay chain (Pu-241→Am-241→Np-237) were calculated by the model. PATHRAE has the ability to model five other decay chains, but these were not modeled.

The simulation of decay chains for Pu-241→ Am-241→ Np-237 and U-238→ Th-230→ Ra-226 require that all decay chain isotopes be contained in a single model run. The vertical model run with decay contained a total of 65 isotopes. The remaining 35 isotopes were modeled in a separate run, which did not invoke the decay chain option. Also, because the decay chain calculations require each isotope in the decay chain to have a different retardation, the Ra-226 K_d was changed from 10.0 to 9.99 in the vertical PathRAE input files.

5.4 Vertical Input Parameters for Flow and Transport

5.4.1 Infiltration

The infiltration rate through the Class A South cell was determined from the HELP3 modeling described in Section 3.4 above. Three infiltration rates were used to evaluate transport. The 0.276 cm/yr infiltration rate was used to evaluate transport from the top slope, while the 0.286 and 0.595 cm/yr infiltration rates were used to evaluate transport from the side slope (Table 32).

Table 32. Infiltration Rates Input to PATHRAE Model

MODEL CASE	INFILTRATION RATE
Top Slope	0.276 cm/yr
Side Slope – 18" Type-B Filter	0.286 cm/yr
Side Slope – 12" Type-B Filter	0.595 cm/yr

5.4.2 Single Homogeneous Medium

PATHRAE is limited to solving the contaminant transport equation in one homogeneous medium for the vertical zone and one for the horizontal zone. In reality, particles migrating out of the landfill cell along the vertical pathway may travel through the waste, the bottom clay liner, the Unit 3 sand, and potentially the Unit 2 clay, all of which have differing hydraulic properties.

For the vertical pathway, the characteristics of individual units were converted to a single equivalent porous medium based on the thickness-weighted averages for moisture content, density, and porosity of the individual units. The equivalent moisture content and soil moisture velocity were calculated using the infiltration rate from the HELP modeling and UNSAT-H modeling. This approach is identical to that used in previous modeling for the Envirocare LARW, 11e.(2), Class A, and Mixed Waste cells. The characteristics of the equivalent porous media for the top slope are given in Table 33. The characteristics of the equivalent porous media for the side slope are given in Table 34 and Table 35.

Table 33. Calculation of Equivalent Porous Media Properties based on Class A South Cell Top Slope Design (0.276 cm/year Infiltration)

Layer	Material Type	Soil Bulk Density (g/cm^3)	Layer Thickness (cm)	Volumetric Water Content	Infiltration (cm/day)	Vadose Velocity (cm/yr)	Vadose Velocity (m/yr)	Saturated Hydraulic Conductivity (cm/sec)	Saturated Hydraulic Conductivity (m/yr)
0	Waste	1.8	50	0.059	0.00076	4.72	0.047	5.00E-04	157.7
1	Clay Liner	1.35	61	0.419	0.00076	0.66	0.007	1.00E-06	0.315
2	Unit 3 Sand	1.6	303	0.047	0.00076	5.90	0.059	3.71E-04	117.0
1+2	Weighted average	1.558		0.109		2.529	0.025	3.09E-04	97.4

Notes: Waste thickness is based on midpoint of unit (1 m^3) block of waste above liner.
Volumetric water content from UNSAT-H model run CAS-T27e
Infiltration from HELP model, Class A South top slope run 11c2-T6
Vadose velocity = Infiltration/effective porosity
Vadose velocity for Clay+Unit 3 = (infiltration) / (weighted average effective porosity)

Table 34. Calculation of Equivalent Porous Media Properties based on Class A South Cell Side Slope Design (0.286 cm/year Infiltration)

Layer	Material Type	Soil Bulk Density (gm/cm^3)	Layer Thickness (cm)	Volumetric Water Content	Infiltration (cm/day)	Vadose Velocity (cm/yr)	Vadose Velocity (m/yr)	Saturated Hydraulic Conductivity (cm/sec)	Saturated Hydraulic Conductivity (m/yr)
0	Waste	1.8	50	0.059	0.00078	4.85	0.049	5.00E-04	157.7
1	Clay Liner	1.35	61	0.419	0.00078	0.68	0.007	1.00E-06	0.315
2	Unit 3 Sand	1.6	303	0.047	0.00078	6.10	0.061	3.71E-04	117.0
1+2	Weighted average	1.558		0.109		2.617	0.026	3.09E-04	97.4

Notes: Waste thickness is based on midpoint of unit (1 m^3) block of waste above liner.
Volumetric water content from UNSAT-H model run CAS-S28c
Infiltration from HELP model, Class A South cell side slope run 11e2S28d
Vadose velocity = Infiltration/effective porosity
Vadose velocity for Clay+Unit 3 = (infiltration) / (weighted average effective porosity)

Table 35. Calculation of Equivalent Porous Media Properties based on Class A South Cell Side Slope Design (0.595 cm/year Infiltration)

Layer	Material Type	Soil Bulk Density (gm/cm^3)	Layer Thickness (cm)	Volumetric Water Content	Infiltration (cm/day)	Vadose Velocity (cm/yr)	Vadose Velocity (m/yr)	Saturated Hydraulic Conductivity (cm/sec)	Saturated Hydraulic Conductivity (m/yr)
0	Waste	1.8	50	0.066	0.0016	9.02	0.090	5.00E-04	157.7
1	Clay Liner	1.35	61	0.421	0.0016	1.41	0.014	1.00E-06	0.315
2	Unit 3 Sand	1.6	303	0.051	0.0016	11.74	0.117	3.71E-04	117.0
1+2	Weighted average	1.558		0.113		5.277	0.053	3.09E-04	97.4

Notes: Waste thickness is based on midpoint of unit (1 m^3) block of waste above liner.
Volumetric water content from UNSAT-H model run CAS-59c
Infiltration from HELP model, Class A South cell side slope run 11e2S59c
Vadose velocity = Infiltration/effective porosity
Vadose velocity for Clay+Unit 3 = (infiltration) / (weighted average effective porosity)

5.4.3 Aquifer Velocity

The aquifer velocity in the vertical model was calculated according to the equation for average linear velocity in the vadose zone (Stephens, 1996):

$$v = q / \theta_e$$

where v = average linear velocity (L/T)
q = infiltration rate (L/T)
θ_e = effective water content that participates in carrying the flow (L^3/L^3)

In this equation, the infiltration rate (q) was determined using the HELP3 model. The moisture content (θ) was determined using the UNSAT-H model for each vadose zone material. For example, the UNSAT-H model used a hydraulic conductivity of 6.04×10^{-4} cm/sec for the Unit 3 sand (as described in Section 4.2), to determine the moisture content on which the vadose zone velocity is based.

The moisture content (θ_e) of the layered vertical profile was calculated as a thickness-weighted average of the clay liner and Unit 3 sand (the equivalent porous media for the materials underlying the Class A South waste materials.) The vadose zone velocities calculated for the equivalent porous media (liner and silty sand) underlying the top slope and two side slope simulations are 0.025, 0.026 and 0.053 m/yr, as shown in Table 33 through Table 35.

5.4.4 Vertical Transport Distance

The vertical pathway represents the distance from the bottom of the waste to the aquifer, including the 2-foot thick clay liner and excluding the capillary fringe. The distance from the bottom of the waste to the top of the aquifer is 13.1 feet, based on the cell design and the measured water levels in four quarters of 1998. Using the measured elevations adjusted for freshwater head (Table 13), and the capillary fringe height predicted by the UNSAT-H modeling (Section 4.3.2), the adjusted distance was calculated as follows:

$$\text{Adjusted Distance} = H_{clay} - H_{aq} - cf$$

$$\text{Adjusted Distance} = 4264.4 - 4251.3 - 1.17 = 11.93 \text{ feet}$$

where H_{clay} = Avg. elevation of the top of the clay (4264.7, based on engineering drawing 07021 V3)
H_{aq} = Elevation of the top of the aquifer (4251.3, see Table 13)
cf = Capillary fringe (1.17 feet, from UNSAT-H modeling)

The PATHRAE model requires distances in meters. The 11.93 feet was converted to 3.64 meters, for the vertical transport distance.

5.4.5 Dispersivity

Dispersivity is an empirical index of the magnitude of variations of the pore velocities in the soil. Dispersivity in the vadose zone tends to be lower than that in the saturated zone. The dispersivity was calculated as 10% of the distance along the vertical pathway. A dispersivity of 10% (equivalent to 0.1 meters) has been used in previous modeling at the site. The actual distance was calculated based on the vertical distance less the capillary fringe, to be determined after the UNSAT-H modeling is complete.

5.4.6 River Flow Rate

The river flow rate in the vertical model was set equal to the infiltration rate, in order to prevent any dilution of concentrations. The river flow rate was set to 0.00276, 0.00286, and 0.00595 for the top slope and two side slope PATHRAE simulations.

5.5 Vertical Transport Model Results

5.5.1 Vertical Top Slope Analysis (0.276 cm/yr)

Eleven of the 100 nuclides[5] modeled exceeded the GWPLs at the water table in less than 500 years, as shown in Table 36, based on the top slope cover design infiltration rate of 0.276 cm/yr (0.109 in/yr) and

[5] 93 real nuclides and 7 synthetic surrogate nuclides

limited starting concentrations for four nuclides. A listing of peak concentrations for all nuclides modeled along with the year in which the GWPLs were exceeded at the water table are provided in Table 37. A complete listing of output times and concentrations for all nuclides that arrived at the water table is provided in Table 38. In all tables, the "Year To Exceed" is conservatively reported as the next *lowest* model output time. None of the surrogate nuclides exceeded a benchmark standard of 1 pCi/L.

Table 36. Summary of Peak Concentrations and Exceedences at the Water Table, PATHRAE Vertical Model Results for Top Slope 0.276 cm/yr Case

Nuclide	Time To Exceed (Year)	Peak Concentration (Ci/m^3)	Peak Concentration (pCi/L)	Peak Year
Sr-90	100	2.12E-04	2.12E+05	230.9
H-3	115	7.54E-04	7.54E+05	174.4
Bk-247	145	6.62E-10	6.62E-01	167.1
Cl-36	155	2.04E-06	2.04E+03	171.5
I-129	155	1.32E-02	1.32E+07	471.5
K-40	160	1.60E+01	1.60E+10	547.5
Tc-99	160	5.25E-01	5.25E+08	445.8
Re-187	185	6.23E-02	6.23E+07	356.3
Si-32	210	1.50E+06	1.50E+15	905.4
Ca-41	215	8.71E-06	8.71E+03	292.4
Pd-107	470	4.07E+02	4.07E+11	1569.6

Most of the nuclides did not exceed GWPLs at the water table, due to a high K_d value, low starting concentration, or short half-life. Radionuclides having the same K_d value arrive at the water table and peak at the time (e.g., Bk-247 and Cl-36 in Figure 11) although the peak concentrations may differ.

The time and concentration curves show generally smooth concentration curves, with dispersion evident by the leading and trailing edges of the concentration curves (Figure 11, Figure 12). A smooth curve is desirable, for defining the discrete source for input to the horizontal modeling. Although most of the radionuclides that exceed GWPLs at the water table within 500 years also peak within 500 years (Figure 11), constituents such as K-40 and Si-32 peak later than 500 years (Figure 12).

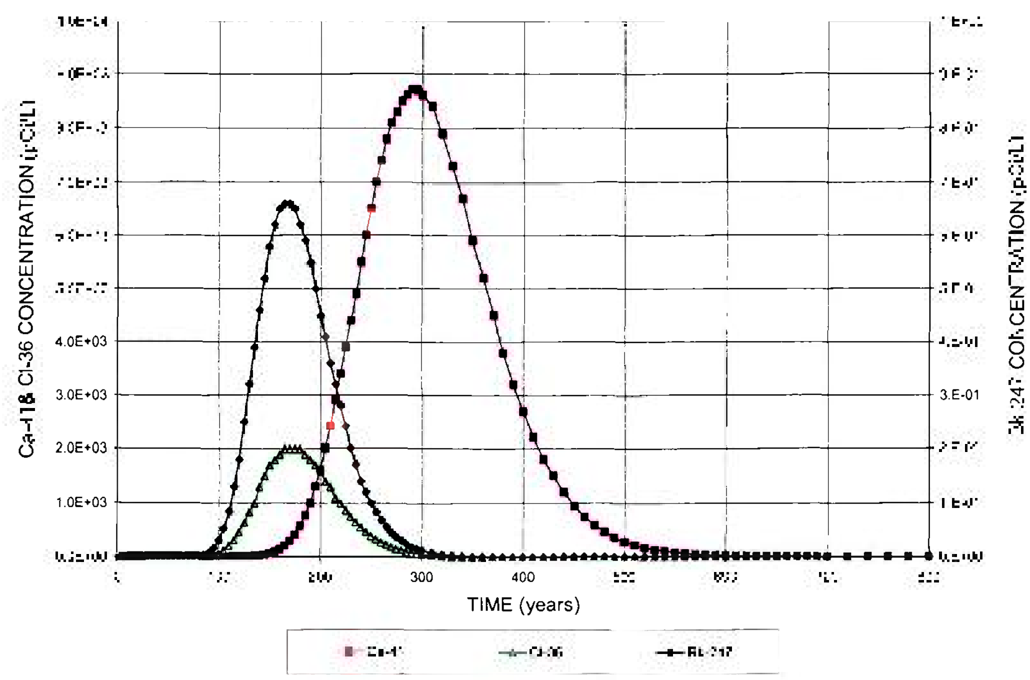


Figure 11. Ca-41, Cl-36, and Bk-247: Example Constituents whose Concentrations (pCi/L) Peak Within 500 Years and Exceed GWPLs at the Water Table, Vertical PATHRAE Model Output Based on 0.276 cm/year Infiltration

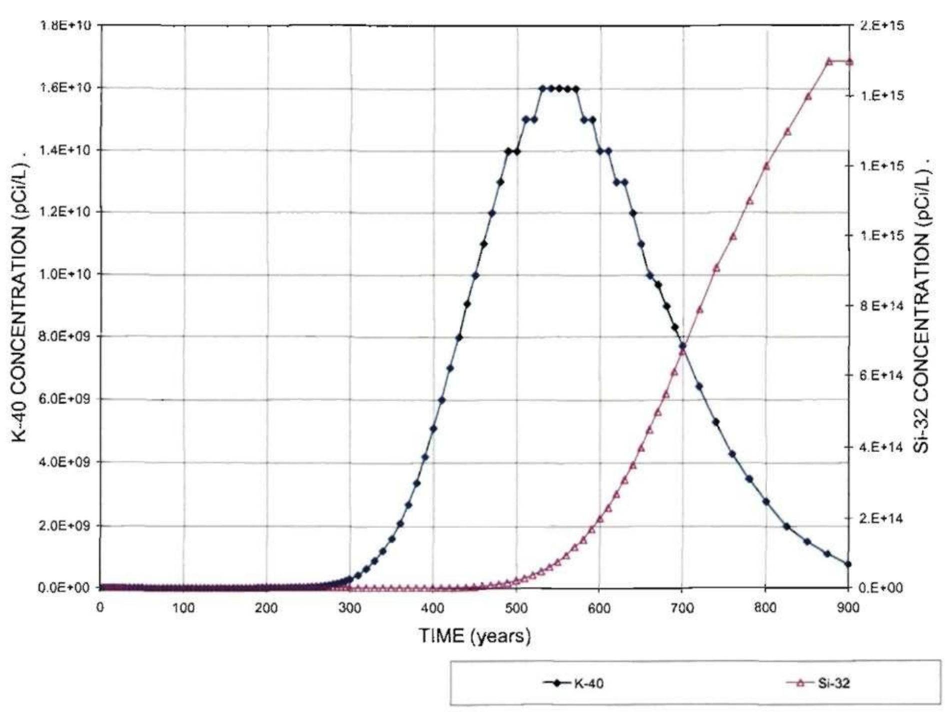


Figure 12. K-40 and Si-32: Constituents whose Concentrations Peak after 500 Years and Exceed GWPLs at the Water Table within 500 Years, Vertical PATHRAE Model Output Based on 0.276 cm/year Infiltration

Table 37. Peak Radionuclide Concentrations and Time to Exceed GWPL at the Water Table, Vertical PATHRAE Results for Class A South Cell Top Slope (0.276 cm/year Infiltration)

(See large tables at end of report document.)

Table 38. Radionuclide Concentrations (pCi/L) at the Water Table, Vertical PATHRAE Model Results for the Class A South Top Slope (0.276 cm/year Infiltration)

(See large tables at end of report document.)

A total of 20 nuclides were carried through to the horizontal PATHRAE modeling. This included the 11 nuclides that exceeded GWPLs at the water table in the 0.276 cm/yr top slope model, and an additional 9 nuclides that were carried through to the horizontal PATHRAE modeling for consistency with the 0.286 cm/yr side slope simulation.

5.5.2 Vertical Side Slope Analysis (0.286 cm/yr)

Eleven of the 100 nuclides and surrogates modeled exceeded the GWPLs at the water table in less than 500 years, as shown in Table 39, based on the side slope cover design infiltration rate of 0.286 cm/yr (0.113 in/yr) and limited starting concentrations for five nuclides. A listing of peak concentrations for all nuclides modeled along with the year in which the GWPLs were exceeded at the water table are provided in Table 40. A complete listing of output times and concentrations for all nuclides that arrived at the water table is provided in Table 41. In all tables, the "Year To Exceed" is conservatively reported as the next *lowest* model output time. None of the surrogate nuclides exceeded a benchmark standard of 1 pCi/L.

Table 39. Summary of Peak Concentrations and Exceedences at the Water Table, PATHRAE Vertical Model Results for Side Slope 0.286 cm/yr Case

Nuclide	Time To Exceed (Year)	Peak Concentration (Ci/m^3)	Peak Concentration (pCi/L)	Peak Year
Sr-90	100	2.63E-04	2.63E+05	223.5
H-3	110	1.10E-03	1.10E+06	169.7
Bk-247	145	6.14E-10	6.14E-01	160.7
I-129	150	1.33E-02	1.33E+07	453.4
Cl-36	155	1.93E-06	1.93E+03	164.9
K-40	155	1.60E+01	1.60E+10	526.5
Tc-99	160	2.18E-01	2.18E+08	428.7
Re-187	195	1.95E-02	1.95E+07	342.7
Si-32	200	1.73E+06	1.73E+15	875.2
Ca-41	220	6.48E-06	6.48E+03	281.5
Pd-107	450	4.08E+02	4.08E+11	1509.5

Most of the nuclides modeled did not exceed GWPLs at the water table due to a high K_d value, low starting concentration, or short half-life. Bi-207, for example, remains well below standards and is predicted to peak at the water table after the 500 years (Figure 13).

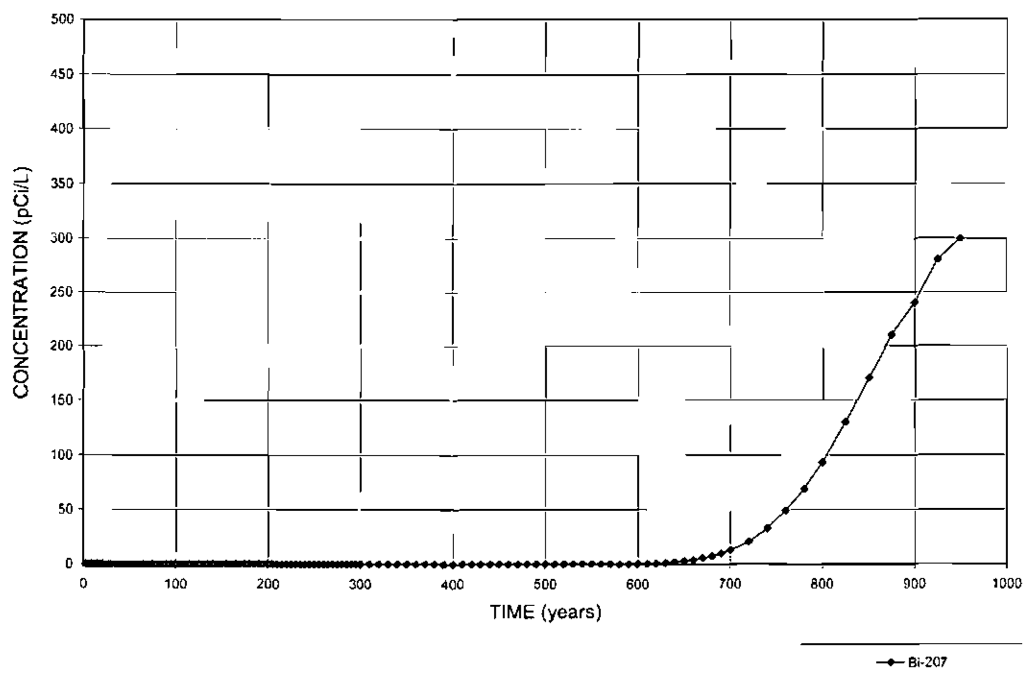


Figure 13. Bi-207: Example Constituent whose Concentrations Peak after 500 Years and Do Not Exceed GWPLs at the Water Table, Vertical PATHRAE Model Output Based on 0.286 cm/year Infiltration

Table 40. Peak Radionuclide Concentrations and Time to Exceed GWPL at the Water Table, Vertical PATHRAE Results for Class A South Cell Side Slope (0.286 cm/year Infiltration)

(See large tables at end of report document.)

Table 41. Radionuclide Concentrations (pCi/L) at the Water Table, Vertical PATHRAE Model Results for the Class A South Side Slope (0.286 cm/year Infiltration)

(See large tables at end of report document.)

A total of 20 nuclides were carried through to the horizontal PATHRAE modeling. This included the 11 nuclides which exceeded GWPLs at the water table in the 0.286 cm/yr side slope model, plus an additional 9 nuclides.

5.5.3 Vertical Side Slope Analysis (0.595 cm/yr)

Twenty of the 100 nuclides[6] modeled exceeded the GWPLs at the water table in less than 500 years, as shown in Table 42, based on the side slope cover design infiltration rate of 0.595 cm/yr (0.234 in/yr) and

[6] 93 real nuclides and 7 synthetic surrogate nuclides

limited starting concentrations for eight nuclides. A listing of peak concentrations for all nuclides modeled along with the year in which the GWPLs were exceeded at the water table are provided in Table 43. A complete listing of output times and concentrations for all nuclides that arrived at the water table is provided in Table 44. In all tables, the "Year To Exceed" is conservatively reported as the next *lowest* model output time. None of the surrogate nuclides exceeded a benchmark standard of 1 pCi/L.

Table 42. Summary of Peak Concentrations and Exceedences at the Water Table, PATHRAE Vertical Model Results for Side Slope 0.595 cm/yr Case

Nuclide	Time To Exceed (Year)	Peak Concentration (Ci/m^3)	Peak Concentration (pCi/L)	Peak Year
H-3	45	2.30E-01	2.30E+08	98.5
Sr-90	60	1.54E-05	1.54E+04	120.8
Bk-247	70	6.28E-10	6.28E-01	79.5
Cl-36	75	1.90E-06	1.90E+03	81.4
Si-32	95	1.18E+07	1.18E+16	449.9
Ca-41	110	5.61E-06	5.61E+03	136.6
K-40	125	1.03E-04	1.03E+05	253.1
I-129	140	1.77E-07	1.77E+02	218.0
Tc-99	155	8.19E-06	8.19E+03	206.6
Pd-107	215	4.12E+02	4.12E+11	719.3
Pt-193	275	9.71E+01	9.71E+10	708.3
Se-79	280	3.20E+04	3.20E+13	1,241.3
Bi-207	290	1.75E-01	1.75E+08	640.6
Bi-210m	300	2.65E+02	2.65E+11	1,243.3
Cd-113m	330	3.39E-07	3.39E+02	460.7
Fe-60	380	1.35E+03	1.35E+12	1,708.2
Am-241	390	4.08E-03	4.08E+06	1,255.0
Am-242m	410	1.98E-05	1.98E+04	999.8
Am-243	410	4.16E-03	4.16E+06	1,237.4
Nb-91	410	2.58E+05	2.58E+14	1,796.7

Eighty of the modeled nuclides did not exceed GWPLs at the water table, due to a high K_d value, low starting concentration, or short half-life. Examples of radionuclides that peaked within 500 years and exceeded GWPLs at the water table are shown in Figure 14. The starting concentration of Re-187 was limited so as not to exceed the GWPL (Figure 15).

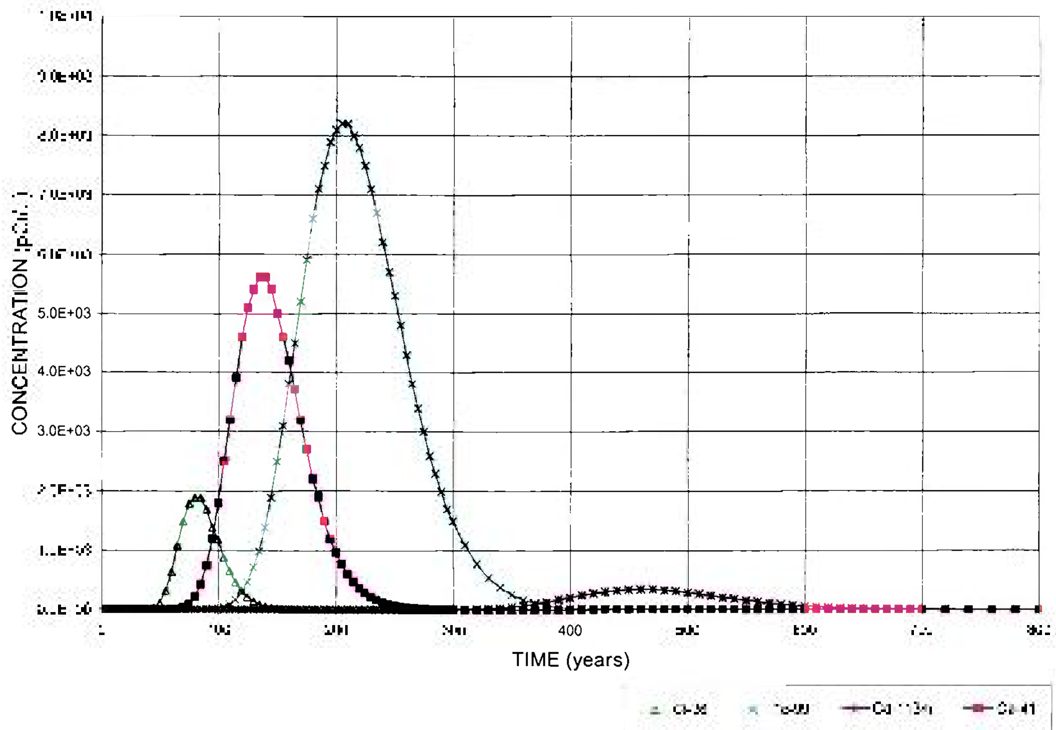


Figure 14. Cl-36, Tc-99, Cd-113m, and Ca-41: Constituents whose Concentrations (pCi/L) Peak Within 500 Years and Exceed GWPLs at the Water Table, Vertical PATHRAE Model Output Based on 0.595 cm/year Infiltration

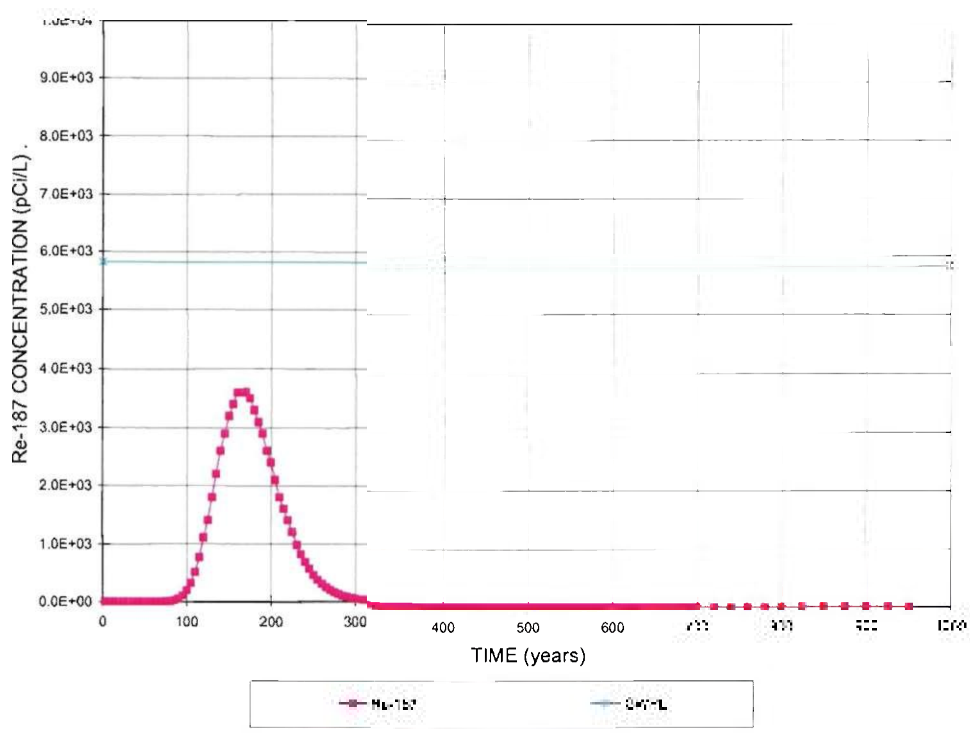


Figure 15. Re-187: Constituent whose Limited Concentration Peaked Within 500 Years but did not Exceed GWPLs at the Water Table, Vertical PATHRAE Model Output Based on 0.595 cm/year Infiltration

Table 43. Peak Radionuclide Concentrations and Time to Exceed GWPL at the Water Table, Vertical PATHRAE Results for Class A South Cell Side Slope (0.595 cm/year Infiltration)

(See large tables at end of report document.)

Table 44. Radionuclide Concentrations (pCi/L) at the Water Table, Vertical PATHRAE Model Results for the Class A South Side Slope (0.595 cm/year Infiltration)

(See large tables at end of report document.)

A total of 21 nuclides were carried through to the horizontal PATHRAE modeling. This included the 20 nuclides that exceeded GWPLs at the water table within 500 years in the 0.595 cm/yr side slope model (vertical PathRAE runs 59La and 59Lb) plus one additional radionuclide (Re-187) for which limiting concentrations were calculated.

5.5.4 Vertical Analysis for Metals and Formerly Characteristic Waste

Vertical PATHRAE modeling for metals and Formerly Characteristic (D Code) wastes was performed for the top slope and both the 0.286 cm/yr and 0.595 cm/yr side slope cases.

The top slope vertical model results indicate that none of the 32 organic constituents modeled would exceed GWPLs at the water table within 1000 years, based on the top slope cover design infiltration rate of 0.276 cm/yr (0.109 in/yr). None of the 13 metals exceed GWPLs at the water table within 750 years. Thirty of the 45 compounds modeled did not arrive at the water table within the 1,000 years modeled. Concentrations of the 15 constituents that arrived at the water table peaked in 83 to 7,058 years (Table 45). A complete listing of output times and concentrations for all nuclides that arrived at the water table is provided in Table 46. In all tables, the "Year To Exceed" is conservatively reported as the next *lowest* model output time.

Table 45. Peak Concentrations and Time to Exceed GWPL at the Water Table, 0.276 cm/yr Top Slope Vertical PATHRAE Model Results for Metals and Formerly Characteristic Waste

SYMBOL	COMPOUND	TIME TO EXCEED (Year)	PEAK CONCENTRATION (Kg/m^3)	PEAK CONCENTRATION (mg/L)	PEAK YEAR
Benz	Benzene	-1	---		
Ctet	Carbon tetrachloride	-1	2.35E-19	2.35E-10	78
Clr	Chlordane	-1	0		> 10,000
ChlB	Chlorobenzene	-1	---		
CF	Chloroform	-1	3.96E-13	0.000396	83
oCrs	o-Cresol	-1	---		
mCrs	m-Cresol	-1	---		
pCrs	p-Cresol	-1	---		
Crs	Cresol	-1	---		
24D	2,4-D	-1	---		
14DCB	1,4-Dichlorobenzene	-1	---		
DCA	1,2-Dichloroethane	-1	---		
DCE	1,1-Dichloroethylene	-1	---		
DNT	2,4-Dinitrotoluene	-1	---		
End	Endrin	-1	---		
Hep	Heptachlor (and its epoxide)	-1	---		
HxCB	Hexachlorobenzene	-1	0		> 10,000
HxCBd	Hexachlorobutadiene	-1	0		> 10,000
HxCh	Hexachloroethane	-1	---		
Lind	Lindane	-1	---		
Mox	Methoxychlor	-1	0		> 10,000
MEK	Methyl ethyl ketone	-1	---		
Nbenz	Nitrobenzene	-1	---		
PCP	Pentachlorophenol	-1	---		
Pyr	Pyridine	-1	---		
TetCE	Tetrachloroethylene	-1	1.81E-19	1.81E-10	95
Tox	Toxaphene	-1	0		> 10,000
TCE	Trichloroethylene	-1	2.06E-12	0.00206	95
245T	2,4,5-Trichlorophenol	-1	2.16E-12	0.00216	136
246T	2,4,6-Trichlorophenol	-1	2.74E-16	0.000000274	85
Silvx	2,4,5-TP (Silvex)	-1	---		
VC	Vinyl chloride	-1	1.09E-09	1.09	92
As	Arsenic	800	461	4.61E+11	2,718
Ba	Barium	-1	0		> 10,000
Be	Beryllium	-1	191	1.91E+11	6,548
Cd	Cadmium	760	461	4.61E+11	2,718
Cr	Chromium	825	461	4.61E+11	2,718
Cu	Copper	900	461	4.61E+11	2,718
Pb	Lead	-1	0		> 10,000
Hg	Mercury	-1	0		> 10,000
Mo	Molybdenum	800	461	4.61E+11	2,718
Ni	Nickel	-1	0		> 10,000
Se	Selenium	800	461	4.61E+11	2,718
Ag	Silver	-1	177	1.77E+11	7,058
Zn	Zinc	-1	0		> 10,000

NOTES: -1 indicates that compound did not exceed standard within the 1,000 years modeled
--- indicates that concentrations do not peak at the water table within 10,000 yrs

The time and concentration results from the vertical modeling (Figure 16) show generally smooth concentration curves, with dispersion evident by the leading and trailing edges of the concentration curves.

Table 46. Concentrations (mg/L) at the Water Table, 0.276 cm/yr Top Slope Vertical PATHRAE Model Results for Metals and Formerly Characteristic Waste

(See large tables at end of report document.)

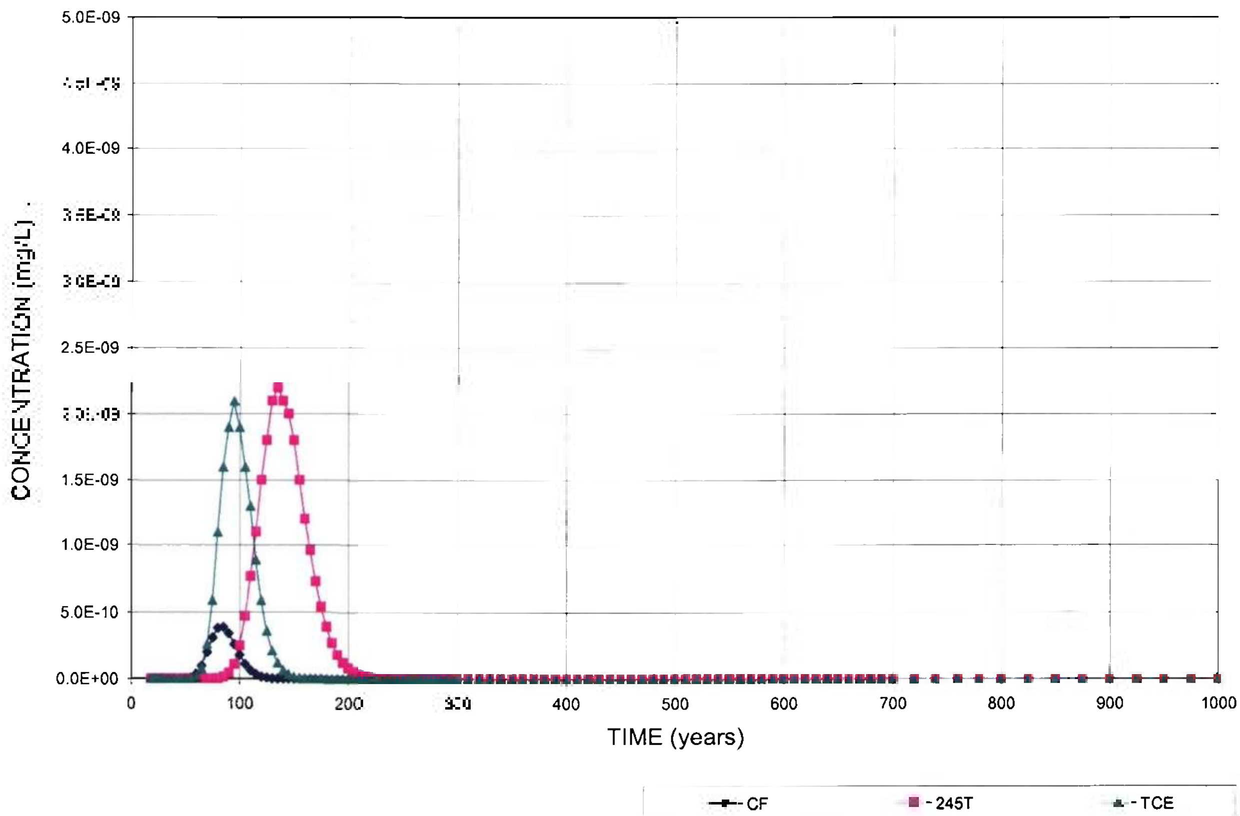


Figure 16. Output Concentrations (mg/L) for Selected Formerly Characteristic Waste Compounds at the Water Table, Vertical PATHRAE Model Output Based on Top Slope (0.276 cm/year Infiltration)

The 0.286 cm/yr side slope vertical model results indicate that none of the 32 organic constituents modeled would exceed GWPLs at the water table within 1000 years and none of the 13 metals would exceed GWPLs at the water table within 700 years. Twenty nine of the 45 compounds modeled did not arrive at the water table within the 1,000 years modeled. Concentrations of the 16 constituents that arrived at the water table peaked in 77 to 6,788 years (Table 47). A complete listing of output times and concentrations for all nuclides that arrived at the water table is provided in Table 48. In all tables, the "Year To Exceed" is conservatively reported as the next *lowest* model output time.

The 0.595 cm/yr side slope vertical model results indicate that none of the 32 organic constituents modeled would exceed GWPLs at the water table within 1000 years and none of the 13 metals would exceed GWPLs at the water table within 325 years. Twenty one of the 45 compounds modeled did not arrive at the water table within the 1,000 years modeled. Concentrations of the 24 constituents that arrived at the water table peaked in 33 to 3,224 years (Table 49). A complete listing of output times and concentrations for all nuclides is provided in Table 50. Example time and concentration curves for the 0.595 cm/yr side slope modeling are shown in Figure 17.

Table 47. Peak Concentrations and Time to Exceed GWPL at the Water Table, 0.286 cm/yr Side Slope Vertical PATHRAE Model Results for Metals and Formerly Characteristic Waste

SYMBOL	COMPOUND	TIME TO EXCEED (Year)	PEAK CONCENTRATION (Kg/m^3)	PEAK CONCENTRATION (mg/L)	PEAK YEAR
Benz	Benzene	-1	---		
Ctet	Carbon tetrachloride	-1	6.84E-19	6.84E-16	77
Clr	Chlordane	-1	0		> 10,000
ChlB	Chlorobenzene	-1	---		
CF	Chloroform	-1	8.49E-13	8.49E-10	81
oCrs	o-Cresol	-1	---		
mCrs	m-Cresol	-1	---		
pCrs	p-Cresol	-1	---		
Crs	Cresol	-1	---		
24D	2,4-D	-1	---		
14DCB	1,4-Dichlorobenzene	-1	---		
DCA	1,2-Dichloroethane	-1	---		
DCE	1,1-Dichloroethylene	-1	---		
DNT	2,4-Dinitrotoluene	-1	---		
End	Endrin	-1	---		
Hep	Heptachlor (and its epoxide)	-1	---		
HxCB	Hexachlorobenzene	-1	0		> 10,000
HxCBd	Hexachlorobutadiene	-1	0		> 10,000
HxCh	Hexachloroethane	-1	---		
Lind	Lindane	-1	---		
Mox	Methoxychlor	-1	0		> 10,000
MEK	Methyl ethyl ketone	-1	---		
Nbenz	Nitrobenzene	-1	---		
PCP	Pentachlorophenol	-1	---		
Pyr	Pyridine	-1	---		
TetCE	Tetrachloroethylene	-1	5.26E-19	5.26E-16	93
Tox	Toxaphene	-1	0		> 10,000
TCE	Trichloroethylene	-1	4.24E-12	4.24E-09	93
245T	2,4,5-Trichlorophenol	-1	4.4E-12	4.40E-09	133
246T	2,4,6-Trichlorophenol	-1	6.91E-16	6.91E-13	84
Silvx	2,4,5-TP (Silvex)	-1	---		
VC	Vinyl chloride	-1	1.95E-09	1.95E-06	89
As	Arsenic	780	4.62E+02	4.62E+05	2,614
Ba	Barium	-1	0		> 10,000
Be	Beryllium	-1	1.92E+02	1.92E+05	6,298
Cd	Cadmium	720	4.62E+02	4.62E+05	2,614
Cr	Chromium	800	4.62E+02	4.62E+05	2,614
Cu	Copper	875	4.62E+02	4.62E+05	2,614
Pb	Lead	-1	0		> 10,000
Hg	Mercury	-1	0		> 10,000
Mo	Molybdenum	780	4.62E+02	4.62E+05	2,614
Ni	Nickel	-1	0		> 10,000
Se	Selenium	780	4.62E+02	4.62E+05	2,614
Ag	Silver	-1	1.78E+02	1.78E+05	6,788
Zn	Zinc	-1	0		> 10,000

NOTES: -1 indicates that compound did not exceed standard within the 1,000 years modeled
--- indicates that concentrations do not peak at the water table within 10,000 yrs

Table 48. Concentrations (mg/L) at the Water Table, 0.286 cm/yr Side Slope Vertical PATHRAE Model Results for Metals and Formerly Characteristic Waste

(See large tables at end of report document.)

Table 49. Peak Concentrations and Time to Exceed GWPL at the Water Table, 0.595 cm/yr Side Slope Vertical PATHRAE Model Results for Metals and Formerly Characteristic Waste

SYMBOL	COMPOUND	TIME TO EXCEED (Year)	PEAK CONCENTRATION (Kg/m^3)	PEAK CONCENTRATION (mg/L)	PEAK YEAR
Benz	Benzene	-1	6.9E-17	6.9E-14	33
Ctet	Carbon tetrachloride	-1	5.69E-12	5.69E-09	51
Clr	Chlordane	-1	0		> 10,000
ChlB	Chlorobenzene	-1	6.1E-20	6.1E-17	41
CF	Chloroform	-1	5.68E-08	5.68E-05	52
oCrs	o-Cresol	-1	---		
mCrs	m-Cresol	-1	---		
pCrs	p-Cresol	-1	---		
Crs	Cresol	-1	---		
24D	2,4-D	-1	---		
14DCB	1,4-Dichlorobenzene	-1	---		
DCA	1,2-Dichloroethane	-1	4.33E-14	4.33E-11	36
DCE	1,1-Dichloroethylene	-1	2.71E-17	2.71E-14	34
DNT	2,4-Dinitrotoluene	-1	6.32E-14	6.32E-11	39
End	Endrin	-1	3.64E-18	3.64E-15	886
Hep	Heptachlor (and its epoxide)	-1	---		
HxCB	Hexachlorobenzene	-1	0		> 10,000
HxCBd	Hexachlorobutadiene	-1	0		> 10,000
HxCh	Hexachloroethane	-1	---		
Lind	Lindane	-1	3.82E-19	3.82E-16	47
Mox	Methoxychlor	-1	0		> 10,000
MEK	Methyl ethyl ketone	-1	---		
Nbenz	Nitrobenzene	-1	1.84E-14	1.84E-11	41
PCP	Pentachlorophenol	-1	4.99E-13	4.99E-10	71
Pyr	Pyridine	-1	---		
TetCE	Tetrachloroethylene	-1	4.76E-12	4.76E-09	62
Tox	Toxaphene	-1	0		> 10,000
TCE	Trichloroethylene	-1	1.58E-07	1.58E-04	59
245T	2,4,5-Trichlorophenol	-1	1.64E-07	1.64E-04	85
246T	2,4,6-Trichlorophenol	-1	5.87E-10	5.87E-07	55
Silvx	2,4,5-TP (Silvex)	-1	---		
VC	Vinyl chloride	-1	7.77E-06	7.77E-03	56
As	Arsenic	370	4.67E+02	4.67E+05	1,243
Ba	Barium	-1	0		> 10,000
Be	Beryllium	850	1.94E+02	1.94E+05	2,992
Cd	Cadmium	340	4.67E+02	4.67E+05	1,243
Cr	Chromium	380	4.67E+02	4.67E+05	1,243
Cu	Copper	420	4.67E+02	4.67E+05	1,243
Pb	Lead	-1	0		> 10,000
Hg	Mercury	-1	0		> 10,000
Mo	Molybdenum	370	4.67E+02	4.67E+05	1,243
Ni	Nickel	-1	0		> 10,000
Se	Selenium	370	4.67E+02	4.67E+05	1,243
Ag	Silver	-1	1.80E+02	1.80E+05	3,224
Zn	Zinc	-1	0		> 10,000

NOTES: -1 indicates that compound did not exceed standard within the 1,000 years modeled
--- indicates that concentrations do not peak at the water table within 10,000 yrs

Table 50. Concentrations (mg/L) at the Water Table, 0.595 cm/yr Side Slope Vertical PATHRAE Model Results for Metals and Formerly Characteristic Waste

(See large tables at end of report document.)

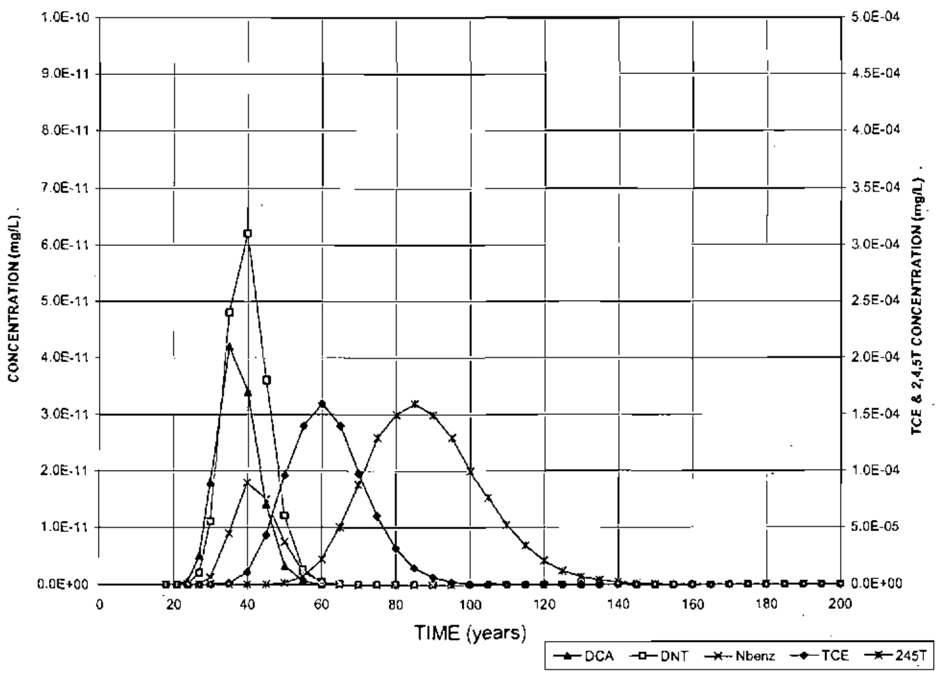


Figure 17. Output Concentrations (mg/L) for Selected Formerly Characteristic Waste Compounds at the Water Table, Vertical PATHRAE Model Output Based on 0.595 cm/year Side Slope

6. HORIZONTAL PATHRAE FATE AND TRANSPORT MODELING

6.1 Horizontal Input Parameters for Contaminant Release

6.1.1 Waste Source Term Concentrations

The source term concentrations for the horizontal model were calculated from the output from the vertical model, as described in Section 5.1. The method involves calculating the concentration in each of the 115± "slices" using the following equation:

$$C = \frac{(C_t + C_{t+n})}{2} \cdot ((t+n) - t)$$

where:
- C = Mass/activity of nuclide in a given time slice [Ci·yrs]
- C_t = Output concentration at time t [Ci/m³]
- C_{t+n} = Output concentration at time t+n [Ci/m³]
- t = Time at beginning of "time slice" [years]
- $t+n$ = Time at end of "time slice" [years]
- n = Duration of "time slice" [years]

The leachate concentration in water (Ci/m^3) was converted to a sorbate concentration on aquifer soil (Ci/m^3). The mass ascribed to one cubic meter of aquifer was determined using the following equation:

$$C_{aq} = \frac{C_l(q_{in})}{V_{soil}} = \frac{C_l(q_{in})}{(1\ m^3)}$$

where:
- C_{aq} = Concentration of constituent sorbed onto 1 m^3 of aquifer soil [Ci/m^3 soil]
- C_l = Concentration in leachate (output of vertical slice) [Ci/m^3 water]
- q_{in} = Infiltration rate [m/yr]

6.1.2 Aquifer Bulk Density

The aquifer bulk density in the horizontal model was set at the thickness weighted average bulk density shown in Table 34 through Table 36 (1.558 gm/cm^3.)

6.1.3 Aquifer Moisture Content

The aquifer is saturated, with a moisture content equal to the saturated porosity of 29%. The effective porosity value of 0.29 has been used in previous modeling (DWQ, 1994 August), and is based on site specific data.

6.1.4 Partitioning Coefficients (Kd_s)

The distribution coefficients (K_ds) used in the horizontal model were identical to those used in the vertical model. The radionuclide and metal K_d values used in the modeling were summarized in Table 27 while the organic constituent K_d values were summarized in Table 29.

6.1.5 Fractional Release Rate

The contaminant release rate (or leach rate) for the horizontal simulation was set to 1/yr for all constituents modeled. In this manner, the entire waste concentration in each "time slice" was released "instantaneously". The K_d-limited leach rate was already accounted for in the vertical simulation and the resulting time offset for the "time slices" which was input to the horizontal model.

6.2 Horizontal Input Parameters for Flow and Transport

6.2.1 Hydraulic Conductivity

The geologic materials underlying the Class A South cell area include the Unit 3 sand and Unit 2 clay. The hydraulic conductivity of these two units is not clearly distinct, based on slug test results.

The aquifer hydraulic conductivity (K) has been tested in monitoring wells surrounding the cell, and in wells across the site. The results of slug tests performed and analyzed by Adrian Brown Consultants (1997c), EarthFax Engineering (1999), and Whetstone Associates (2000) are compiled in Table 16. The data from 96 wells indicated that the site wide geometric mean hydraulic conductivity in the shallow aquifer is 6.09×10^{-4} cm/sec. The 90% upper confidence level (UCL) about the geometric mean is 7.67×10^{-4} cm/sec. The 90% UCL was used in the horizontal PATHRAE modeling.

The 7.67×10^{-4} cm/sec UCL saturated hydraulic conductivity was also used in modeling the 11e.(2) cell (Whetstone, 2001).

6.2.2 Hydraulic Gradient

Hydraulic gradients at the Class A South and 11e.(2) cell area have changed over time, in response to site activities. For example, trenching and excavating operations contributed to preferentially increased infiltration and a mound at GW-36 in the mid 1990's. That mound has since greatly dissipated (see the Revised Hydrogeologic Report, Pentacore, 1999). After closure of the cell, the liner, waste, and cover will contribute to a more uniform moisture flux into the subsurface, and gradients are expected to be even lower than at present.

The hydraulic gradient used in the model is not intended to represent future conditions at the Class A South cell and 11e.(2) cell area. Since DRC has required that the gradient used in the modeling serve as a bounding condition, a conservatively high gradient has been selected. The selection of the hydraulic gradient for use in the model was based on a rigorous analysis, the history of which is summarized below:

- Area-weighted average hydraulic gradients were calculated in 1997 for the 11e.(2) and LARW cells. The gradients, calculation method, and sets of well triplets used for each time period were reported in "Volume II LARW Groundwater Fate and Transport Modeling Input Parameters and Results," dated February 12, 1998. The period of record for this analysis was January 1992 - June 1996, and the differences between the average gradients and the area-weighted average gradients were minimal. The gradient was accepted for the LARW cell model. For the 11e.(2) cell, the calculated average gradient for the appropriate well triplets (2.66×10^{-3}) was proposed for modeling in the July 1999 report "11e.(2) Disposal Cell Infiltration and Transport Model Input Parameters".
- DRC responded with a request to "describe and justify why the former hydraulic gradient, 2.66E-3 ft/ft is representative or conservative of the entire record of groundwater head and hydraulic gradient information available for the 11e.(2) facility." DRC pointed out that the horizontal hydraulic gradient value was based on groundwater elevation measurements made between January, 1992 and June 1996, and that since that time, additional groundwater head measurements and equipotential maps had been prepared by Envirocare.
- Whetstone and Envirocare responded by amending the report to reflect the more recent water level data for the 11e.(2) cell area. Hydraulic gradients were calculated monthly for the unconfined shallow groundwater beneath the 11e.(2) cell, using the most current data set (December 1998 – November

1999). The average hydraulic gradient below the 11e.(2) cell for this period was calculated at 6.37×10^{-4} ft/ft, using a direct well comparison method.

- DRC responded with a request to calculate the gradients using a three point method and to "justify why the period of record selected is representative of current and future groundwater conditions" and point out that any hydraulic gradient selected for the purpose of modeling will bound the analyzed condition at the facility.
- Hydraulic gradients were calculated for 1998, 1999, and 2000 using the Surfer program. (Gradients were calculated on 50-ft centers, using the 3-point method in Surfer.) This data set was combined with the 1992 – 1996 data (calculated using a 3-point method, non-area weighted). The results are shown in Figure 18 and Table 51.
- The maximum average hydraulic gradient was 4.63×10^{-3}, measured in July 1995. The maximum hydraulic gradient between any set of three well pairs 9.36×10^{-3}, measured in January 1992. While either of these values could bound the existing data set, future conditions are expected to follow the trend illustrated in Figure 18, that of a decreasing hydraulic gradient after human-induced perturbation of the system has ceased. The trend of decreasing gradient is also illustrated in the following table:

YEAR	AVERAGE
1992	3.37E-03
1993	2.59E-03
1994	2.32E-03
1995	3.30E-03
1996	2.04E-03
1998	9.87E-04
1999	9.71E-04
2000	9.14E-04

The maximum hydraulic gradients (measured between any three well pairs or in a 50x50 ft zone) at the Class A South and 11e.(2) cell area are shown in Table 51. An average maximum gradient for the period from February 1998 – March 2000 is 3.29×10^{-3}. This value was used in the horizontal transport modeling for the Class A South cell (and was used previously for the 11e.(2) cell [Whetstone, 2001]). This value is not considered representative of future conditions. Nor is it representative of conditions from February 1998 – March 2000. It is an average extreme value.

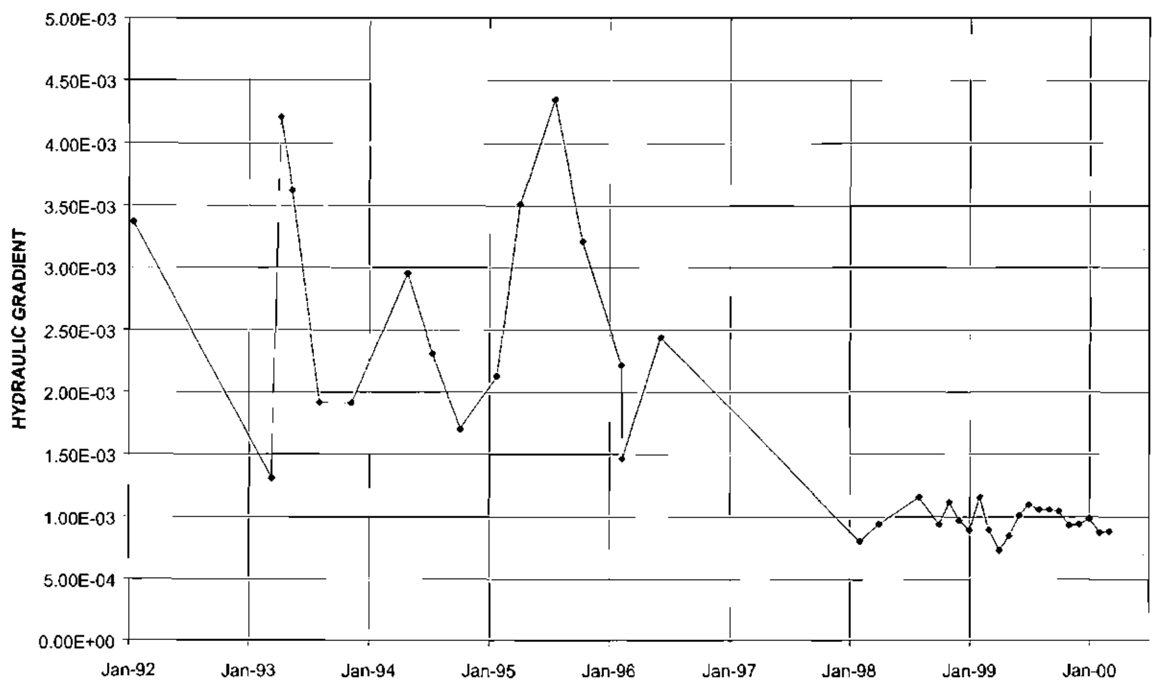


Figure 18. Hydraulic Gradients Measured in the Class A South and 11e.(2) Cell Area

Table 51. Hydraulic Gradient for the Monitoring Wells in the Class A South and 11e.(2) Cell Area

DATE MEASURED	MAXIMUM	MINIMUM	AVERAGE
15-Jan-92	9.36E-03	5.63E-04	3.37E-03
10-Mar-93	7.45E-03	3.34E-04	1.31E-03
07-Apr-93	8.32E-03	6.59E-04	4.21E-03
12-May-93	6.61E-03	6.32E-04	3.62E-03
04-Aug-93	2.82E-03	2.39E-04	1.91E-03
09-Nov-93	2.82E-03	2.39E-04	1.91E-03
28-Apr-94	7.79E-03	9.72E-04	2.95E-03
12-Jul-94	4.07E-03	2.26E-04	2.31E-03
05-Oct-94	3.98E-03	1.53E-04	1.70E-03
25-Jan-95	4.49E-03	1.77E-04	2.13E-03
05-Apr-95	6.94E-03	4.24E-04	3.51E-03
19-Jul-95	7.03E-03	9.11E-04	4.36E-03
11-Oct-95	4.72E-03	5.94E-04	3.21E-03
07-Feb-96	3.37E-03	3.55E-04	2.22E-03
09-Feb-96	2.44E-03	2.15E-04	1.46E-03
05-Jun-96	5.47E-03	1.20E-03	2.44E-03
Feb-98	1.60E-03	2.68E-05	8.02E-04
Apr-98	2.90E-03	2.32E-05	9.40E-04
Aug-98	2.09E-03	8.78E-06	1.15E-03
Oct-98	4.77E-03	2.87E-05	9.34E-04
Nov-98	5.04E-03	1.84E-05	1.12E-03
Dec-98	2.59E-03	3.74E-05	9.71E-04
Jan-99	2.78E-03	2.67E-05	8.92E-04
Feb-99	2.08E-03	1.24E-04	1.16E-03
Mar-99	2.42E-03	4.01E-05	8.94E-04
Apr-99	2.91E-03	4.32E-05	7.30E-04
May-99	3.05E-03	4.31E-05	8.45E-04
Jun-99	4.03E-03	5.23E-05	1.01E-03
Jul-99	4.57E-03	2.45E-05	1.10E-03
Aug-99	4.22E-03	3.89E-05	1.06E-03
Sep-99	4.22E-03	3.10E-05	1.06E-03
Oct-99	3.62E-03	1.30E-05	1.04E-03
Nov-99	2.81E-03	2.83E-05	9.31E-04
Dec-99	2.67E-03	4.78E-06	9.38E-04
Jan-00	5.54E-03	4.93E-05	9.86E-04
Feb-00	2.60E-03	1.67E-05	8.75E-04
Mar-00	2.51E-03	1.84E-05	8.81E-04
Maximum (1/92–3/00)	9.36E-03	1.20E-03	4.36E-03
Minimum (1/92–3/00)	1.60E-03	4.78E-06	7.30E-04
Average (1/92–3/00)	4.23E-03	2.32E-04	1.70E-03
Maximum (2/98–3/00)	5.54E-03	1.24E-04	1.16E-03
Minimum (2/98–3/00)	1.60E-03	4.78E-06	7.30E-04
Average (2/98–3/00)	3.29E-03	3.32E-05	9.68E-04

6.2.3 Effective Porosity

The effective porosity value of 0.29 was used in the calculation of aquifer velocity for all calculations in the saturated zone / horizontal pathway.

6.2.4 Aquifer Average Linear Velocity

The aquifer velocity (v_a) was calculated based on the Darcy equation, such that:

$$\bar{v} = \frac{Ki}{n_e}$$

where
v = average linear velocity in the aquifer (L/T)
K = hydraulic conductivity (L/T)
i = hydraulic gradient (L/L)
n_e = aquifer effective porosity (L^3/L^3)

Using the effective porosity (0.29), 90% UCL hydraulic conductivity ($7.67x10^{-4}$ cm/sec), and a conservatively extreme hydraulic gradient ($3.29x10^{-3}$) described in the previous sections, the average groundwater linear velocity is 2.744 m/yr (9.0 ft/yr), as shown below:

$$\bar{v} = \frac{Ki}{n_e} = \frac{(7.67x10^{-4}\ \text{cm/sec})(3.29x10^{-3})}{0.29} = 8.70x10^{-6}\ \text{cm/sec} = 2.744\ \text{m/yr}$$

The 2.744 m/yr aquifer velocity used in modeling the Class A South and 11e(2) cell area is 3 to 9 times higher than the aquifer velocity used in modeling other cells at the site. The March 2, 2000 Class A cell modeling report used a linear aquifer velocity of 0.317 m/yr, (1.0 ft/yr), which was based on the average hydraulic gradient and 69 site-wide hydraulic conductivity tests. The June 12, 2000 Class A cell modeling report used an average linear velocity (0.824 m/yr), which was based on the conservative estimate of hydraulic gradient and hydraulic conductivity tests from 81 wells site-wide. The May 2005 CAC cell modeling report used an average linear velocity of 0.846 m/yr.

6.2.5 Horizontal Transport Distance

The horizontal distance was modeled as the distance from the edge of the waste to the nearest compliance monitoring well, which is approximately 90 feet (27.4 meters) for the side slope simulations and 250 feet (76.2 meters) for the top slope simulation.

6.2.6 River Flow Rate

The river flow rate in the horizontal model was set equal to the aquifer flux through a square meter (cross-sectional area) of aquifer. The aquifer flux was calculated based on the hydraulic gradient and hydraulic conductivity:

$$q = Ki$$

This aquifer flux rate was used as the "infiltration rate" and "river flow rate." Values of 0.00276, 0.00286, and 0.00595 m^3/yr were used for the top slope and two side slope river flow rates. These rates assume that there is no dilution along the flow path, and the leachate arrives at the well (or "river") at the same rate it issued from the disposal cell.

6.3 Horizontal Transport Model Results

Horizontal PATHRAE modeling was conducted for the top slope and two side slope infiltration rates. The model results are summarized in Table 52, which shows the time to exceed the GWPLs at the compliance well. The "Year To Exceed" is conservatively reported as the next *lowest* model output time.

Table 52. Summary of Horizontal PATHRAE Model Results—Time to Exceed GWPLs at the Compliance Monitoring Well, based on 0.276, 0.286 and 0.595 cm/yr Infiltration

Radionuclide	Top Slope 0.276 cm/yr Model Results YEAR TO EXCEED	Side Slope 0.286 cm/yr Model Results YEAR TO EXCEED	Side Slope 0.595 cm/yr Model Results YEAR TO EXCEED
Am-241	-1	-1	-1
Am-242m	-1	-1	-1
Am-243	-1	-1	-1
Bi-207	-1	-1	-1
Bi-210m	-1	-1	-1
Bk-247	-1	-1	-1
Ca-41	500	505	-1
Cd-113m	nm	nm	-1
Cl-36	-1	-1	-1
Fe-60	-1	-1	-1
H-3	-1	-1	-1
I-129	555	510	500
K-40	655	600	510
Nb-91	-1	-1	-1
Pd-107	-1	-1	-1
Pt-193	-1	-1	-1
Re-187	500	500	-1
Se-79	-1	-1	-1
Si-32	-1	1500	755
Sr-90	-1	-1	-1
Tc-99	530	510	-1

NOTES: Year to exceed GWPL reported to next lowest model output year.
nm = not modeled in horizontal PathRAE run
-1 indicates nuclide does not exceed GWPL within the 2,000 years modeled

Note that all nuclides that exceeded GWPLs at the water table (in the vertical modeling) were carried forward to the horizontal modeling. The PATHRAE code only produces output for nuclides that arrive at the compliance point. Therefore, several of the nuclides that were input to the horizontal model are not included by PATHRAE in the output files (described below). The output concentration of these nuclides is essentially zero.

6.3.1 Top Slope Horizontal Modeling Results (0.276 cm/yr)

None of the nuclides modeled exceeded the GWPLs at the compliance well within 500 years, based on horizontal modeling of the top slope cover design infiltration rate of 0.276 cm/yr (0.109 in/yr). The concentrations of each constituent at each model output time are given in Table 53.

As described in Section 6.1.1 and listed in Table 20, the source concentrations for Bk-247, Ca-41, Cl-36, and Re-187 used in the top slope model were set to the limiting concentrations that met GWPLs for 500 years at a compliance well located 250 ft from the edge of the waste. All other radionuclides were modeled at Class A limits or Specific Activity and met the groundwater standard for at least 500 years.

Table 53. Radionuclide Concentrations (pCi/L) at the Compliance Well, Horizontal PATHRAE Model Results for Class A South Cell Top Slope (0.276 cm/year Infiltration)

(See large tables at end of report document.)

6.3.2 Side Slope Horizontal Modeling Results (0.286 cm/yr)

None of the nuclides exceeded the GWPLs at the compliance well in less than 500 years, based on the side slope cover design infiltration rate of 0.286 cm/yr (0.113 in/yr), which corresponds to the side slope with an 18-inch thick Type-B filter. The concentrations of each constituent at each model output time are given in Table 54.

As described in Section 6.1.1 and listed in Table 20, the concentrations of five radionuclides (Bk-247, Ca-41, Cl-36, Re-187, and Tc-99) were limited to meet the GWPL in the 0.286 cm/yr side slope simulations. All other modeled constituents would meet the groundwater standard if placed under the 0.286 cm/yr side slope at Class A limits.

Table 54. Radionuclide Concentrations (pCi/L) at the Compliance Well, Horizontal PATHRAE Model Results for Class A South Cell Side Slope (0.286 cm/year Infiltration)

(See large tables at end of report document.)

6.3.3 Side Slope Horizontal Modeling Results (0.595 cm/yr)

None of the nuclides exceeded the GWPLs at the compliance well in less than 500 years, based on the side slope cover design infiltration rate of 0.595 cm/yr (0.234 in/yr), which corresponds to the side slope with a 12-inch thick Type-B filter. The concentrations of each constituent at each model output time are given in Table 55.

As described in Section 6.1.1 and listed in Table 20, the concentrations of eight radionuclides (Bk-247, Ca-41, Cl-36, I-129, K-40, Re-187, Sr-90, and Tc-99) were limited to meet the GWPL in the 0.595 cm/yr side slope simulations. All other modeled constituents would meet the groundwater standard if placed under the 0.595 cm/yr side slope at Class A limits.

Table 55. Radionuclide Concentrations (pCi/L) at the Compliance Well, Horizontal PATHRAE Model Results for Class A South Cell Side Slope (0.595 cm/year Infiltration)

(See large tables at end of report document.)

6.3.4 Horizontal Modeling Results for Metals and Formerly Characteristic Waste

Horizontal modeling was not performed. It was unnecessary because none of the metals or Formerly Characteristic waste constituents exceeded GWPLs at the water table for the top slope (0.276 cm/yr infiltration) or side slope (0.286 and 0.595 cm/yr infiltration) cases. Metals and Formerly Characteristic (D-Code) waste can be placed in the top slope or side slope areas at essentially any concentration.

7. CONCLUSIONS

The infiltration, fate, and transport modeling for EnergySolutions' Class A South cell was based on previous modeling of the existing Class A cell and 11e.(2) cell. The input parameters have been selected to provide conservative (environmentally protective) estimates for infiltration through the cell and for fate and transport of constituents from the waste.

The HELP infiltration modeling results indicate that 0.276 cm/yr infiltration would occur through the Class A South cell top slope, while 0.286 cm/yr would infiltrate through the side slope with an 18-inch thick Type-B filter and 0.595 cm/yr would infiltrate through the side slope with a 12-inch thick Type-B filter. Based on these infiltration rates, moisture contents would stabilize at 0.059 v/v in the waste and 0.047 v/v in the native soil below the top slope, at 0.059 and 0.047 v/v in the waste and native soil below the 0.286 cm/yr side slope, and at 0.066 and 0.051 v/v in the waste and native soil below the 0.595 cm/yr side slope.

The PATHRAE fate and transport modeling for the top slope (0.276 cm/yr infiltration case) indicates that all radionuclides modeled would remain below the GWPLs for at least 500 years at a compliance well located 250 feet from the edge of the waste, provided that the concentrations of four radionuclides (Bk-247, Ca-41, Cl-36, and Re-187) are received in limited concentrations shown below. All other modeled constituents would meet the groundwater standard if placed in the top slope area at Class A limits.

	Class A South Disposal Cell Top Slope Limiting Concentrations Based on 0.276 cm/yr Infiltration		
ISOTOPE	(pCi/gm)	(Ci/m^3)	Source
Bk-247	0.00009833	1.77E-10	Model
Ca-41	2.06	3.70E-06	Model
Cl-36	0.286	5.14E-07	Model
Re-187	17,860	3.21E-02	Model

The PATHRAE fate and transport modeling for the side slope with an 18-inch thick Type-B filter (0.286 cm/yr infiltration case) indicates that all radionuclides modeled would remain below the GWPLs for at least 500 years at a compliance well located 90 feet from the edge of the waste, provided that the concentrations of five radionuclides (Bk-247, Ca-41, Cl-36, Re-187, and Tc-99) are received in limited concentrations shown below. All other modeled constituents would meet the groundwater standard if placed under the side slope at Class A limits.

	Class A South Disposal Cell Side Slope Limiting Concentrations Based on 0.286 cm/yr Infiltration		
ISOTOPE	(pCi/gm)	(Ci/m^3)	Source
Bk-247	0.0000906	1.63E-10	Model
Ca-41	1.322	2.38E-06	Model
Cl-36	0.268	4.83E-07	Model
Re-187	5,556	1.00E-02	Model
Tc-99	77,778	1.40E-01	Model

The PATHRAE fate and transport modeling for the side slope with a 12-inch thick Type-B filter (0.595 cm/yr infiltration case) indicates that all radionuclides modeled would remain below the GWPLs for at least 500 years at a compliance well located 90 feet from the edge of the waste, provided that the concentrations of eight radionuclides (Bk-247, Ca-41, Cl-36, I-129, K-40, Re-187, Sr-90, and Tc-99) are received in limited concentrations shown below. All other modeled constituents would meet the groundwater standard if placed under the side slope at Class A limits.

	Class A South Disposal Cell Side Slope Limiting Concentrations Based on 0.595 cm/yr Infiltration		
ISOTOPE	(pCi/gm)	(Ci/m^3)	Source
Bk-247	0.00009111	1.64E-10	Model
Ca-41	1.328	2.39E-06	Model
Cl-36	0.2706	4.87E-07	Model
I-129	0.0667	1.20E-07	Model
K-40	45.0	8.10E-05	Model
Re-187	1.039	1.87E-06	Model
Sr-90	80.0	1.44E-04	Model
Tc-99	2.922	5.26E-06	Model

The transport of heavy metals and Formerly Characteristic (D-Code) waste was modeled using vertical PATHRAE model runs for the 0.276 cm/yr top slope, 0.286 cm/yr side slope, and 0.595 cm/yr side slope areas. The results indicated that all 45 of the metals and D-Code wastes can be placed in the cell at full concentration (ten times the Treatment Standard). The model results showed that concentrations met GWPLs at the water table for the 200-year compliance period.

December 7, 2007
Prepared and submitted by:

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TABLES

TABLE 5. SUMMARY AND EVALUATION OF DAILY TEMPERATURE IN HELP MODEL 100-YEAR SYNTHETIC WEATHER DATA SET

YEAR->	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46
Jan 1	32.8	39.6	40.5	27.8	30.0	37.3	31.3	35.8	46.6	32.5	28.0	26.5	29.6	35.4	22.5	35.5	40.3	46.4	26.0	17.7	41.9	37.9	23.1	27.8	35.2	40.9	51.6	30.3	39.4	34.6	20.9	31.3	36.1	36.4	34.1	37.9	29.9	15.8	37.1	33.5	24.0	31.1	36.3	28.7	32.0	24.2
Jan 2	29.6	32.4	43.1	32.9	34.0	27.6	29.7	29.4	38.6	26.7	31.4	20.2	37.0	34.9	24.0	34.9	37.8	42.0	29.1	14.5	47.1	36.4	18.4	28.0	38.9	30.2	40.0	30.3	31.0	27.3	23.1	38.0	29.0	36.8	26.9	39.9	28.9	18.7	27.7	38.5	28.4	28.9	39.5	35.4	34.0	26.6
Jan 3	29.5	32.6	38.3	22.6	35.6	32.6	41.9	37.5	25.2	21.6	39.6	14.7	28.9	35.0	31.6	27.1	35.1	38.2	33.8	24.6	41.4	30.4	21.6	24.9	38.7	27.4	28.9	30.4	35.5	33.5	20.0	26.2	33.0	37.7	26.3	39.5	31.8	24.7	28.4	44.4	37.7	41.5	39.9	34.1	31.4	24.6
Jan 4	23.6	26.4	38.7	32.5	23.9	31.1	31.4	38.7	36.6	26.7	38.3	19.9	38.9	26.8	31.5	29.7	38.3	41.6	34.1	24.7	37.7	27.2	37.6	27.3	29.3	29.7	41.5	35.7	33.3	27.9	12.9	20.6	28.7	33.1	43.7	47.1	40.3	31.3	23.6	41.2	37.8	30.0	27.0	22.7	24.7	18.2
Jan 5	29.6	35.2	33.0	28.3	17.5	19.6	35.9	31.8	33.0	20.9	30.8	19.7	29.2	28.7	35.1	37.7	36.3	30.4	31.4	32.8	34.9	34.3	35.4	31.3	32.9	32.2	38.8	36.4	23.5	27.4	17.6	29.0	34.9	40.4	31.9	39.1	51.8	30.0	29.5	41.1	33.3	24.9	29.0	17.0	24.1	14.7
Jan 6	39.1	39.8	30.8	40.1	32.1	21.8	42.1	41.3	32.3	23.0	43.9	40.3	37.3	23.0	28.0	29.3	27.2	24.5	33.2	31.3	35.5	31.9	29.0	33.2	29.5	38.7	42.0	34.2	30.3	23.1	13.8	31.4	29.5	46.6	24.9	32.1	47.8	33.0	30.4	32.4	38.3	33.0	35.0	30.0	21.2	16.8
Jan 7	32.0	39.6	35.3	37.5	39.8	14.9	32.1	36.1	36.0	37.3	36.8	47.2	34.2	29.8	39.7	20.9	27.2	19.5	44.5	24.2	38.4	23.5	26.6	39.7	27.2	24.4	33.6	41.8	25.1	23.1	8.5	30.0	24.6	37.3	24.6	33.0	31.2	34.2	15.4	27.3	34.3	28.4	27.6	22.5	30.7	20.6
Jan 8	33.1	30.6	26.3	41.4	36.7	25.7	28.6	45.8	38.4	40.2	33.7	34.5	33.8	27.0	27.1	26.6	37.2	18.2	46.5	18.1	38.3	29.2	34.2	40.7	27.0	18.0	24.8	35.0	24.0	26.6	20.6	23.6	27.4	32.2	20.9	36.0	39.6	27.8	22.7	29.0	39.3	33.7	27.3	24.7	37.7	31.3
Jan 9	34.6	21.2	19.3	33.3	44.6	23.3	25.8	45.1	28.8	39.3	33.6	29.9	31.9	23.5	24.8	29.8	39.4	26.1	38.9	29.9	33.3	34.6	32.8	31.4	29.0	21.9	41.4	31.6	26.4	29.6	25.6	28.5	24.0	27.1	25.6	37.1	38.1	27.9	18.0	38.6	34.6	23.8	26.0	22.6	33.2	32.5
Jan 10	25.9	22.5	26.1	31.2	28.6	28.9	28.3	38.8	32.8	33.5	26.1	24.6	29.4	34.7	24.9	33.1	41.7	29.8	33.9	29.0	33.3	33.4	26.5	35.0	22.2	39.1	47.6	37.9	40.3	26.1	20.0	22.6	30.7	28.1	22.1	39.7	37.4	25.7	12.1	36.9	36.7	24.8	29.5	30.0	27.2	38.2
Jan 11	31.4	13.8	36.4	27.7	35.7	35.7	26.0	32.2	21.0	50.6	34.4	24.9	36.1	27.7	18.9	37.5	32.9	32.4	26.2	37.9	37.2	46.9	29.0	28.5	26.8	38.1	46.0	23.3	29.0	15.4	16.4	19.6	32.7	26.7	26.5	37.9	36.5	33.8	11.3	21.5	40.0	33.8	31.9	32.6	35.5	31.7
Jan 12	26.1	22.8	35.3	22.0	23.6	31.9	20.8	33.9	20.0	41.3	38.4	29.0	33.6	28.1	18.2	33.4	22.9	35.7	24.2	43.5	27.9	38.9	37.1	28.7	28.3	36.6	37.9	21.9	38.2	22.0	18.0	23.4	33.7	28.7	28.4	30.0	31.6	30.1	19.7	34.6	46.2	36.1	41.5	25.9	35.1	29.7
Jan 13	25.9	12.4	32.6	18.8	21.2	34.3	28.0	35.2	30.3	39.8	32.7	18.8	35.1	24.5	16.5	31.0	31.0	26.1	18.3	28.7	28.2	30.6	25.6	26.1	25.7	32.6	40.1	19.1	37.1	26.6	15.1	38.0	37.6	22.6	25.9	25.3	30.8	35.5	24.3	38.2	44.1	35.5	34.6	22.3	32.9	27.3
Jan 14	19.2	13.2	38.4	29.0	28.0	30.6	24.5	40.9	24.7	27.4	34.6	26.9	38.6	28.1	20.8	30.4	21.9	22.7	12.7	34.6	31.0	31.9	31.0	21.6	30.3	29.9	39.1	32.1	42.0	26.6	13.1	38.9	40.9	32.3	25.2	32.0	31.4	30.9	27.0	30.7	42.2	26.5	25.1	20.0	43.2	26.7
Jan 15	14.6	17.9	35.9	24.7	23.8	21.7	30.8	40.8	27.1	24.2	19.4	28.0	38.3	23.3	20.3	29.9	31.6	26.0	26.5	36.1	42.5	35.1	31.5	24.8	28.0	19.5	38.2	23.6	39.5	32.5	22.4	43.4	45.1	37.5	21.2	33.6	27.1	38.1	31.5	35.1	41.7	27.2	21.1	32.8	33.4	20.3
Jan 16	23.5	22.6	37.2	19.2	11.7	24.7	18.7	37.9	29.8	30.8	17.9	33.6	30.5	26.2	24.5	40.1	28.3	33.4	29.7	35.7	40.0	40.9	31.5	26.4	39.0	23.7	33.0	20.7	28.7	26.9	24.1	36.2	46.2	32.0	21.4	32.8	20.8	34.1	28.9	36.8	31.5	32.2	22.2	37.3	40.2	24.3
Jan 17	28.5	28.2	37.6	17.6	20.2	25.5	20.2	32.0	30.0	32.5	21.8	27.5	37.9	32.7	24.5	37.6	21.6	32.7	29.2	30.9	41.5	42.1	31.3	26.7	30.3	20.1	42.8	23.3	23.8	25.7	28.6	44.6	52.9	33.9	24.7	43.1	25.9	18.4	21.4	41.0	42.6	37.8	28.1	36.3	44.1	24.5
Jan 18	31.0	32.2	34.3	10.4	20.8	21.0	26.6	23.9	27.3	42.5	24.6	22.8	32.4	29.6	28.1	30.0	22.8	41.7	26.3	31.4	36.1	39.1	29.2	28.9	34.2	18.8	39.6	18.6	31.3	30.0	40.4	41.4	43.7	31.4	29.8	34.0	27.5	24.9	18.5	32.9	32.8	37.6	20.8	42.8	38.5	36.6
Jan 19	44.4	34.7	32.7	22.2	17.2	18.7	34.6	28.7	32.5	30.0	19.7	18.2	30.9	25.6	36.1	32.0	25.2	40.3	29.5	38.4	37.7	25.2	29.5	21.6	37.0	19.6	40.4	16.7	23.5	20.5	25.4	41.3	32.5	38.3	32.2	37.2	19.2	35.4	33.9	31.0	32.0	36.3	23.4	41.0	48.0	35.3
Jan 20	41.1	29.7	35.2	23.8	13.5	12.4	38.9	32.8	32.9	15.0	23.7	22.5	23.9	23.7	30.7	41.9	34.1	30.9	29.8	41.2	26.9	38.0	31.1	33.8	47.1	21.6	34.2	25.1	27.0	17.5	28.6	43.5	22.6	42.6	23.6	36.6	16.9	37.0	20.7	39.9	42.4	38.2	21.8	32.7	33.2	40.8
Jan 21	52.8	34.4	36.6	20.9	14.6	24.2	40.3	34.3	38.1	28.2	38.1	25.2	22.0	21.8	42.2	36.4	28.7	23.6	27.7	35.0	25.3	19.5	31.9	25.9	36.1	21.5	35.1	23.1	28.9	20.0	37.7	35.9	33.3	32.1	37.6	23.2	19.3	47.0	19.4	39.8	39.8	24.8	19.3	31.0	34.5	35.5
Jan 22	43.3	28.0	38.8	18.5	24.5	23.3	35.9	40.4	38.4	30.5	37.2	25.9	15.3	22.1	33.7	31.1	25.0	33.6	27.3	42.3	24.1	26.7	32.2	29.8	44.9	20.7	40.3	29.5	23.0	34.7	32.0	32.7	37.2	40.7	30.3	19.8	20.6	42.7	33.5	39.7	45.8	37.2	27.8	28.1	39.2	39.4
Jan 23	44.0	30.7	32.3	23.6	35.5	29.1	45.0	34.1	32.4	35.9	38.8	22.5	28.3	17.7	30.6	28.7	32.3	39.1	18.2	32.3	20.4	31.9	26.6	27.6	30.5	25.5	38.1	41.9	30.5	40.3	32.1	29.3	26.9	35.3	36.7	30.5	21.2	38.1	37.1	30.0	37.9	46.5	19.3	18.0	35.2	32.6
Jan 24	45.3	20.5	37.6	26.4	33.9	21.9	48.7	37.6	31.4	26.8	46.1	20.8	26.6	17.4	29.2	14.8	22.2	40.3	26.8	39.0	22.2	43.0	24.0	27.4	34.3	20.1	32.4	43.6	34.8	38.3	39.8	16.8	31.1	38.3	31.3	26.9	29.2	37.2	36.3	28.4	34.5	45.8	17.1	32.8	28.2	33.3
Jan 25	37.6	25.0	29.1	35.1	29.4	23.8	27.4	33.2	36.5	27.2	45.6	26.9	31.5	30.5	36.6	15.8	23.2	38.0	34.5	33.4	22.9	34.9	23.1	28.8	29.1	29.0	33.8	40.3	28.7	31.6	35.1	19.8	35.9	37.6	30.7	32.1	37.4	37.8	22.5	42.3	42.4	38.6	25.4	36.2	25.9	46.8
Jan 26	39.7	19.2	26.1	31.7	39.9	18.6	26.5	32.0	39.2	43.6	44.3	27.5	30.8	18.5	40.1	23.6	19.9	35.4	29.3	31.5	34.5	38.3	39.7	29.5	30.1	14.7	30.6	43.7	18.4	39.0	30.2	27.6	41.4	37.6	24.5	25.5	32.0	29.4	25.4	46.8	37.4	37.1	43.6	41.3	28.1	44.2
Jan 27	41.4	30.7	22.0	36.9	40.4	22.0	19.5	36.3	39.1	45.9	36.1	14.1	38.5	22.8	31.9	20.7	31.8	39.6	44.5	28.6	29.6	33.0	39.2	31.1	30.5	26.7	32.5	29.2	19.1	40.6	25.1	32.4	41.0	34.9	21.8	24.3	35.2	36.7	25.9	36.5	31.6	21.1	41.9	26.1	36.1	39.5
Jan 28	39.9	32.2	35.4	37.5	46.1	22.6	30.3	40.4	31.0	55.5	29.2	18.1	21.2	16.2	38.6	25.7	20.8	41.5	34.0	23.6	31.6	26.5	31.7	29.7	36.4	39.9	33.7	25.2	11.0	42.0	35.3	36.4	33.9	32.1	22.4	28.4	41.4	46.9	26.1	33.7	42.0	27.9	37.1	31.6	28.6	45.6
Jan 29	37.3	26.9	30.8	44.4	40.9	34.9	31.4	46.3	28.5	44.3	34.0	28.5	16.1	17.3	30.1	39.5	26.1	26.3	38.7	38.0	31.4	25.1	30.2	29.6	33.6	39.4	26.7	28.0	9.2	36.4	32.9	44.9	24.9	29.5	22.2	34.9	41.0	47.0	19.4	35.3	30.5	24.5	34.4	32.5	32.2	43.6
Jan 30	45.4	25.0	41.9	51.8	36.9	32.6	25.4	45.4	22.7	39.2	33.1	28.1	21.7	19.6	28.8	31.5	35.1	29.6	34.2	31.6	29.9	28.6	39.7	19.6	31.1	34.8	25.5	24.2	11.4	31.7	32.6	38.8	19.8	37.9	23.6	40.7	41.0	37.9	19.0	29.9	23.1	18.4	31.6	24.6	23.6	35.0
Jan 31	40.3	25.7	46.2	34.4	43.3	38.2	25.6	55.9	20.7	35.1	37.1	31.4	33.3	30.0	42.5	23.6	29.1	30.6	45.1	29.8	24.6	23.1	41.1	15.5	25.8	26.3	23.7	30.6	12.1	31.3	35.1	45.3	24.8	33.3	31.3	30.0	35.2	28.7	20.9	36.6	35.5	15.1	34.4	21.1	12.9	29.5
Feb 1	26.7	34.1	45.7	38.6	37.3	38.8	19.1	40.6	15.6	31.5	24.8	34.0	30.2	29.7	39.2	23.4	25.4	16.1	36.1	34.5	22.1	27.0	38.1	28.2	36.1	29.3	17.9	28.3	24.5	29.5	41.7	31.1	27.0	37.6	21.1	42.7	35.3	27.4	18.3	29.3	33.7	25.1	30.5	30.4	23.4	22.2
Feb 2	29.2	28.3	40.5	35.4	44.5	36.2	31.0	39.4	23.6	44.6	31.8	18.1	20.1	29.3	31.3	31.6	24.1	14.1	43.9	32.8	20.8	22.5	39.5	31.8	26.6	22.6	28.8	29.5	23.1	20.2	39.7	33.5	31.1	40.6	27.3	34.3	27.1	23.0	29.7	29.1	33.7	21.7	34.9	19.5	34.5	18.2
Feb 3	35.1	24.6	28.2	30.8	34.4	28.0	27.3	29.9	23.8	38.9	35.6	22.4	30.8	27.5	31.3	32.1	29.6	18.6	46.7	27.2	25.7	30.5	44.9	33.5	27.6	28.2	14.6	31.3	30.6	33.0	28.5	26.9	34.0	29.5	23.2	32.7	31.4	25.8	37.4	35.3	30.7	30.6	33.7	18.7	26.4	22.6
Feb 4	22.2	30.5	29.3	27.6	26.5	26.2	34.3	23.2	29.9	25.6	43.6	21.6	23.8	28.3	30.2	34.1	23.8	23.2	41.4	25.7	29.2	25.7	44.3	39.5	21.5	28.6	6.7	30.9	36.4	34.1	26.2	24.2	35.7	31.2	30.6	43.9	25.9	33.5	30.6	36.3	32.4	39.9	39.2	25.2	33.3	28.2
Feb 5	27.6	27.4	32.5	34.7	28.1	18.5	32.0	36.6	29.6	27.3	40.3	29.4	20.4	33.4	28.5	34.9	33.7	26.4	32.9	24.7	22.6	24.5	36.3	41.2	23.2	33.6	13.5	23.8	38.3	23.0	31.5	24.6	28.1	18.7	39.7	25.9	34.7	34.1	29.9	34.3	40.1	27.8	37.5	22.0	30.7	33.1
Feb 6	31.1	24.3	41.6	27.3	27.7	32.7	44.4	37.2	38.2	42.1	33.2	32.1	20.1	29.1	31.8	19.3	39.7	16.5	31.7	37.4	35.8	14.0	45.5	24.6	30.5	38.7	19.1	16.3	35.6	28.4	30.6	24.8	41.3	22.9	35.7	23.8	32.8	23.2	23.5	37.0	37.6	23.7	39.3	27.3	27.0	31.5
Feb 7	42.2	28.8	34.0	31.5	28.0	37.3	43.5	19.1	30.8	29.6	26.4	23.2	22.7	24.6	19.3	20.4	36.6	18.9	41.4	32.2	25.4	22.7	28.5	25.2	32.7	40.0	13.9	16.8	32.1	23.1	32.4	25.5	37.8	14.2	38.3	19.2	35.4	25.9	32.8	28.9	38.8	27.1	35.4	26.5	22.0	35.6
Feb 8	43.0	37.0	37.1	17.7	28.1	36.5	37.9	32.8	32.8	27.6	30.3	13.4	19.4	32.9	19.4	25.3	37.6	11.7	39.0	34.9	27.9	29.4	36.9	21.5	39.5	36.9	25.8	29.8	32.3	18.0	31.4	22.6	39.8	22.4	33.2	24.8	48.8	23.3	40.4	24.5	29.9	21.1	41.9	21.1	17.1	20.6
Feb 9	34.2	37.8	29.6	23.9	17.7	36.1	36.4	34.7	31.0	23.8	29.3	17.9	18.1	49.1	28.0	21.4	37.0	18.4	26.5	29.4	35.3	28.5	33.3	31.9	26.4	34.4	24.9	36.1	20.6	21.9	28.8	25.3	36.8	26.2	37.1	26.6	34.1	13.4	33.5	30.7	41.8	14.9	42.5	25.8	24.3	17.5
Feb 10	47.4	40.9	39.7	17.1	17.9	36.2	27.1	27.9	23.5	33.1	30.6	20.1	24.3	51.0	30.6	30.1	44.6	24.1	17.2	38.4	36.9	33.6	37.1	28.6	24.5	34.5	33.6	38.6	24.6	28.0	29.8	29.8	32.8	35.7	41.8	26.3	42.3	16.9	29.8	28.1	38.9	29.3	41.9	30.3	28.8	26.7
Feb 11	45.2	37.5	37.8	36.8	20.0	32.8	28.6	29.1	29.8	24.0	21.2	10.8	20.1	57.6	29.2	27.0	39.6	24.8	22.1	32.2	24.9	46.4	38.7	20.3	25.0	46.9	40.4	34.3	26.0	29.5	45.0	29.1	36.4	40.7	43.8	29.9	26.1	19.9	24.1	27.6	31.0	25.3	43.4	25.3	28.8	24.2
Feb 12	45.2	39.1	42.0	34.6	22.0	29.4	28.2	16.1	38.6	29.7	20.3	24.9	25.5	47.2	22.7	30.1	32.8	21.8	19.1	34.4	32.7	30.4	30.3	19.3	20.6	45.1	47.0	38.7	21.1	20.0	42.6	21.2	36.7	37.1	50.7	34.5	24.3	30.5	18.0	30.2	28.6	27.6	31.8	28.8	40.7	30.9
Feb 13	49.7	28.6	40.3	44.7	21.2	31.9	20.6	28.2	36.8	34.8	32.2	15.8	30.4	33.7	23.0	18.5	37.9	17.4	31.4	28.6	40.9	24.7	24.1	11.9	24.5	38.6	38.8	31.3	36.1	27.7	38.3	19.5	32.6	46.5	48.0	30.6	37.8	39.3	20.9	28.0	29.9	34.0	25.5	40.6	54.9	38.3
Feb 14	38.0	18.7	36.5	49.7	20.4	30.8	21.7	36.6	30.5	30.3	33.2	30.2	31.4	35.5	23.5	17.5	37.9	22.0	25.3	24.8	28.8	28.5	25.6	23.8	25.1	51.2	23.5	25.2	45.3	34.9	33.1	29.1	31.9	54.9	45.8	26.9	36.7	38.4	28.0	30.4	27.8	29.2	30.0	38.5	45.0	39.7
Feb 15	43.6	31.1	41.9	35.1	21.4	35.6	35.6	45.7	34.4	22.1	28.2	20.4	40.3	30.3	32.7	21.8	23.0	31.4	13.5	25.3	34.5	30.5	27.6	26.8	25.9	42.0	28.7	37.3	38.5	24.8	44.5	25.4	43.9	45.8	43.2	38.7	41.9	32.3	27.2	37.9	25.4	23.5	26.5	28.3	40.2	44.1
Feb 16	41.7	30.1	31.6	36.9	21.2	36.4	31.3	40.9	42.1	29.1	24.1	13.9	41.2	30.0	29.3	27.2	29.0	28.7	19.2	28.9	29.0	37.0	33.3	28.9	30.5	41.4	22.9	35.7	43.6	32.0	40.0	28.1	41.5	38.8	29.9	33.8	30.8	30.1	21.4	28.9	21.4	37.3	41.9	30.0	36.7	37.8
Feb 17	42.2	19.9	24.9	36.4	26.4	23.5	23.2	36.4	32.3	29.0	26.0	14.9	37.6	25.9	32.6	22.8	30.6	33.7	19.1	23.7	20.7	40.0	27.7	39.7	29.2	37.9	23.0	38.1	35.9	23.8	39.3	36.5	40.8	35.4	37.0	36.0	30.1	29.9	15.5	28.4	31.9	36.9	45.8	29.9	34.5	39.3
Feb 18	41.5	21.0	34.5	36.8	36.9	36.2	22.7	38.8	27.9	42.4	29.0	25.5	28.1	30.3	23.7	32.3	29.0	29.7	24.6	25.9	22.3	24.1	33.8	37.5	18.7	37.0	25.4	38.1	43.4	22.3	37.2	31.6	42.2	36.9	31.6	36.4	23.1	29.4	24.2	25.3	20.6	36.6	44.3	28.7	32.9	28.9
Feb 19	36.2	31.4	28.2	34.7	36.1	36.9	22.2	47.4	20.0	35.8	33.9	28.8	25.7	24.6	24.0	34.7	30.9	34.9	31.5	31.7	18.4	22.8	35.8	29.9	25.0	35.5	29.9	40.2	36.2	29.7	29.5	21.3	36.2	34.9	24.7	35.3	27.0	18.5	13.6	29.5	20.3	33.2	42.5	26.3	32.7	40.0
Feb 20	42.6	32.8	28.6	38.9	44.5	29.7	20.3	39.2	28.6	29.2	29.2	28.2	22.1	27.2	40.3	37.3	23.1	24.7	38.4	39.8	19.4	28.4	31.9	26.1	19.8	44.0	39.7	43.6	24.4	30.5	25.0	29.5	37.3	34.0	25.4	33.3	33.8	27.5	15.8	30.9	17.6	26.9	28.8	39.5	30.5	26.3
Feb 21	34.0	32.4	32.5	36.4	32.7	29.1	23.3	35.1	27.5	24.8	34.3	30.2	18.9	25.5	29.1	31.3	29.4	21.5	33.6	42.7	26.9	27.9	38.3	33.5	27.3	38.7	36.7	35.4	27.5	17.5	28.0	30.1	33.5	31.4	31.9	30.0	36.0	22.2	17.4	36.7	25.0	24.7	29.5	48.0	34.9	28.4
Feb 22	28.6	23.0	32.7	49.6	41.5	40.4	23.7	43.2	40.5	30.5	33.5	39.2	24.7	28.5	38.5	29.6	30.3	24.6	32.9	41.7	28.9	38.5	32.0	22.9	30.1	31.6	28.5	37.8	31.9	31.9	13.5	29.3	37.0	32.5	29.5	43.5	18.7	25.2	19.2	32.0	25.1	14.7	33.3	37.8	34.0	30.8
Feb 23	26.0	27.0	27.3	41.5	36.6	48.2	23.8	37.0	31.8	23.0	33.8	38.9	23.5	44.4	44.3	27.5	19.9	31.4	31.3	42.3	31.3	30.7	34.6	25.1	25.8	41.6	30.1	34.6	34.4	38.0	6.7	24.5	47.4	29.1	32.8	53.2	17.7	30.1	25.7	32.2	24.0	14.7	37.1	44.0	41.6	34.3
Feb 24	34.9	34.2	24.3	32.0	43.0	45.1	33.2	30.9	31.8	40.5	29.4	42.1	29.0	43.8	30.3	27.0	21.6	20.2	34.1	39.2	31.9	34.3	26.8	38.5	33.8	47.2	28.6	34.7	15.9	43.1	30.0	24.1	54.0	35.4	49.3	47.0	22.6	25.5	33.9	48.7	30.3	31.1	42.8	40.2	38.8	30.9
Feb 25	30.0	29.3	24.6	38.6	34.7	41.0	35.5	36.2	27.2	42.1	29.3	30.9	37.0	35.1	22.8	36.0	36.1	12.6	27.5	30.8	34.4	44.2	31.3	34.3	46.2	42.9	39.2	42.2	27.6	41.4	36.9	34.1	50.7	39.0	41.3	33.6	34.4	29.6	30.9	40.9	23.7	36.2	33.1	26.8	39.2	38.0
Feb 26	33.8	24.4	35.3	32.5	31.2	40.9	44.2	46.4	23.3	48.7	42.3	35.5	33.0	40.2	36.4	41.1	35.5	11.6	27.4	33.3	49.5	38.7	33.9	36.5	51.8	30.8	29.5	46.4	33.4	27.0	41.4	39.5	34.8	36.5	34.9	32.8	28.0	27.4	35.8	43.5	28.6	43.1	30.9	23.2	45.3	39.8
Feb 27	34.4	35.5	40.0	32.6	33.3	34.8	43.8	40.4	19.5	53.3	34.0	43.3	35.8	33.3	29.6	30.8	35.7	21.7	32.1	24.5	44.2	40.8	40.6	40.7	60.9	31.1	27.9	38.7	42.6	28.3	39.4	43.0	32.8	36.8	30.0	25.9	32.0	34.3	38.6	40.1	32.3	37.1	40.4	29.3	59.0	39.4
Feb 28	35.6	28.7	41.8	36.2	34.0	39.4	49.4	49.2	22.8	33.7	35.6	46.5	33.1	39.5	32.8	37.3	29.8	24.9	26.2	26.5	32.3	39.6	39.3	43.2	43.2	36.9	37.2	37.3	44.1	36.2	27.2	49.5	25.0	39.3	33.9	31.5	42.7	35.8	27.7	55.8	34.0	32.0	49.9	28.0	52.8	51.4
Feb 29	34.6	29.7	34.7	30.0	28.3	42.6	56.8	41.4	16.6	33.5	37.6	37.8	45.2	40.1	43.2	42.7	29.8	31.2	32.8	24.3	41.2	39.1	47.1	37.0	44.9	42.0	37.3	37.2	37.9	44.3	33.9	41.8	28.6	35.3	40.3	39.9	37.2	38.8	33.1	44.7	38.0	43.7	46.0	24.9	48.4	51.9
Mar 1	24.9	27.5	30.8	30.9	28.1	45.1	57.3	37.3	21.7	32.1	44.6	45.9	48.9	29.6	40.0	40.6	32.1	30.9	39.1	31.7	37.5	31.8	46.4	42.5	38.3	30.6	40.1	32.2	38.9	37.4	40.8	46.3	42.9	41.5	39.0	40.0	37.1	35.1	39.4	44.4	43.4	49.6	41.0	27.3	46.7	47.1
Mar 2	20.5	22.1	25.3	28.3	34.5	41.4	46.9	35.9	37.0	34.3	38.5	40.4	48.5	40.5	48.0	50.7	33.2	37.1	41.3	33.9	35.0	39.5	54.3	46.3	38.2	35.1	37.0	27.9	34.1	45.7	40.3	41.1	41.2	45.9	35.3	50.9	38.4	35.0	51.5	44.1	41.0	47.0	42.9	27.8	38.9	40.6
Mar 3	38.3	22.5	44.8	27.1	37.6	30.9	53.6	41.3	36.1	27.9	46.7	32.8	43.1	39.0	42.4	47.4	34.1	39.7	35.3	34.6	39.2	39.2	52.3	43.9	37.2	44.6	37.9	23.4	34.8	45.4	47.0	36.9	42.2	49.0	39.9	59.3	33.4	35.6	57.4	31.5	42.1	49.4	30.7	31.9	28.7	43.8
Mar 4	40.1	24.3	33.9	21.4	42.2	44.4	53.8	35.9	31.0	42.7	51.3	33.8	32.9	29.0	37.4	40.9	40.2	49.4	31.5	27.4	45.1	46.8	49.6	31.9	40.5	35.3	36.3	37.4	34.5	37.4	48.1	41.4	36.5	37.2	30.9	59.7	29.9	39.5	42.2	46.0	49.9	40.8	46.2	39.3	33.6	35.3
Mar 5	34.0	39.3	34.1	33.1	28.1	39.5	52.5	30.1	24.1	42.6	36.7	36.2	32.1	40.1	28.5	45.9	47.8	44.0	34.2	29.9	43.2	40.0	40.4	36.1	42.6	39.6	43.9	31.8	38.6	44.1	47.5	39.0	37.0	26.7	34.0	45.4	24.6	36.1	44.8	35.9	52.9	41.3	44.5	41.9	25.6	31.1
Mar 6	31.3	49.5	43.7	39.3	30.9	33.3	52.0	35.1	29.2	49.5	42.4	37.7	46.5	40.6	33.8	42.0	47.9	47.8	39.8	24.5	40.8	40.1	32.5	40.6	48.6	44.3	42.5	28.3	35.6	40.0	50.5	42.9	33.7	31.7	36.3	54.1	29.9	31.6	48.5	41.5	47.1	41.7	52.5	31.5	23.2	27.0
Mar 7	44.9	42.3	40.6	35.4	36.3	35.3	46.6	37.9	34.1	46.3	45.0	38.5	43.7	55.8	28.0	49.7	48.6	36.7	31.6	27.4	47.5	44.7	31.4	36.9	49.1	34.1	34.7	21.6	44.3	43.1	41.6	32.1	40.3	37.7	47.9	37.6	38.9	36.8	38.0	37.4	49.6	40.1	44.8	41.8	38.9	18.4
Mar 8	28.9	46.5	39.5	34.8	58.9	27.5	50.4	41.9	43.0	44.5	39.7	42.1	40.3	39.8	43.3	41.1	57.9	30.0	37.1	26.0	38.3	44.5	35.8	37.4	48.0	33.7	33.2	17.4	43.6	43.7	44.6	43.6	41.4	36.9	52.3	32.3	39.0	33.0	47.8	27.6	49.3	38.3	46.1	30.3	37.5	25.6
Mar 9	35.7	41.4	49.9	39.0	63.3	23.7	41.1	36.8	43.7	44.8	34.1	38.4	36.5	39.9	39.0	42.8	49.1	32.8	36.8	20.7	36.5	50.3	38.4	36.8	40.1	39.2	28.9	17.7	43.6	41.3	42.9	39.8	35.9	43.5	45.1	31.7	41.6	29.5	38.2	36.0	55.9	28.5	39.0	26.3	33.6	31.4
Mar 10	27.8	39.1	39.9	34.5	66.3	36.1	46.2	38.5	38.6	44.7	44.5	35.9	32.6	34.3	34.5	42.6	38.3	36.9	37.0	22.6	34.9	53.3	49.4	33.3	36.0	38.1	32.4	27.3	43.6	44.5	41.6	42.1	26.1	53.3	49.7	26.2	39.1	36.2	46.9	28.6	56.7	25.8	40.5	22.4	29.2	38.8
Mar 11	29.6	41.6	30.9	36.5	60.0	43.5	47.7	38.0	37.8	40.8	44.6	41.3	36.4	40.7	25.3	50.2	42.6	45.0	32.2	32.6	38.7	55.5	51.8	36.3	36.6	43.2	22.2	28.4	45.9	52.7	30.4	44.6	18.3	54.5	45.0	22.3	37.0	29.2	29.4	30.7	68.9	32.9	48.7	27.6	30.9	31.8
Mar 12	27.1	51.7	19.7	40.5	50.4	40.2	56.4	48.1	28.2	51.1	47.2	39.6	41.1	46.9	36.2	54.9	48.1	42.6	40.2	42.0	33.9	41.8	41.8	36.7	33.5	43.5	10.5	38.6	57.4	35.6	19.2	43.5	38.5	39.6	45.6	37.6	41.8	44.7	30.6	31.1	59.6	40.8	36.7	33.1	34.5	36.2
Mar 13	33.4	53.8	35.9	30.6	51.5	35.1	45.4	41.9	39.4	49.8	46.9	42.1	43.8	57.8	47.2	44.8	43.7	44.0	45.8	47.3	33.4	43.7	39.2	40.3	36.7	41.3	23.3	36.8	58.6	35.7	19.2	44.4	36.0	44.7	52.3	50.1	37.9	51.7	34.4	32.4	55.4	47.1	37.0	40.7	35.5	36.7
Mar 14	40.8	43.8	31.9	37.8	54.7	46.0	50.4	33.4	40.3	56.1	42.7	34.8	39.7	52.9	43.6	40.4	41.7	50.7	47.5	52.6	41.1	35.0	44.9	48.6	26.1	37.2	29.2	40.0	49.5	48.8	24.4	40.5	31.5	33.0	57.9	49.6	27.4	49.6	26.5	38.4	55.4	44.2	41.4	36.2	49.8	45.6
Mar 15	47.7	46.7	38.8	24.0	61.2	42.1	34.1	26.7	35.9	51.2	52.3	40.7	44.2	46.5	44.5	31.5	37.3	35.3	56.1	55.0	57.4	36.7	41.7	44.3	28.7	47.3	32.2	29.6	47.0	43.9	38.5	35.5	26.0	35.7	60.2	40.0	31.6	39.5	27.7	33.0	55.3	50.9	35.8	52.3	34.6	40.0

TABLE 5. SUMMARY AND EVALUATION OF DAILY TEMPERATURE[illegible] IN HELP MODEL 100-YEAR SYNTHETIC WEATHER DATA SET

YEAR->	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46
Mar 16	41.4	47.3	35.1	29.0	60.6	40.4	44.6	43.6	43.4	47.4	54.1	44.1	50.6	41.5	50.4	33.3	40.5	39.7	55.6	45.8	64.6	33.0	41.0	42.7	36.0	42.0	47.4	33.1	50.1	37.3	45.6	44.4	37.6	39.2	52.4	46.8	28.5	44.6	43.8	31.8	47.8	44.2	37.3	44.3	54.3	29.6
Mar 17	32.4	47.8	39.2	28.9	45.7	40.4	39.6	48.5	44.5	52.7	47.4	42.9	54.5	36.5	42.2	40.0	51.4	41.9	43.9	39.3	54.2	34.8	36.7	35.8	42.1	36.1	51.7	29.3	57.7	38.8	51.5	52.8	37.5	46.3	47.7	51.7	37.5	47.9	30.5	35.5	58.4	37.8	42.9	48.7	52.0	28.3
Mar 18	47.6	31.6	41.3	42.6	51.2	37.4	25.3	53.3	40.4	43.9	50.3	39.1	69.9	49.9	33.7	36.0	51.2	41.6	49.9	41.0	54.9	32.7	40.9	41.9	52.5	29.8	46.9	30.5	49.7	44.4	44.0	62.5	39.2	47.9	55.9	59.4	37.4	54.2	33.7	30.5	58.9	44.8	58.0	46.1	55.2	38.7
Mar 19	59.4	28.7	34.7	47.3	49.7	50.8	37.2	51.1	44.4	57.2	46.6	34.8	62.1	51.7	35.5	44.0	54.7	44.1	46.5	43.0	63.1	40.7	38.2	46.2	38.2	37.8	44.1	30.8	58.5	37.6	39.7	53.9	39.0	42.6	69.2	46.9	41.6	58.5	21.9	31.4	68.9	41.1	66.0	49.5	48.5	44.0
Mar 20	47.9	31.9	38.8	46.2	47.7	49.6	27.3	54.2	47.4	54.8	43.3	45.6	46.7	53.7	44.5	43.6	49.7	37.2	56.0	45.5	54.3	34.9	43.3	43.2	39.3	26.7	33.3	28.0	56.9	37.1	42.2	43.7	47.2	39.5	50.7	54.1	37.5	39.5	29.3	26.8	66.9	41.9	56.8	51.4	49.4	37.4
Mar 21	45.6	39.7	37.7	49.7	43.5	43.1	29.3	58.2	51.3	48.6	42.3	50.5	41.9	50.9	44.4	55.6	57.3	43.6	50.9	44.1	43.4	50.6	42.5	39.2	42.8	33.6	22.2	24.3	50.3	47.8	43.5	54.0	43.6	40.1	40.9	45.9	45.3	53.3	43.2	28.3	61.6	50.8	54.5	41.7	33.5	38.9
Mar 22	43.7	35.8	44.2	36.2	37.4	56.3	34.9	54.8	40.4	50.4	43.7	42.6	40.6	43.6	49.0	44.8	57.8	41.3	49.7	32.0	52.6	57.8	48.4	34.9	48.8	44.7	30.3	30.6	45.4	46.0	43.4	43.5	61.4	42.8	48.0	45.6	37.6	41.9	36.5	38.0	55.8	52.4	53.0	49.6	44.7	46.2
Mar 23	44.7	54.9	40.4	44.9	38.6	47.3	38.7	40.8	36.4	56.1	45.4	34.1	47.9	31.4	53.4	47.1	60.2	50.4	52.8	33.1	45.2	49.5	42.9	39.9	53.3	35.3	50.5	46.4	48.2	51.5	43.4	40.9	55.2	53.6	42.6	53.0	47.7	41.1	30.8	45.0	50.8	53.7	50.9	54.0	33.0	43.3
Mar 24	54.5	62.0	49.4	35.2	38.5	49.5	47.3	34.8	46.7	43.5	54.0	35.8	45.0	35.3	52.6	61.7	63.1	37.5	37.8	28.5	47.9	47.8	52.2	35.9	54.5	39.0	51.7	41.7	43.1	50.3	39.2	35.1	53.4	62.0	49.1	46.7	47.7	49.6	28.8	41.3	47.4	51.9	47.6	42.3	47.0	44.7
Mar 25	57.0	59.8	46.5	34.9	42.5	56.4	43.3	34.2	51.6	43.6	53.2	42.6	46.5	41.1	55.5	49.5	68.9	41.6	38.3	32.4	49.7	47.4	53.4	43.3	48.5	40.9	46.5	31.4	47.3	51.1	34.6	39.7	53.0	59.1	45.8	54.7	44.0	49.9	45.8	44.2	42.4	53.9	47.7	52.0	51.8	42.6
Mar 26	58.8	61.0	39.9	28.9	41.7	51.2	38.3	34.8	51.9	49.2	41.3	42.0	45.9	41.3	54.3	54.2	67.2	52.0	45.7	36.7	53.2	46.8	44.8	41.7	46.4	47.1	47.9	40.5	47.4	56.0	27.5	47.8	46.2	52.3	34.7	46.0	52.2	64.0	45.7	45.5	50.9	49.2	45.9	57.2	54.1	34.7
Mar 27	44.8	49.7	37.8	37.5	42.7	45.1	36.9	34.9	48.6	46.7	40.7	41.9	55.7	31.9	60.8	37.2	67.1	61.7	48.2	45.1	44.2	41.9	44.8	44.2	39.5	68.7	45.3	32.6	41.9	47.5	39.2	56.1	36.2	52.1	38.2	39.2	52.2	55.5	40.7	35.4	53.6	39.8	45.0	43.0	56.3	51.1
Mar 28	53.2	53.4	27.9	42.0	36.4	43.0	43.1	41.1	56.0	37.5	44.2	41.9	57.5	44.0	66.6	35.9	62.5	53.3	43.0	38.0	41.1	43.5	40.2	46.0	49.5	71.7	40.1	32.6	52.2	55.1	46.2	50.2	34.8	51.4	48.0	33.0	46.2	54.2	46.6	32.8	64.4	41.4	37.7	53.0	42.7	52.9
Mar 29	58.4	52.6	40.3	51.8	41.6	45.0	36.9	50.4	49.3	35.7	34.9	50.7	54.0	34.3	62.8	35.2	54.4	66.1	35.4	50.8	43.2	47.5	52.2	41.0	45.4	70.9	47.8	43.6	49.5	57.7	40.7	48.3	42.6	44.5	50.6	30.9	33.3	62.0	44.8	38.7	52.1	32.9	50.8	57.1	37.2	53.4
Mar 30	52.9	57.1	38.5	50.6	38.0	46.9	31.0	51.4	54.7	45.5	35.9	54.6	49.9	42.2	53.2	46.4	54.6	69.5	44.0	47.6	55.0	44.1	35.2	42.3	44.2	54.3	51.9	48.4	36.6	42.8	35.5	48.1	38.8	46.7	58.0	38.8	35.0	65.6	50.0	45.9	47.6	33.7	61.7	55.9	33.3	53.6
Mar 31	48.0	49.8	41.1	40.4	38.0	35.9	45.9	53.6	44.4	49.2	37.0	51.5	49.9	46.6	54.1	39.8	49.7	66.8	40.2	42.1	49.3	43.9	33.8	45.3	37.5	62.9	50.3	47.2	41.3	54.8	29.7	34.7	37.2	27.8	52.2	25.1	24.2	58.4	45.0	41.2	52.6	24.9	66.3	46.6	30.3	50.7
Apr 1	61.3	51.9	43.8	31.0	29.4	33.6	53.3	43.0	34.4	38.3	28.2	48.8	48.0	39.6	49.2	45.0	57.7	56.9	30.3	32.7	57.6	50.6	35.6	27.2	38.3	59.8	55.1	41.7	46.0	47.0	43.3	34.7	31.5	28.2	35.5	35.5	33.7	51.3	43.1	44.7	58.5	38.6	58.1	40.5	36.4	40.8
Apr 2	57.1	55.7	42.4	37.7	26.4	39.1	47.1	51.1	37.7	40.3	39.4	59.7	51.4	44.9	48.6	54.8	58.3	58.9	36.6	38.2	51.8	40.0	36.8	24.0	31.7	58.9	62.3	42.3	42.6	47.3	31.9	34.3	50.5	40.1	36.8	37.3	36.8	54.5	52.1	43.8	45.2	40.4	50.6	45.4	42.5	36.9
Apr 3	37.6	52.6	42.2	44.9	39.1	46.7	50.7	33.1	44.3	35.5	25.4	56.1	51.9	46.7	53.5	63.5	51.3	49.6	38.7	36.6	51.1	42.6	37.4	28.7	43.9	43.3	58.8	40.1	56.7	47.5	42.0	46.3	38.8	34.6	47.6	47.4	49.2	44.8	58.4	53.9	45.7	49.4	48.7	37.8	50.6	33.2
Apr 4	40.8	43.8	42.8	37.5	37.5	59.8	52.1	41.8	42.1	37.0	36.6	46.8	40.0	48.7	51.8	57.1	56.0	51.1	35.6	37.1	45.6	31.2	32.5	29.5	37.0	50.5	57.3	37.8	47.1	55.6	43.8	55.1	40.3	35.5	43.8	47.4	39.3	44.5	59.7	63.9	41.4	43.5	48.8	37.3	45.9	43.3
Apr 5	32.9	44.5	38.0	51.8	34.0	60.2	52.6	35.3	44.7	31.6	44.4	41.5	42.7	56.7	47.1	60.0	40.6	53.2	40.9	34.1	60.2	48.2	38.3	32.0	28.3	44.5	64.4	32.3	41.4	59.2	43.1	59.2	35.8	42.5	45.6	39.9	46.6	44.4	55.7	63.6	44.7	44.1	62.4	45.6	49.7	38.6
Apr 6	34.4	39.6	44.2	50.3	38.0	62.1	42.9	45.0	45.7	41.6	56.5	48.3	37.4	50.6	61.3	49.3	58.9	43.7	50.3	43.3	47.9	36.6	36.5	31.1	33.2	45.2	62.5	42.3	40.5	57.6	49.9	53.6	41.3	38.2	40.9	44.1	41.7	45.7	56.9	55.2	52.1	43.8	58.2	62.6	54.6	37.8
Apr 7	39.5	47.9	38.2	52.7	36.3	59.3	33.5	53.6	38.8	41.8	54.8	54.4	39.1	45.1	52.0	52.9	44.7	44.2	37.6	46.8	39.8	45.0	44.5	33.0	46.3	46.8	47.6	43.2	31.7	42.4	41.3	64.7	47.3	44.4	39.2	42.5	39.7	53.9	54.4	46.5	61.9	54.0	63.2	53.1	60.3	37.0
Apr 8	26.1	45.3	45.3	52.5	31.7	54.4	36.5	41.3	42.3	49.9	46.4	46.5	45.5	39.9	54.9	55.8	43.7	48.3	39.7	54.3	36.8	46.7	35.2	43.2	37.5	37.7	57.3	49.9	42.7	53.5	43.2	63.6	39.4	44.0	39.0	51.1	51.4	48.1	55.8	42.0	57.8	47.7	49.7	59.5	56.9	43.9
Apr 9	46.9	41.2	47.8	53.5	41.3	50.5	40.3	45.0	56.5	42.6	34.0	40.8	42.7	41.0	52.3	64.8	49.0	36.0	42.1	62.1	39.6	44.0	36.7	45.4	42.0	46.1	62.7	39.8	47.3	39.1	36.0	45.6	32.3	43.5	36.6	41.2	59.4	41.3	51.2	44.6	53.0	57.9	59.6	61.7	65.4	43.1
Apr 10	35.7	54.6	54.3	49.7	33.2	66.0	37.4	49.8	56.9	39.0	33.3	39.8	38.7	51.6	44.8	57.5	53.7	34.2	43.4	56.0	37.8	48.3	36.5	47.1	41.5	31.9	60.5	56.7	51.4	34.4	40.2	42.9	38.4	38.1	52.5	44.8	62.0	48.5	54.1	52.8	39.7	56.3	58.8	59.9	51.3	37.2
Apr 11	39.3	68.9	49.4	42.3	31.1	59.8	40.7	49.2	68.3	47.6	39.2	40.0	54.3	56.5	47.5	55.3	44.9	33.2	38.4	66.6	32.2	48.0	46.0	50.2	41.9	33.7	49.1	44.3	54.4	34.4	37.9	61.9	42.6	34.9	53.0	48.2	51.0	48.6	39.3	54.4	42.1	54.4	54.9	61.2	57.2	54.5
Apr 12	45.6	62.4	40.4	43.1	45.0	49.7	34.1	51.4	59.0	52.8	53.1	49.9	64.4	64.9	48.6	49.0	40.2	37.4	54.5	54.8	29.5	55.2	45.0	46.2	38.9	31.8	54.8	56.7	58.5	37.1	47.5	58.7	43.5	34.0	52.4	48.4	49.6	57.1	39.4	56.4	52.8	59.8	55.9	62.5	57.1	37.8
Apr 13	53.3	66.4	52.2	41.6	37.1	46.7	44.6	62.9	54.0	46.8	58.3	48.9	61.0	63.7	58.0	45.5	49.1	40.5	56.0	77.2	24.9	57.2	46.3	42.7	34.0	45.0	52.6	58.0	60.1	28.0	43.0	46.5	49.3	41.6	64.2	47.8	54.9	52.9	30.3	51.6	51.9	60.0	46.7	59.7	63.3	32.9
Apr 14	47.8	56.6	49.8	37.9	37.0	52.7	53.9	62.9	53.2	47.3	64.9	51.0	65.3	57.6	59.8	45.8	43.2	38.2	59.2	82.1	31.7	58.3	57.4	44.1	42.8	48.4	54.6	54.0	50.4	41.0	45.3	44.9	50.9	43.2	60.2	60.7	58.3	54.4	37.7	45.0	47.7	51.2	55.9	53.4	52.7	44.5
Apr 15	53.9	50.6	46.8	36.9	41.1	53.5	58.0	57.9	61.9	51.1	49.7	52.6	50.7	54.1	61.2	48.8	48.4	49.4	66.6	68.7	44.7	67.1	41.8	55.3	40.7	49.4	39.2	45.9	60.6	51.3	41.2	34.8	61.5	43.7	62.4	53.6	61.3	55.2	35.9	49.2	56.7	52.6	62.1	45.7	50.4	56.8
Apr 16	63.6	42.7	48.9	37.4	40.6	41.9	68.6	59.7	50.0	54.4	46.7	60.2	57.9	61.8	56.5	40.7	54.9	39.5	58.7	54.8	57.4	62.1	46.2	46.3	35.4	51.0	43.7	47.5	55.9	45.7	40.9	56.8	64.6	48.2	60.6	60.3	62.3	53.5	38.8	38.0	57.9	57.7	53.3	46.4	54.2	64.3
Apr 17	66.3	51.2	62.0	46.3	42.9	53.5	59.3	45.3	47.7	51.2	49.9	61.1	53.1	57.5	58.3	44.2	45.8	40.9	49.5	46.6	60.7	53.3	45.6	42.2	50.7	45.5	48.3	45.8	59.8	51.0	35.9	53.9	60.8	50.1	55.2	56.5	52.6	49.6	38.4	42.1	61.9	63.1	56.8	61.8	55.3	56.0
Apr 18	71.6	55.2	56.2	45.3	39.4	58.9	52.5	49.0	50.9	52.7	60.5	51.4	44.5	66.4	46.9	42.5	45.3	53.2	53.5	45.6	64.1	52.4	38.5	43.2	50.2	49.3	53.0	31.1	54.6	53.1	40.2	62.8	60.5	49.8	54.0	59.6	55.6	58.6	39.0	48.9	60.8	70.4	64.3	54.6	60.1	53.7
Apr 19	68.8	44.1	60.8	58.2	52.1	49.7	46.3	54.6	57.3	60.8	64.8	45.7	48.9	57.2	50.8	51.6	38.9	40.6	59.5	48.0	50.5	55.8	33.3	40.9	63.2	61.7	62.3	38.7	67.6	60.2	35.3	64.3	61.1	46.1	42.2	55.6	51.4	65.1	50.6	51.4	50.4	64.0	62.4	47.4	53.0	54.3
Apr 20	70.6	50.3	60.0	67.3	48.2	52.5	43.2	58.1	59.6	62.4	57.3	54.6	51.0	54.9	54.2	57.8	40.2	45.2	52.6	55.3	54.7	48.6	44.0	45.7	63.6	68.0	61.5	41.7	58.7	57.0	47.5	64.8	55.2	46.1	44.0	61.3	48.3	61.9	41.3	50.2	49.4	58.9	62.2	51.3	61.7	60.8
Apr 21	55.7	53.3	62.5	57.1	58.2	57.3	56.4	57.5	52.2	63.7	63.3	49.2	46.0	55.1	53.1	64.7	40.0	47.1	52.3	55.5	47.2	42.9	45.5	51.3	60.5	71.7	55.3	43.5	49.3	58.5	50.9	66.0	51.0	40.1	46.8	63.8	47.0	58.3	45.5	42.5	50.5	56.4	59.2	50.3	65.1	57.2
Apr 22	47.3	59.1	59.4	51.1	61.9	45.3	50.5	60.8	53.2	67.3	66.7	40.9	51.4	55.8	49.9	61.9	53.7	58.0	58.9	55.2	52.4	53.9	44.6	55.6	63.8	56.4	52.8	50.5	48.2	50.2	47.6	53.6	58.0	32.7	36.1	67.1	56.1	51.3	46.3	37.6	54.6	53.1	59.6	49.7	56.4	54.5
Apr 23	51.2	64.7	63.7	50.8	61.4	40.7	42.9	47.9	44.9	63.3	57.7	40.3	62.8	57.2	51.3	51.6	54.0	46.6	61.4	49.3	50.3	55.6	45.0	51.1	73.2	66.6	52.3	47.0	48.0	53.8	45.9	58.4	49.7	35.0	49.8	67.3	50.7	48.5	44.9	43.6	57.6	57.9	56.7	41.2	61.2	54.1
Apr 24	52.5	62.5	55.4	60.1	46.7	43.3	51.7	47.5	46.4	54.9	52.9	45.8	70.6	47.3	42.8	70.9	53.7	35.3	53.5	49.2	47.7	45.4	53.8	45.0	68.2	52.5	52.7	45.3	49.8	53.3	52.6	59.5	51.1	51.7	43.8	62.0	53.3	49.3	51.8	43.7	47.1	50.1	58.1	33.0	58.8	48.1
Apr 25	45.3	51.0	63.1	56.0	46.5	40.7	46.7	44.1	51.4	46.3	57.0	47.0	71.1	41.5	40.3	69.6	58.4	39.9	58.7	71.4	48.6	52.1	53.3	45.5	62.5	58.2	46.2	48.3	42.7	62.3	56.8	53.7	54.1	49.2	55.3	63.3	58.2	55.7	56.2	39.6	47.2	53.0	53.0	41.1	62.5	68.7
Apr 26	55.3	50.5	61.5	55.3	49.2	39.4	58.3	48.1	65.3	46.0	62.1	58.4	57.8	52.9	49.9	56.2	47.2	49.0	64.7	56.2	54.6	62.4	45.1	46.2	74.6	62.3	46.5	47.1	43.8	65.4	61.3	54.0	54.0	48.1	52.8	61.9	53.9	58.7	54.9	51.7	47.1	54.5	52.2	44.1	52.9	59.7
Apr 27	42.9	39.0	68.1	48.1	47.9	51.1	63.7	49.9	56.3	43.2	66.3	61.7	52.0	48.9	53.5	48.2	43.7	51.4	69.4	68.7	44.3	49.8	41.3	58.0	75.5	52.8	51.9	52.3	40.0	73.0	62.4	58.6	47.3	50.2	53.1	64.7	62.2	52.3	56.2	61.3	51.5	73.5	54.7	40.5	54.1	55.9
Apr 28	47.9	53.6	57.1	51.9	52.5	44.9	59.3	61.6	51.9	47.8	61.7	66.2	53.4	55.8	59.7	49.7	61.2	47.9	54.3	69.2	45.6	46.4	48.6	63.5	64.0	49.3	58.2	52.2	31.2	55.0	55.3	61.7	53.2	49.5	57.6	65.2	52.0	55.4	50.8	56.3	43.8	73.8	47.7	59.3	55.7	45.4
Apr 29	54.2	57.4	53.0	49.7	60.5	53.9	54.8	61.3	52.8	54.2	64.5	63.1	49.1	60.4	49.3	50.7	60.6	51.8	60.6	59.6	38.0	56.6	58.2	58.9	62.2	61.7	57.6	48.5	55.8	57.2	44.2	65.3	57.3	53.5	57.2	65.5	47.1	63.5	43.5	58.7	44.1	72.4	46.3	56.9	53.3	48.5
Apr 30	52.1	56.1	58.8	56.4	62.9	51.9	59.0	61.7	54.4	52.3	62.0	71.2	58.4	53.6	50.8	53.5	56.2	44.7	44.0	57.8	51.1	49.3	55.3	45.9	59.4	60.7	53.8	51.4	55.9	53.2	50.7	56.8	46.2	47.0	57.0	59.2	44.8	68.7	39.0	55.4	43.7	65.9	50.0	47.4	57.3	48.0
May 1	55.7	61.2	51.6	59.0	52.7	53.4	55.0	59.8	54.4	53.3	56.0	60.4	57.0	54.3	57.0	57.6	54.9	48.4	50.2	65.4	62.7	45.4	51.3	47.6	59.1	56.1	46.0	63.0	48.5	64.9	55.4	61.3	51.9	49.9	56.8	50.1	57.3	64.4	50.5	46.9	48.3	65.4	57.9	42.8	45.9	50.3
May 2	55.8	48.9	54.0	60.2	42.2	63.5	60.6	59.3	51.9	54.8	57.5	56.1	51.5	58.3	55.2	53.0	58.7	50.6	43.7	71.7	60.1	50.8	55.7	51.4	59.1	52.0	52.0	69.7	50.2	62.9	49.4	73.1	61.2	59.2	58.0	42.6	55.3	56.7	58.3	52.0	52.0	68.2	56.0	45.4	56.6	56.0
May 3	64.0	60.5	51.8	66.0	52.7	61.3	60.1	60.0	57.4	54.8	55.7	56.9	54.1	61.7	67.0	50.2	50.3	59.3	51.0	64.9	60.8	56.1	50.1	51.0	65.3	45.8	52.2	54.5	56.4	64.7	46.4	60.8	49.7	51.0	56.2	48.8	54.3	52.4	56.3	48.1	54.8	67.4	60.6	44.2	55.3	50.8
May 4	62.7	67.7	47.7	64.3	52.3	57.2	57.7	55.7	61.0	55.5	55.2	60.9	59.1	67.2	75.2	54.2	44.3	55.3	57.3	63.4	54.9	44.7	52.4	45.1	49.2	43.1	49.5	50.9	47.9	69.2	50.0	54.2	52.2	58.8	56.4	58.7	46.9	65.1	56.5	53.5	55.5	60.2	63.3	45.9	59.3	57.9
May 5	59.8	52.6	61.1	56.1	54.9	65.4	53.1	65.7	62.3	56.2	52.2	51.8	54.1	60.0	62.3	60.8	49.9	55.8	57.2	64.1	51.3	59.6	64.4	59.6	52.1	56.9	47.7	48.1	47.1	57.0	49.1	51.3	49.7	52.7	59.1	50.9	51.4	66.5	50.8	55.5	53.7	61.7	50.8	55.4	51.4	50.6
May 6	55.8	58.9	59.3	56.1	61.3	57.4	59.2	61.3	55.4	61.4	48.1	55.4	50.1	57.0	59.3	50.4	44.8	47.7	52.0	60.9	45.8	60.2	60.9	64.3	49.9	55.8	43.0	57.2	46.2	51.8	54.7	57.8	64.0	60.1	54.3	44.1	48.8	61.8	59.2	48.4	46.7	63.4	57.4	68.6	53.1	61.2
May 7	58.7	63.8	57.1	59.8	60.2	55.6	55.2	64.5	57.5	68.6	54.0	61.5	47.7	56.1	63.7	63.8	52.7	55.6	52.6	57.4	55.4	69.5	68.2	61.7	59.5	62.1	56.4	47.4	52.9	62.6	59.1	47.7	65.9	62.3	59.5	43.1	52.8	55.5	50.2	42.6	48.1	59.7	63.9	65.1	50.4	57.4
May 8	64.9	64.5	57.8	57.3	60.0	58.2	50.8	74.3	61.5	58.9	59.9	59.5	47.1	54.0	65.9	53.8	56.7	53.4	46.0	63.4	51.4	64.7	54.9	62.9	52.2	62.9	59.5	48.5	55.8	57.0	64.7	44.4	65.0	61.6	73.2	36.2	53.5	50.0	49.5	36.7	55.1	53.6	59.4	67.0	42.9	62.4
May 9	55.2	61.5	59.0	62.7	58.4	55.5	54.4	66.5	55.6	57.8	62.9	58.9	50.7	46.0	60.0	48.1	52.6	58.9	46.9	64.0	56.8	64.2	58.3	62.4	55.2	61.2	64.5	48.3	56.1	51.5	66.6	48.4	59.1	53.7	60.7	58.3	62.4	57.4	48.5	47.8	60.2	51.9	61.9	69.2	52.2	62.4
May 10	58.5	62.6	64.0	63.0	51.3	46.5	58.7	66.0	61.4	62.3	61.7	60.8	57.5	52.4	68.1	60.0	56.0	52.7	55.5	61.7	55.9	66.3	70.1	56.7	39.8	55.4	67.1	56.7	59.3	50.2	59.1	42.2	53.8	48.0	54.0	52.3	63.9	69.3	44.3	53.4	68.5	47.9	58.8	62.5	53.6	55.9
May 11	63.4	60.3	54.0	68.4	52.2	58.7	55.9	72.6	51.6	58.9	53.8	59.2	53.7	46.0	62.3	59.5	61.2	54.6	50.0	55.0	56.8	53.7	60.2	66.6	46.4	60.0	64.1	52.4	59.3	49.1	60.2	46.4	57.4	46.1	56.5	52.9	67.1	67.8	50.9	55.6	63.1	46.3	65.5	61.4	55.0	56.5
May 12	63.7	56.3	56.9	68.7	60.4	68.0	59.5	62.5	50.9	58.6	56.9	63.3	55.3	55.1	62.1	61.3	63.3	53.9	62.3	51.8	55.0	53.4	59.1	56.0	51.3	53.4	67.3	54.9	56.4	58.3	50.1	50.0	55.4	44.4	61.9	51.0	70.4	61.9	48.4	57.8	57.1	56.8	62.1	53.5	57.4	66.3
May 13	58.9	48.7	58.1	61.4	63.8	70.9	57.9	52.1	57.0	64.2	54.2	67.3	57.7	54.1	69.0	64.8	71.9	46.5	59.6	60.1	56.8	59.2	53.7	52.5	49.6	59.5	61.6	52.0	58.2	66.0	58.6	59.9	52.9	62.4	53.0	53.3	68.6	61.5	55.7	70.3	64.6	57.2	68.5	44.6	65.7	69.4
May 14	62.3	44.4	60.1	57.0	63.6	70.6	48.7	51.2	57.2	56.5	53.4	60.8	62.5	49.0	69.2	61.1	66.3	49.2	60.9	53.1	52.5	52.4	60.7	60.1	57.7	65.6	56.3	61.2	67.7	68.4	62.1	65.3	50.4	60.1	62.7	52.0	68.2	59.0	56.7	62.6	61.0	58.9	61.7	50.4	65.8	67.3
May 15	62.0	41.2	60.4	66.9	70.9	70.6	56.2	57.9	60.1	58.6	54.9	55.3	61.5	54.5	57.5	66.7	62.8	60.2	53.5	56.1	48.7	48.6	78.1	49.5	56.2	62.7	64.2	55.5	65.4	65.6	52.7	65.1	51.0	57.8	61.5	67.8	61.2	59.2	53.8	71.5	64.0	54.8	52.9	54.6	67.3	59.5
May 16	58.4	40.6	56.4	69.8	70.7	62.9	51.2	55.4	58.6	62.6	61.9	51.0	72.7	56.8	61.8	64.1	62.9	64.1	59.3	62.8	47.6	52.7	69.4	50.7	66.4	50.6	63.9	48.4	58.1	58.2	52.1	61.8	57.4	61.5	66.4	58.9	58.1	54.8	64.8	68.8	51.5	61.2	57.6	56.9	60.5	57.0
May 17	60.7	45.4	60.2	66.6	62.2	67.6	58.6	64.4	60.8	65.6	60.2	60.9	66.9	65.9	60.4	57.1	63.0	66.3	62.2	63.2	62.0	57.2	75.6	54.1	61.4	51.0	55.6	51.5	65.7	55.2	57.6	62.9	56.9	62.3	70.7	66.7	56.9	62.4	68.5	71.6	53.9	58.6	67.1	53.8	57.6	57.8
May 18	57.7	50.6	55.4	60.1	53.4	68.3	64.4	68.6	59.2	65.4	61.3	55.6	74.1	70.7	64.3	57.1	63.6	63.2	66.4	59.5	64.4	64.5	71.6	56.4	59.4	47.9	70.0	49.3	63.7	59.3	58.1	72.2	68.2	64.5	70.9	66.9	58.2	66.8	66.6	78.2	59.1	62.3	60.1	52.7	59.1	60.4
May 19	59.9	60.5	51.7	57.4	60.5	74.7	67.8	61.4	54.9	67.6	62.6	60.4	70.1	72.6	57.0	56.2	59.1	49.6	58.8	59.8	62.5	59.4	70.0	57.4	53.4	54.2	66.3	54.8	63.6	56.7	64.4	69.2	68.7	68.7	73.0	63.5	64.6	67.7	56.7	69.1	49.7	64.1	63.2	60.5	60.3	57.7
May 20	52.8	56.0	53.9	52.8	59.8	73.0	61.8	57.6	59.0	60.1	66.5	64.7	71.2	79.4	61.0	56.9	59.3	58.1	53.4	59.1	59.3	62.9	62.4	61.8	49.2	58.5	64.1	58.6	62.8	59.5	62.0	74.0	68.7	60.2	67.3	59.4	60.7	69.1	53.7	62.1	56.0	57.0	64.5	62.2	66.4	59.6
May 21	61.6	62.4	61.6	55.6	57.5	64.5	63.9	48.7	60.5	54.3	76.3	64.6	66.3	70.1	55.7	61.4	68.0	54.0	56.7	63.1	71.9	59.1	60.4	62.6	58.0	73.6	58.8	60.9	55.0	65.7	61.0	75.5	67.7	66.9	64.4	55.3	54.5	69.7	53.9	57.0	56.3	59.3	55.9	65.6	64.2	67.4
May 22	62.3	60.1	63.8	60.7	64.7	60.9	60.7	48.9	67.6	58.2	71.6	52.9	68.4	66.0	73.4	61.5	60.8	56.2	56.5	61.0	72.8	57.3	60.1	57.9	57.9	79.5	58.8	57.1	57.9	63.5	59.7	68.4	72.5	69.9	66.0	54.1	60.0	70.4	60.3	65.9	48.6	57.1	49.9	60.0	66.6	66.2
May 23	51.5	55.2	64.1	62.9	61.7	62.7	60.1	55.0	66.8	66.6	70.8	58.6	65.3	65.9	71.0	64.6	60.8	65.0	51.3	61.2	77.3	60.9	67.0	54.7	62.5	82.6	63.4	56.7	66.0	65.4	61.4	59.0	59.5	67.2	69.4	54.9	65.7	70.4	65.3	59.9	54.0	60.0	50.3	57.5	62.4	59.8
May 24	57.5	55.3	63.7	61.2	72.2	68.1	49.7	50.5	62.5	61.8	70.8	64.5	67.1	61.4	60.5	58.2	54.2	69.2	64.6	69.1	71.5	57.5	56.5	53.4	58.9	72.6	54.8	62.5	61.7	64.9	65.9	61.3	59.2	60.1	64.0	57.6	61.3	73.8	71.4	67.2	52.6	57.5	51.3	65.0	64.1	67.5
May 25	53.5	62.1	61.3	58.6	72.7	59.5	47.2	56.5	55.6	65.4	69.7	55.8	68.8	66.5	61.2	57.0	57.2	80.8	60.9	62.8	71.1	55.9	52.9	58.4	54.7	66.6	65.2	59.9	66.3	63.4	65.3	66.5	66.0	64.2	71.3	48.7	74.5	65.5	72.7	66.3	51.6	57.3	63.7	62.7	73.1	68.9
May 26	62.4	62.1	58.2	51.0	64.0	66.0	57.2	62.1	65.4	65.3	66.8	53.5	62.7	65.0	71.9	62.9	65.5	75.2	62.2	59.4	67.0	62.4	53.9	56.7	55.3	63.7	65.4	58.5	71.2	65.7	68.3	61.4	63.3	59.9	72.3	49.8	65.5	75.1	71.5	74.2	53.2	58.8	63.3	58.3	66.6	69.7
May 27	65.7	64.1	58.0	47.4	70.9	59.8	58.3	50.2	63.2	55.6	67.6	57.0	56.8	68.7	70.9	73.2	71.5	77.1	63.4	65.0	70.1	64.7	55.4	60.4	54.3	62.3	64.6	65.8	65.1	68.4	71.4	59.7	63.1	66.3	78.7	54.3	66.9	64.4	65.4	71.3	54.4	56.8	60.1	71.0	64.2	68.0
May 28	64.9	52.5	67.3	52.8	67.5	66.6	68.8	51.6	64.4	65.0	64.1	60.7	59.4	60.0	62.5	72.2	76.2	80.0	68.2	68.6	58.5	64.4	56.5	69.7	47.6	60.2	70.2	72.5	69.3	62.3	68.3	57.2	67.5	61.2	71.0	57.0	60.0	66.2	72.6	67.4	62.6	56.4	59.5	64.3	69.3	75.2
May 29	72.8	59.5	66.7	52.3	70.9	68.4	75.0	62.6	67.0	63.0	63.5	66.9	67.2	66.2	59.5	70.4	77.0	80.2	62.7	65.7	60.6	58.3	62.1	68.3	50.1	69.9	68.3	74.0	77.6	61.9	65.7	55.5	69.9	60.8	64.7	63.0	63.0	66.1	68.6	64.2	70.4	64.8	56.7	59.3	69.2	70.4

YEAR->	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46
May 30	70.7	58.5	70.8	57.9	65.7	63.6	69.7	66.2	72.9	60.4	66.9	52.7	62.9	68.7	64.3	67.3	75.5	75.0	63.5	69.2	63.2	59.9	64.0	71.1	56.9	71.6	72.2	70.6	78.5	63.8	63.8	61.6	73.8	64.3	69.0	66.8	60.8	64.3	70.9	54.1	68.2	63.8	66.2	54.9	66.2	76.0
May 31	72.4	63.3	76.2	60.1	61.4	73.4	70.1	62.0	73.1	66.4	69.4	53.9	67.2	58.7	73.3	61.8	74.3	69.1	64.7	57.2	67.4	56.0	65.9	75.7	57.9	72.8	67.3	70.7	73.9	65.6	62.6	63.8	64.5	65.0	66.9	71.0	72.6	66.6	65.7	55.7	71.2	68.6	72.8	56.0	67.5	68.5
Jun 1	83.2	60.0	76.3	58.2	62.8	73.5	70.4	61.7	80.7	62.1	78.2	59.9	72.5	69.5	74.7	63.9	77.5	66.4	64.2	51.0	66.1	63.3	65.3	79.6	66.3	73.4	71.8	76.8	69.7	66.1	57.2	67.6	61.9	65.7	70.1	66.2	76.2	68.6	52.9	52.7	69.3	72.1	70.4	58.6	59.2	60.6
Jun 2	73.7	56.2	76.8	61.2	67.5	69.8	68.5	69.9	77.7	69.0	78.4	62.8	70.4	70.4	74.1	65.2	70.5	69.6	60.6	57.6	65.7	67.4	66.9	81.0	71.9	73.8	69.5	66.9	62.8	66.6	60.8	63.2	59.4	71.1	69.0	71.1	77.9	67.5	57.5	49.5	72.8	68.3	66.4	61.0	59.9	58.5
Jun 3	65.7	55.5	70.8	68.4	64.7	64.3	66.0	65.5	79.6	63.9	74.2	66.6	69.7	68.4	67.9	62.4	72.4	63.6	63.6	57.4	63.4	66.6	60.6	73.4	69.0	71.0	70.7	71.0	66.2	68.5	61.5	65.1	59.0	73.4	73.7	69.5	67.1	60.8	64.3	63.7	74.0	71.7	70.3	57.1	63.3	74.9
Jun 4	68.5	63.5	79.6	70.2	61.8	63.1	62.9	69.5	75.9	68.1	72.9	69.8	68.7	71.3	70.2	61.9	77.4	64.9	64.4	59.3	70.6	66.1	67.9	70.5	75.4	75.8	68.0	62.9	69.8	70.2	57.8	69.2	64.3	73.9	75.2	68.8	64.5	64.3	60.0	67.1	65.3	68.6	68.0	69.3	59.9	77.7
Jun 5	75.0	64.8	71.8	70.8	64.4	60.5	62.8	68.6	76.5	67.5	70.2	67.8	68.9	75.3	67.8	69.7	73.8	67.0	62.7	66.8	70.4	64.6	63.5	62.9	74.8	68.0	61.7	69.7	72.2	62.7	67.8	65.4	66.1	76.5	72.6	75.5	70.2	69.1	60.0	71.0	69.8	67.8	64.5	63.9	60.9	75.2
Jun 6	74.9	66.6	67.6	68.2	64.9	66.9	66.7	72.7	81.3	70.7	58.7	67.8	69.9	76.9	65.4	72.1	71.4	68.5	59.9	72.7	69.7	72.9	62.4	64.5	70.5	69.8	67.8	59.0	76.6	69.1	72.2	73.0	71.2	76.7	70.9	71.1	60.0	61.5	68.6	70.4	70.1	72.8	66.7	69.5	67.8	72.8
Jun 7	74.3	66.9	62.9	64.8	62.6	72.7	68.8	75.2	72.0	72.5	62.7	64.8	73.4	80.6	66.9	72.3	63.9	71.4	55.7	60.2	72.0	75.5	65.0	69.3	67.5	71.7	64.9	59.9	76.1	63.6	72.5	70.7	70.1	68.2	67.7	67.6	62.5	62.3	67.3	60.8	66.2	77.1	54.1	70.5	72.3	71.6
Jun 8	73.8	77.8	58.9	66.7	69.8	71.2	70.0	76.5	69.2	74.6	59.0	61.3	75.4	70.9	71.6	76.6	60.3	74.0	58.6	63.9	63.6	70.0	60.9	73.7	66.2	73.7	71.6	64.7	67.4	65.9	73.1	69.9	66.3	63.3	64.2	65.0	61.7	65.5	65.9	65.2	61.6	71.6	70.3	66.8	72.3	78.3
Jun 9	73.7	75.9	63.7	65.2	78.8	68.7	66.4	70.3	70.3	77.9	67.1	66.4	66.2	67.3	71.3	68.4	65.0	66.6	71.1	59.4	66.6	73.6	67.2	78.0	60.8	75.7	67.5	63.6	71.6	63.6	71.6	66.0	64.7	64.3	66.0	69.3	66.0	68.2	64.9	72.5	63.5	75.4	69.5	70.2	71.6	67.6
Jun 10	71.2	68.8	59.6	63.6	77.6	68.1	74.9	68.8	62.9	74.4	74.8	66.6	64.3	64.1	72.7	72.9	54.5	69.8	72.5	62.4	71.2	76.7	63.9	80.3	63.4	74.3	71.7	65.2	76.1	64.5	71.2	70.4	63.7	64.3	71.2	76.0	71.2	58.4	68.3	60.4	65.1	74.8	71.6	73.8	72.4	69.1
Jun 11	76.8	69.0	59.3	67.5	81.4	62.7	70.2	64.8	58.3	73.5	75.6	71.7	66.2	66.2	72.0	74.8	56.0	59.8	75.8	64.6	65.0	71.6	63.4	80.0	66.3	74.1	71.0	67.0	72.6	64.1	67.9	70.9	64.6	69.5	75.8	71.2	62.7	63.2	72.7	72.8	64.8	70.6	75.8	66.4	75.7	68.5
Jun 12	67.5	64.7	58.6	68.8	73.7	60.9	69.6	68.2	60.8	75.9	68.4	71.1	69.3	66.1	73.7	72.4	49.9	53.7	75.0	67.9	65.3	69.0	64.2	80.0	64.9	80.1	74.9	68.6	72.9	70.4	75.8	77.5	65.6	63.6	71.6	70.1	63.7	70.3	74.7	77.1	70.1	65.7	79.8	69.5	72.3	68.9
Jun 13	63.8	67.7	55.8	69.9	62.0	61.1	65.3	62.2	76.3	73.5	73.6	68.4	63.2	68.1	73.0	68.7	57.8	59.9	71.8	71.6	66.5	73.5	65.7	79.3	60.5	77.7	76.5	70.2	66.6	80.7	70.3	65.7	66.5	67.0	79.1	71.4	66.0	64.6	67.9	76.8	73.4	69.0	72.2	66.3	66.1	67.2
Jun 14	64.7	64.6	60.6	72.0	64.6	69.0	67.6	62.7	75.8	78.2	73.1	66.1	72.4	68.8	79.8	69.3	61.5	66.7	70.4	69.4	69.4	75.0	63.0	75.7	68.8	79.3	76.3	63.9	69.5	76.9	67.9	65.1	65.4	73.5	78.1	79.1	69.2	68.1	71.0	76.5	69.6	65.4	75.8	64.4	63.6	68.3
Jun 15	68.4	63.4	69.8	65.5	71.0	70.8	66.6	65.9	76.2	74.9	71.1	68.0	76.3	63.0	69.5	60.8	69.3	65.0	73.1	65.2	76.0	67.6	66.2	75.9	64.0	74.0	77.0	62.0	72.4	78.7	61.6	70.8	63.2	73.8	73.2	80.2	74.6	65.4	73.7	70.4	69.9	66.6	73.8	63.0	59.1	63.3
Jun 16	76.2	61.4	67.3	71.1	68.9	71.2	65.4	74.2	69.9	78.1	71.3	67.8	65.8	57.9	68.6	69.1	71.6	63.9	71.7	68.2	66.5	68.5	70.7	74.9	71.3	77.8	69.1	61.4	69.0	77.7	66.3	71.2	70.0	65.0	77.0	73.3	71.5	67.2	73.6	71.4	64.4	66.0	72.4	63.8	65.0	63.6
Jun 17	80.8	61.2	65.4	72.9	72.7	69.4	68.9	79.5	76.9	75.3	68.0	78.0	62.6	55.5	76.9	62.6	71.7	71.1	75.6	78.1	67.8	70.4	75.8	75.1	74.0	77.2	67.2	65.2	68.3	73.3	62.9	71.9	70.1	68.8	77.8	71.1	77.3	65.4	73.7	74.5	65.1	72.8	77.4	69.8	67.1	67.9
Jun 18	70.8	67.9	67.7	66.7	67.7	69.9	73.0	80.0	77.6	78.3	74.9	78.5	65.1	57.2	72.5	70.5	76.1	68.5	72.2	79.0	65.8	72.9	74.8	74.9	69.7	73.7	66.8	78.7	77.5	73.4	61.3	63.9	68.2	66.0	71.4	75.9	84.5	62.5	65.8	77.8	66.3	74.0	74.3	74.8	68.9	69.9
Jun 19	74.4	71.1	68.8	73.8	67.7	75.9	73.1	77.1	71.0	79.9	72.3	80.8	60.6	60.3	73.1	71.1	79.2	75.4	72.3	70.6	71.4	71.5	72.9	72.1	82.2	67.6	66.0	77.6	79.9	74.5	58.2	70.2	66.0	70.4	67.9	69.8	83.0	67.2	64.2	72.5	70.3	70.9	72.4	75.1	63.0	64.8
Jun 20	75.5	73.7	68.9	67.9	66.5	65.4	72.8	74.9	66.5	78.6	76.0	80.1	61.1	56.7	71.8	68.8	81.6	74.4	77.1	78.8	67.9	63.4	73.5	71.3	77.2	66.8	71.4	77.4	76.7	66.5	60.6	65.8	61.3	71.2	62.3	70.1	80.3	67.0	64.8	70.7	75.9	68.9	73.1	73.7	70.7	66.1
Jun 21	76.5	77.7	73.5	61.0	68.0	67.2	71.6	75.9	69.0	80.8	70.0	79.4	69.8	63.8	75.5	63.8	79.5	73.4	70.4	84.6	69.2	64.4	78.9	74.4	78.2	77.5	74.7	74.5	74.3	64.4	63.9	64.4	65.5	64.4	55.5	66.7	84.1	70.6	65.0	66.0	71.0	70.7	77.7	74.5	62.3	69.3
Jun 22	74.7	74.9	73.6	72.9	71.7	64.5	73.0	69.0	68.6	81.0	73.9	79.2	63.7	57.2	73.4	67.1	76.6	77.0	67.8	80.5	73.5	61.3	76.9	70.7	73.2	73.8	74.6	81.8	73.4	63.4	64.8	69.4	67.6	71.2	58.8	73.6	84.2	66.6	69.5	72.0	67.2	69.1	76.5	73.0	71.8	76.5
Jun 23	76.1	77.0	65.1	76.5	70.8	68.6	72.3	80.7	71.3	71.6	75.3	68.5	68.2	62.1	71.9	63.2	79.0	75.1	67.4	64.6	71.3	67.1	72.3	77.0	68.9	74.2	72.5	79.5	72.6	68.7	68.5	68.0	68.5	69.1	57.1	71.9	80.9	63.5	74.4	70.6	69.4	65.5	73.5	77.3	72.9	77.0
Jun 24	76.1	73.5	63.8	72.4	67.7	67.5	74.7	78.4	63.7	70.1	75.7	74.8	66.2	61.0	72.1	66.9	70.7	76.5	70.9	71.5	71.2	66.4	71.5	80.4	72.3	72.4	70.7	79.3	80.6	64.6	70.9	70.9	72.4	69.0	56.8	74.0	82.3	71.2	71.8	67.7	63.1	69.1	69.4	79.5	66.2	75.1
Jun 25	78.4	68.6	76.5	75.1	64.2	73.7	78.8	76.2	67.8	72.2	75.2	79.4	67.6	60.2	76.0	71.1	68.2	72.3	71.9	68.5	70.0	67.7	73.2	74.6	73.6	74.4	75.0	75.2	81.0	69.1	70.4	69.8	67.0	71.5	69.6	72.2	82.3	74.3	72.3	71.8	68.6	63.9	73.6	78.8	60.3	75.6
Jun 26	74.1	65.0	75.9	76.4	67.0	74.0	74.6	75.8	73.2	78.4	74.0	77.2	73.0	69.1	74.3	71.5	70.7	69.1	66.3	71.5	77.1	62.8	70.4	77.6	71.4	73.9	79.4	74.0	79.0	69.5	75.4	71.8	71.9	71.7	70.0	70.6	78.3	77.8	70.3	67.3	70.5	63.5	73.9	79.5	66.5	77.2
Jun 27	67.5	73.0	68.1	74.6	66.5	73.4	75.6	76.3	72.0	75.9	76.2	73.3	76.6	65.4	75.0	71.4	67.6	72.2	68.7	74.7	73.0	70.6	76.4	76.1	72.8	72.7	71.8	70.4	78.9	69.8	75.7	79.8	75.9	76.4	71.6	76.5	73.0	75.6	65.3	71.9	71.7	66.3	76.0	79.3	69.5	79.4
Jun 28	75.2	77.2	67.2	73.7	68.7	77.2	80.2	71.6	70.9	73.2	76.0	75.2	75.9	67.8	72.4	66.7	71.5	72.4	66.8	76.3	68.5	74.1	78.3	71.7	73.1	75.6	76.3	71.7	76.5	67.8	75.8	78.0	71.9	72.4	71.7	76.9	72.4	77.2	70.8	66.6	67.7	65.8	74.6	79.4	75.4	71.6
Jun 29	70.1	82.0	67.8	74.8	69.8	74.4	69.2	69.5	75.2	72.9	73.3	79.4	72.3	72.0	75.2	74.0	77.2	75.8	70.9	77.5	75.5	67.7	76.2	72.5	74.8	73.2	73.3	69.1	69.7	70.8	66.1	75.8	74.9	67.4	72.8	81.2	76.4	80.3	72.3	76.6	65.3	70.7	73.9	77.3	79.3	76.2
Jun 30	71.2	79.8	71.2	73.8	72.9	78.3	75.7	72.3	80.5	74.4	77.5	81.1	79.5	77.9	83.4	72.9	84.3	75.0	76.2	78.3	77.1	82.6	85.9	73.8	73.9	85.8	79.3	78.5	79.3	77.7	73.7	76.1	78.4	76.7	77.0	73.8	75.9	86.1	82.5	78.8	69.7	70.0	78.2	77.0	87.6	80.1
Jul 1	75.9	82.9	75.5	83.7	73.9	74.7	79.6	79.9	87.0	76.0	74.1	94.0	83.6	78.8	79.6	85.2	85.8	74.9	77.9	81.2	71.3	83.4	78.7	79.3	77.6	84.6	78.0	83.9	80.1	71.2	76.5	85.1	73.8	80.0	75.4	78.4	78.7	83.3	81.9	80.0	73.6	74.9	75.1	74.6	90.3	72.9
Jul 2	75.1	80.8	66.0	83.7	74.2	73.8	78.7	78.2	89.1	77.8	75.1	89.6	83.0	75.5	81.7	83.2	83.0	79.5	75.2	82.1	78.3	88.3	75.9	80.5	76.3	83.0	80.2	84.9	84.6	72.7	77.7	83.0	71.3	76.6	74.7	79.9	73.3	77.3	76.5	83.6	84.3	72.7	77.9	73.7	90.4	76.8
Jul 3	76.0	80.7	70.9	82.7	72.7	77.3	77.6	76.9	82.7	64.8	80.3	78.9	80.0	76.6	80.7	84.1	81.1	80.9	76.3	75.8	77.1	90.1	79.0	76.1	74.8	74.8	85.0	74.3	82.5	78.9	77.1	85.8	69.5	78.3	73.7	79.1	75.5	83.8	79.8	82.7	81.1	71.7	78.1	79.5	82.0	74.2
Jul 4	80.5	83.7	74.2	78.5	76.7	81.3	77.4	79.0	85.2	79.0	75.7	80.3	75.4	76.3	78.8	79.5	76.5	76.8	83.5	79.0	77.8	83.3	78.5	72.2	82.4	76.9	80.2	77.8	83.8	73.9	77.7	84.4	75.5	76.6	65.8	83.1	79.2	85.9	80.4	84.0	83.3	73.0	75.5	81.3	79.2	76.4
Jul 5	82.8	83.2	80.2	80.9	78.9	84.7	77.2	84.8	80.9	70.6	77.4	81.1	79.4	75.1	71.5	80.5	74.6	79.4	81.5	77.5	77.5	85.7	79.0	79.6	85.1	79.6	73.2	76.2	78.5	70.6	76.5	88.9	74.5	74.6	76.4	82.0	76.7	82.2	85.0	82.1	80.0	76.8	73.5	79.2	79.7	79.8
Jul 6	81.8	79.5	78.7	73.1	81.8	83.6	77.4	80.6	81.8	72.7	76.9	81.8	76.7	76.9	80.9	77.8	73.1	85.5	80.4	80.7	82.3	82.2	79.3	86.2	87.0	84.5	75.9	75.6	80.4	71.5	79.3	77.7	79.0	78.4	79.7	80.2	75.6	75.4	82.7	75.4	78.2	79.4	73.9	75.0	75.6	79.0
Jul 7	84.3	83.5	76.7	77.1	77.6	77.7	78.9	80.9	78.5	70.2	81.5	81.7	83.0	77.2	84.6	82.8	79.0	79.1	80.4	82.2	83.1	78.8	82.5	86.9	81.2	86.7	73.1	73.6	82.6	71.8	71.7	76.3	76.0	80.1	76.3	80.2	70.4	76.4	80.4	76.1	74.2	81.1	75.2	76.2	79.4	86.2
Jul 8	79.7	85.8	84.7	76.7	77.4	82.1	77.7	80.9	81.0	73.1	82.5	74.7	77.1	76.6	84.9	80.2	76.4	78.4	79.4	78.1	80.1	77.6	82.6	80.4	80.4	85.2	74.3	69.7	80.1	73.0	71.9	71.2	78.9	82.7	71.0	79.3	76.7	75.5	81.9	77.8	74.8	85.6	81.1	79.8	73.4	81.0
Jul 9	83.3	86.6	79.2	80.7	80.6	76.7	83.6	82.5	79.5	74.7	82.0	77.6	77.6	74.7	81.1	77.9	76.0	80.4	79.9	79.4	78.0	77.9	83.0	78.6	82.0	76.3	77.8	63.4	79.5	73.6	82.2	72.5	78.0	83.2	71.8	81.3	71.7	76.6	82.4	78.4	76.0	82.5	80.1	76.4	75.0	74.6
Jul 10	81.7	90.0	71.4	81.4	74.3	77.9	83.8	82.7	75.5	74.9	85.5	78.2	82.9	77.6	77.9	74.9	74.0	71.5	84.4	79.0	72.4	73.7	79.7	77.8	76.3	80.0	78.6	69.9	77.4	70.9	81.3	79.7	79.7	79.9	80.5	79.4	69.3	81.0	85.8	79.8	81.7	82.5	77.4	79.5	81.4	74.6
Jul 11	80.7	84.4	72.8	77.8	77.0	77.7	77.7	80.0	75.1	76.4	84.9	80.8	85.1	81.1	78.3	78.5	76.7	74.4	78.1	79.4	79.7	71.4	82.5	77.5	77.7	82.3	81.5	77.6	77.3	78.1	80.3	80.9	81.1	74.8	80.8	80.7	73.9	69.4	86.5	79.2	83.0	86.1	75.0	86.2	76.3	77.8
Jul 12	86.1	86.1	75.7	77.4	77.2	77.9	65.1	79.6	77.7	77.9	82.5	78.9	85.7	84.5	75.7	78.4	72.8	77.6	77.1	72.4	74.9	73.9	84.1	76.0	78.0	79.4	89.0	77.4	86.6	79.9	76.8	78.1	79.7	84.0	84.4	78.3	73.6	73.1	83.8	81.5	81.5	77.6	79.2	83.1	80.8	81.8
Jul 13	88.2	79.2	77.6	86.5	82.9	77.9	85.9	76.3	86.1	74.3	82.7	81.6	83.8	81.6	77.2	78.1	79.1	79.1	77.3	77.9	79.6	79.3	82.1	75.2	80.6	81.6	87.1	76.1	85.9	79.3	83.9	78.4	82.7	80.7	84.8	83.4	74.9	74.3	79.5	81.8	82.9	85.3	81.3	85.2	73.6	82.3
Jul 14	89.3	79.0	81.6	85.2	82.3	79.9	82.4	76.4	83.5	75.3	72.2	81.7	80.2	80.7	79.6	79.7	75.7	79.8	79.8	80.5	80.4	82.6	80.3	76.2	79.9	76.6	79.9	78.6	78.1	70.8	82.7	85.0	81.4	76.6	86.5	87.4	77.3	74.9	83.7	81.8	83.3	87.4	84.5	82.1	76.1	75.8
Jul 15	87.0	78.3	80.6	82.8	82.8	75.2	79.5	76.6	81.5	78.1	76.9	82.6	79.7	76.2	82.8	72.4	79.7	82.1	79.5	73.3	84.9	75.1	76.0	75.7	81.2	78.1	82.3	76.3	78.1	76.5	80.1	85.0	81.9	75.4	81.1	82.3	78.0	73.6	83.9	81.2	84.5	84.9	84.0	82.8	74.9	71.4
Jul 16	84.5	72.3	83.3	83.2	82.8	74.7	75.9	74.1	73.9	75.9	78.4	80.1	80.6	80.1	80.8	77.1	80.6	77.5	80.5	81.3	76.0	74.0	72.9	76.2	77.3	82.2	75.6	72.4	76.7	70.3	82.2	82.4	83.2	77.5	82.4	79.4	79.8	72.9	81.4	79.2	84.2	80.2	83.6	78.7	73.9	70.5
Jul 17	86.0	81.1	80.1	80.3	84.7	74.6	74.8	77.0	79.1	75.7	72.8	72.6	84.6	81.8	81.7	77.1	81.2	80.1	81.2	79.5	79.2	78.1	70.4	78.2	77.2	78.5	75.4	75.0	81.5	78.9	83.2	81.3	78.3	79.2	85.9	78.8	72.5	75.8	87.1	76.4	78.3	74.9	82.9	76.6	76.3	74.9
Jul 18	84.2	79.0	84.2	83.6	87.2	72.3	79.9	80.4	74.1	75.8	77.7	81.0	82.5	81.2	88.1	84.3	83.0	77.8	79.8	81.1	80.6	77.7	71.8	77.9	76.8	79.3	80.5	77.1	79.8	78.1	80.2	82.6	74.1	80.0	88.8	77.4	74.6	76.0	87.1	75.7	79.3	76.2	81.9	76.1	79.6	78.1
Jul 19	87.0	77.1	87.4	78.1	78.4	77.6	79.1	82.6	73.2	69.7	77.4	80.7	78.0	82.1	85.9	82.5	80.7	80.4	82.2	80.3	80.9	80.0	73.4	73.8	79.0	82.5	79.7	80.0	75.6	79.4	76.4	79.5	76.2	83.9	89.1	81.1	74.2	72.7	82.7	76.9	80.2	73.5	79.7	71.5	79.0	80.7
Jul 20	86.0	78.3	86.4	79.0	79.2	83.1	74.8	80.7	76.7	75.3	73.7	75.1	77.5	82.5	84.4	84.8	81.5	81.2	76.2	80.1	78.8	76.1	70.1	81.7	78.0	82.2	83.6	82.1	75.1	79.6	77.2	79.8	79.0	83.4	78.4	83.8	78.4	81.7	79.7	79.5	75.7	75.0	86.1	74.1	79.5	76.4
Jul 21	87.4	79.5	84.7	76.0	77.5	81.8	79.1	71.8	81.8	77.1	70.0	79.2	79.4	82.3	79.5	80.0	78.6	78.2	74.5	76.4	82.5	78.0	71.2	78.0	76.9	78.4	80.0	78.4	74.5	83.2	80.4	82.4	81.8	86.5	80.5	82.3	74.3	80.3	73.7	78.1	77.7	78.5	87.9	78.2	78.7	80.7
Jul 22	86.8	83.5	84.1	77.8	80.5	80.4	79.4	75.1	81.8	79.5	73.7	79.2	79.9	82.6	84.4	76.5	77.9	76.4	79.3	75.1	78.2	76.6	80.8	77.2	80.3	77.9	82.8	74.8	74.6	80.1	78.0	82.4	84.1	82.1	78.9	83.0	74.7	82.7	76.4	75.9	77.3	75.0	86.8	74.0	74.5	69.5
Jul 23	82.0	82.0	77.6	80.7	81.9	84.1	81.6	80.3	79.2	71.9	71.3	77.2	79.4	81.9	85.8	76.1	77.8	70.2	78.3	69.9	77.4	72.4	74.3	71.5	78.6	82.4	77.0	80.2	78.0	86.2	79.4	82.4	87.1	86.9	81.2	81.7	76.6	80.8	76.6	77.5	79.7	72.6	88.1	78.1	77.0	70.1
Jul 24	80.2	79.4	79.9	79.4	77.5	82.6	78.3	74.2	81.1	69.9	69.3	76.7	80.8	78.1	82.5	80.1	77.9	75.1	75.8	70.4	72.6	77.1	79.9	78.7	76.4	75.0	79.5	79.8	77.3	81.1	76.8	77.1	85.7	87.4	80.8	76.2	81.0	84.0	71.1	83.8	81.7	70.6	86.9	71.6	78.4	78.9
Jul 25	80.3	82.8	72.6	79.6	80.5	84.3	75.8	73.6	82.0	77.3	76.9	81.0	80.9	72.7	79.9	80.3	74.1	71.2	74.8	72.5	80.1	78.9	81.1	80.4	77.5	79.1	80.4	79.9	81.6	77.3	77.7	75.2	89.9	85.2	77.3	75.3	72.6	84.5	71.7	81.5	79.8	77.0	84.3	74.1	73.6	82.5
Jul 26	77.3	82.7	77.9	77.6	79.4	85.7	72.9	77.8	76.7	77.2	76.4	79.3	76.5	68.4	75.9	77.1	75.3	68.9	72.8	73.4	84.8	72.7	73.3	79.6	80.6	84.8	81.4	80.8	88.2	80.4	80.0	73.8	81.9	84.7	76.8	74.6	78.4	81.1	74.4	81.4	75.5	80.1	85.2	77.5	73.0	81.1
Jul 27	73.2	78.0	76.3	77.3	78.6	86.8	69.9	80.6	73.4	74.5	75.1	78.7	81.3	65.1	82.1	78.2	72.2	66.4	70.1	76.0	86.2	73.1	79.7	79.0	84.2	86.2	80.5	80.6	91.3	81.4	72.1	75.6	87.1	77.3	71.1	72.8	82.2	74.2	79.2	80.4	76.7	83.4	77.9	78.3	72.1	80.5
Jul 28	67.8	82.9	78.3	81.9	79.2	81.0	75.3	80.4	75.6	80.2	72.1	78.2	78.9	65.0	78.4	82.7	72.9	66.9	77.4	67.8	82.3	77.9	78.5	81.6	83.5	85.2	76.9	81.5	87.8	82.8	71.1	73.2	82.6	78.8	81.0	75.1	78.7	81.8	78.0	76.1	77.2	83.7	72.4	75.5	67.6	78.9
Jul 29	70.3	82.1	79.7	80.9	80.2	74.8	72.1	80.9	78.8	82.7	72.9	75.9	78.7	74.9	80.0	83.3	77.5	76.6	73.1	74.5	77.7	77.4	74.4	76.3	89.5	81.4	75.0	80.7	87.4	82.5	70.7	77.0	79.5	79.1	84.3	75.9	85.1	80.7	77.4	83.0	73.8	80.8	75.3	77.1	69.0	80.2
Jul 30	72.9	79.2	80.9	77.2	80.4	81.6	82.5	82.1	82.6	77.0	74.1	78.8	78.1	77.7	83.8	77.0	78.5	82.5	75.1	70.1	79.1	79.4	70.3	79.4	85.1	76.5	76.7	85.2	84.7	81.3	74.8	78.6	83.6	80.1	90.1	77.8	87.1	70.8	77.7	83.0	72.6	80.2	76.6	73.6	74.6	77.2
Jul 31	74.9	76.8	78.0	77.2	87.2	81.8	80.8	82.0	84.7	83.2	78.6	83.2	79.1	78.9	84.6	81.4	79.9	81.7	73.1	76.6	79.4	82.1	73.6	81.6	80.6	82.4	84.8	81.7	87.7	79.3	79.8	77.9	76.9	80.7	85.7	75.4	85.8	72.5	74.1	83.9	78.1	80.8	73.8	75.5	73.7	85.0
Aug 1	75.3	78.6	77.1	79.0	88.7	84.3	80.0	81.1	83.2	85.3	79.5	87.5	79.2	81.8	82.5	73.9	78.7	80.0	74.8	75.5	75.6	81.2	77.1	86.3	83.0	86.7	80.4	89.6	80.6	77.9	78.1	70.9	80.0	78.6	81.9	82.0	88.4	78.0	69.5	84.0	76.7	79.6	71.1	81.6	73.9	86.5
Aug 2	72.3	79.8	70.2	74.8	80.6	75.9	82.2	83.6	81.7	73.9	80.8	84.5	78.1	81.2	87.7	79.9	74.5	76.5	77.6	80.9	75.6	80.7	80.2	84.6	81.0	77.7	83.3	89.8	79.6	78.5	79.5	71.9	81.5	77.1	88.3	78.2	80.8	78.1	71.6	81.1	77.9	75.2	69.9	80.6	71.7	82.1
Aug 3	70.8	81.4	75.6	80.8	78.5	86.6	77.6	80.3	77.4	75.7	83.4	84.7	78.2	82.9	89.2	79.8	84.6	84.9	82.8	82.4	79.1	80.8	73.9	79.6	81.4	72.7	76.9	83.3	84.3	73.1	76.3	71.9	82.7	78.4	83.0	81.2	79.4	75.5	74.2	80.3	74.4	78.9	73.8	81.6	72.8	84.8
Aug 4	66.4	74.8	78.9	80.9	80.4	78.1	81.0	76.7	81.0	81.8	78.5	87.5	72.9	82.8	91.7	79.5	85.3	80.8	85.8	82.4	79.3	79.4	73.1	83.6	84.9	76.6	77.9	83.7	83.9	79.3	79.5	68.5	80.6	79.4	79.4	77.0	80.1	78.9	76.3	83.7	76.1	80.4	78.5	76.8	64.7	89.5
Aug 5	70.1	72.6	79.5	79.3	76.9	79.6	76.5	73.5	76.9	75.1	83.6	83.9	75.4	84.3	90.2	75.6	84.4	86.9	82.4	78.9	76.6	83.8	67.8	81.6	85.4	78.0	72.6	82.4	80.7	74.6	72.9	71.2	77.0	78.8	79.3	79.1	77.4	78.5	81.0	85.3	84.8	85.3	78.4	74.2	64.4	83.5
Aug 6	74.1	75.2	72.0	84.0	74.4	84.2	81.5	76.2	67.3	75.2	81.2	77.6	72.4	87.8	84.9	73.3	85.4	81.6	78.8	77.7	80.7	79.8	73.5	80.2	82.6	82.3	73.1	77.5	81.7	71.3	72.7	78.9	77.3	72.9	85.5	73.6	75.0	79.6	80.1	90.8	84.2	79.9	67.3	72.3	70.6	86.3
Aug 7	76.0	74.8	79.6	83.7	80.0	84.1	82.2	77.6	71.4	74.9	79.3	81.7	81.5	80.6	81.4	71.2	78.6	88.1	74.7	76.1	83.7	81.6	76.1	77.0	79.9	80.0	70.7	79.9	84.1	75.2	68.1	75.8	79.5	78.1	85.9	72.9	71.8	84.1	76.8	86.6	83.2	79.5	70.3	71.8	70.1	87.3
Aug 8	78.0	85.0	77.6	74.0	77.7	79.5	75.2	78.1	75.5	71.5	85.8	77.3	84.7	78.9	85.1	72.9	86.1	84.9	76.1	81.6	82.6	84.2	72.8	78.7	80.9	77.3	69.8	74.6	83.0	66.4	72.7	78.8	81.4	82.1	75.2	83.2	72.8	78.7	83.1	76.5	78.1	75.9	77.0	71.0	66.1	87.3
Aug 9	87.0	80.7	72.5	72.4	77.5	76.0	77.2	74.0	74.7	74.7	82.9	77.2	81.4	78.2	82.4	73.3	84.0	81.6	79.3	80.5	75.5	84.4	75.5	76.0	75.8	83.0	75.4	80.0	76.8	74.0	78.8	79.2	78.0	77.2	83.1	80.1	78.0	78.1	74.7	78.2	78.3	76.7	77.9	69.1	70.4	85.9
Aug 10	82.3	72.9	72.8	77.2	79.5	81.1	72.4	74.2	69.0	71.6	80.2	83.0	77.4	78.6	83.6	67.5	84.0	76.8	78.4	75.9	75.6	77.6	71.2	75.6	72.9	80.4	76.3	73.9	80.1	75.5	80.9	80.3	75.3	68.8	85.9	78.1	78.1	82.8	74.3	83.6	78.8	78.8	80.1	72.6	74.0	81.6
Aug 11	84.3	75.3	72.4	76.6	77.2	70.7	77.7	73.9	75.9	74.5	86.6	83.7	82.2	80.0	79.6	69.2	84.5	78.7	78.4	75.9	74.1	86.0	74.0	78.9	74.7	79.6	78.3	76.3	77.6	73.2	73.9	79.3	73.7	72.8	73.8	74.9	72.8	84.4	77.3	77.6	76.9	77.0	75.3	70.8	81.1	81.2
Aug 12	71.1	72.6	73.9	74.8	77.9	74.7	75.4	71.2	73.1	77.2	81.4	83.2	83.7	75.0	75.2	72.2	83.2	79.7	78.7	66.9	76.2	84.0	75.1	77.4	72.2	78.5	76.2	76.7	74.5	74.4	79.3	82.0	75.7	80.4	75.0	76.9	71.0	74.6	74.7	78.7	75.5	79.2	80.5	73.1	76.8	79.4

TABLE 5. SUMMARY AND EVALUATION OF DAILY TEMPERATURE IN HELP MODEL 100-YEAR SYNTHETIC WEATHER DATA SET

YEAR->	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46
Aug 13	70.3	81.6	73.8	77.2	82.6	76.1	75.1	74.3	73.5	76.3	82.3	81.7	87.8	75.4	76.1	71.6	79.0	83.0	76.6	77.3	78.1	77.6	83.2	74.4	75.1	74.7	72.4	73.1	78.9	79.4	76.2	79.6	80.9	73.4	73.6	77.6	74.9	71.1	73.5	76.5	71.7	73.2	82.3	72.1	76.8	81.0
Aug 14	65.5	70.2	76.2	77.3	86.7	77.9	75.9	73.9	69.2	76.0	81.4	83.4	85.4	75.3	74.1	72.0	74.7	74.6	83.2	73.8	84.3	83.8	77.0	71.1	74.7	79.5	79.9	67.2	75.7	74.4	78.2	89.4	73.4	73.8	63.7	77.8	76.4	74.0	77.3	84.2	81.9	76.5	78.3	76.2	72.5	81.8
Aug 15	65.1	76.5	74.9	74.3	81.8	77.0	74.4	76.8	67.3	74.8	78.8	83.3	82.7	71.2	79.3	76.3	75.8	77.0	78.5	80.1	80.1	83.4	82.6	77.5	77.4	77.8	84.5	72.8	75.7	72.3	79.1	91.6	74.1	72.4	71.1	76.3	70.6	77.0	74.0	78.6	71.2	72.8	74.0	75.5	76.6	81.5
Aug 16	69.1	72.7	71.0	75.2	85.5	79.1	77.0	79.9	67.2	69.2	79.8	79.2	87.5	73.6	80.4	78.1	78.9	73.0	75.7	83.2	79.4	75.9	78.2	74.8	78.4	78.4	79.4	74.0	73.7	73.3	78.5	91.0	78.7	69.9	68.2	78.6	79.9	80.0	76.4	74.6	69.7	65.3	78.5	73.7	76.0	85.9
Aug 17	77.6	78.2	72.8	74.2	80.2	79.1	77.0	76.6	69.2	76.6	75.3	81.0	84.3	76.3	79.8	67.1	77.7	67.5	77.8	89.2	88.5	71.7	82.7	79.5	77.7	79.1	78.5	69.1	70.9	70.9	77.2	89.5	80.9	72.8	70.8	76.1	76.5	81.2	75.4	65.3	73.0	65.9	80.0	70.7	75.5	80.5
Aug 18	73.2	78.1	74.5	74.9	79.2	76.5	81.3	82.1	72.0	77.6	75.7	77.3	75.2	78.0	71.0	71.5	66.9	72.3	79.1	86.0	88.3	78.2	74.5	78.6	71.8	77.4	74.4	71.8	71.8	70.0	77.0	87.7	78.5	70.1	68.3	79.9	82.0	85.4	76.9	69.0	77.4	63.6	77.6	77.5	78.6	78.1
Aug 19	67.3	77.5	81.7	69.4	81.1	76.6	83.3	85.8	77.3	81.4	81.8	75.3	65.3	75.8	75.9	68.8	67.5	72.4	79.0	85.0	84.8	73.7	72.3	76.9	74.5	75.2	78.7	68.5	73.4	64.0	75.6	82.3	76.2	76.9	73.5	81.9	84.6	79.5	76.7	68.2	71.9	67.2	77.7	80.3	75.8	80.1
Aug 20	72.2	71.9	71.6	69.3	80.5	72.9	79.1	86.4	84.1	81.8	79.5	70.4	65.9	75.7	85.0	74.8	74.9	74.6	76.5	83.5	85.1	72.1	78.9	86.6	72.2	71.8	78.7	68.4	75.3	73.1	77.0	81.9	70.2	75.3	71.1	80.4	85.3	76.9	77.8	60.9	77.1	67.7	82.2	77.3	74.1	79.6
Aug 21	76.9	76.8	68.2	74.3	75.9	74.4	84.2	88.5	87.8	74.3	79.6	73.2	74.4	80.1	80.1	78.5	73.0	78.0	80.6	76.2	80.6	71.4	71.4	84.4	69.5	70.2	76.3	71.5	80.4	75.7	74.2	76.2	69.4	81.1	72.2	78.6	77.6	73.5	69.3	64.2	83.4	71.0	77.7	79.1	76.0	73.8
Aug 22	72.7	81.0	72.4	72.8	73.5	75.1	79.3	78.0	79.3	76.7	71.4	75.3	74.0	75.4	80.6	75.7	75.4	79.9	84.4	81.5	81.9	74.1	76.3	84.8	65.5	69.3	72.6	67.5	78.1	75.8	78.6	80.3	74.5	83.7	72.2	77.1	76.8	75.7	73.0	67.9	79.0	74.3	73.5	76.8	78.7	79.5
Aug 23	77.8	78.1	74.3	71.7	70.0	68.9	78.1	82.5	81.4	84.1	77.7	76.8	73.4	70.2	74.7	75.2	78.4	76.3	85.8	82.0	84.3	72.2	85.2	88.2	68.4	72.4	73.6	70.4	80.4	75.1	80.3	78.5	70.7	84.7	69.1	74.5	77.4	76.6	68.9	68.5	79.6	72.2	69.1	76.1	69.5	73.6
Aug 24	77.5	74.3	74.4	82.8	64.9	75.6	75.4	74.4	78.0	86.4	75.2	72.6	71.3	79.1	67.2	78.8	79.2	74.1	75.3	75.9	79.7	73.2	83.6	86.6	77.7	71.1	82.1	68.7	80.5	77.7	71.4	75.0	72.8	78.9	73.0	71.6	76.7	67.6	70.4	71.2	76.0	70.6	77.9	75.5	75.0	73.2
Aug 25	74.3	72.5	64.4	80.6	64.2	72.1	79.3	80.1	77.6	85.5	66.7	75.3	68.7	82.0	75.8	75.8	79.9	75.4	70.7	72.6	74.9	71.4	76.0	82.4	75.5	69.8	75.9	72.5	70.1	78.3	84.8	73.1	77.4	74.4	76.6	75.9	80.5	68.0	70.0	73.8	81.4	75.2	77.8	68.0	66.8	70.6
Aug 26	73.6	72.4	65.4	81.8	65.6	73.1	78.2	77.8	83.0	78.4	73.6	72.1	67.4	75.3	76.5	84.9	75.6	78.8	63.8	75.2	65.2	72.5	73.3	79.5	74.2	64.0	83.8	72.7	73.8	71.2	78.4	75.6	76.4	66.0	77.5	72.3	69.8	62.5	67.9	79.5	82.1	82.7	80.5	61.4	71.2	74.5
Aug 27	70.9	75.9	68.6	76.5	64.0	77.6	83.1	74.8	72.7	76.9	68.4	66.4	77.3	76.2	76.9	77.7	76.3	69.8	66.4	74.9	71.6	71.5	71.2	78.3	76.7	71.8	80.9	71.9	75.7	71.1	72.9	77.8	78.1	69.6	72.0	70.9	70.4	70.6	73.2	80.3	77.2	84.3	83.7	61.8	72.0	79.1
Aug 28	67.6	73.1	66.8	66.6	70.2	73.3	86.4	70.7	66.8	80.7	65.0	70.6	74.2	75.0	74.5	69.4	73.5	70.1	67.8	71.2	69.8	69.3	72.6	75.9	83.9	77.1	79.8	72.2	80.8	68.8	77.4	71.6	78.4	73.7	74.7	73.9	70.9	70.0	77.7	68.7	81.4	78.6	81.2	64.7	78.3	83.6
Aug 29	67.3	70.9	56.9	70.8	68.1	71.4	83.1	71.2	77.1	79.9	68.3	67.2	74.1	66.9	70.1	66.2	74.1	70.5	67.1	71.7	65.7	71.3	71.0	73.2	86.8	61.1	77.1	71.2	83.4	74.5	75.3	76.4	75.8	74.9	65.9	82.2	71.2	72.7	72.4	79.3	79.9	71.2	76.2	72.9	79.9	82.8
Aug 30	65.3	78.1	61.7	66.8	69.2	79.0	77.3	67.9	72.3	75.1	68.7	58.6	64.2	70.5	71.3	71.5	78.1	70.5	66.7	67.7	70.1	73.8	69.2	83.5	85.7	66.6	74.0	69.6	82.6	71.2	74.2	75.0	70.9	79.6	66.0	83.0	73.2	75.9	73.5	75.2	72.7	75.7	74.6	73.2	73.6	86.0
Aug 31	59.7	78.6	53.8	79.5	74.2	68.8	68.5	69.2	75.4	70.5	57.3	63.2	66.2	65.8	71.8	71.6	73.3	63.3	65.7	65.5	72.1	74.1	70.6	83.5	72.0	63.0	69.7	63.7	69.3	63.2	68.8	72.0	61.8	77.1	60.5	78.0	69.3	69.2	61.4	79.4	73.0	75.8	75.7	76.3	79.4	79.4
Sep 1	61.8	81.2	60.9	74.7	71.5	72.1	69.9	68.2	84.7	69.2	67.8	59.4	63.4	73.6	68.5	67.8	73.4	66.1	69.7	57.6	71.3	74.7	70.5	77.3	75.7	67.5	67.1	71.6	70.5	58.6	66.9	68.5	64.9	71.0	61.1	73.4	74.1	74.9	61.0	73.7	69.8	68.0	74.1	73.6	75.9	81.0
Sep 2	63.3	78.8	60.0	74.7	67.7	74.6	67.1	62.8	84.7	62.2	63.0	62.5	63.5	74.4	67.5	65.4	70.1	67.3	79.3	56.1	67.1	72.2	72.8	74.5	69.9	64.7	67.4	68.7	70.1	61.3	70.5	69.3	71.2	77.8	54.6	74.2	71.7	73.6	71.4	72.8	71.7	77.1	74.8	69.3	80.8	75.1
Sep 3	69.6	76.8	59.6	71.5	61.1	65.5	66.7	66.4	81.1	63.0	60.1	72.1	68.1	71.7	72.4	65.9	76.0	68.2	77.9	69.8	78.0	69.3	77.6	68.7	68.7	64.8	67.1	78.4	58.9	63.0	67.5	59.6	67.3	83.1	59.5	76.9	77.6	63.1	68.0	65.7	64.5	79.5	67.5	67.7	79.5	78.3
Sep 4	57.3	74.8	64.0	63.9	54.8	62.3	69.0	69.2	79.6	61.5	65.8	69.0	66.9	70.5	66.1	67.7	81.5	70.7	86.3	71.3	73.3	75.2	72.4	66.3	72.9	71.0	67.4	75.4	66.6	73.8	68.3	58.8	66.0	81.7	60.7	73.2	71.1	64.9	65.2	73.1	62.0	79.4	68.6	68.0	71.2	74.3
Sep 5	57.2	74.0	73.7	58.9	54.0	65.6	68.2	65.2	74.4	60.8	58.8	68.9	70.9	73.0	63.9	62.8	76.0	75.6	83.4	76.0	69.7	73.5	73.1	68.6	69.9	69.1	71.1	69.2	68.9	68.1	62.9	62.5	64.0	78.8	63.3	72.6	65.8	68.3	63.1	69.6	63.1	68.3	69.7	70.0	71.4	70.1
Sep 6	56.2	70.9	73.4	65.0	48.4	62.2	65.7	64.9	69.1	64.4	58.8	73.0	73.8	66.9	70.4	70.1	81.0	68.9	69.0	77.0	68.0	73.5	74.1	71.1	63.3	81.2	74.0	74.3	72.7	60.4	62.2	65.3	60.9	82.9	65.7	78.0	74.0	68.0	64.5	66.4	70.5	66.0	68.2	65.5	84.3	63.9
Sep 7	52.8	67.4	68.7	67.9	58.4	65.7	65.1	67.6	70.3	63.0	63.7	71.5	70.0	71.0	74.3	68.5	76.4	77.6	66.1	71.9	64.6	70.9	78.3	64.6	62.1	79.4	65.5	68.5	67.5	57.2	59.3	67.3	64.0	78.6	64.2	71.6	70.7	69.0	64.5	71.8	66.4	65.8	71.8	64.6	79.8	52.4
Sep 8	52.7	69.1	60.2	51.8	65.9	62.4	72.4	70.7	62.8	69.4	64.5	69.6	69.7	64.3	72.0	71.0	69.4	81.1	67.9	71.3	61.0	65.2	72.5	66.4	59.3	76.2	73.1	60.7	70.6	66.9	57.9	57.6	61.2	73.3	72.4	68.7	62.3	68.6	61.8	77.3	67.7	62.6	65.3	64.7	77.0	60.2
Sep 9	53.5	70.8	62.5	50.0	71.6	73.6	67.2	75.6	62.5	71.5	73.0	62.9	71.6	65.6	78.9	63.8	73.9	78.6	67.7	71.7	63.7	66.1	74.5	68.6	56.8	76.5	72.3	66.8	72.8	70.2	60.6	59.9	56.5	67.7	67.0	74.1	61.9	66.9	63.9	67.5	66.5	67.3	61.7	70.5	73.7	58.4
Sep 10	59.4	64.4	64.1	50.8	65.4	57.6	64.3	69.9	63.9	74.3	71.1	64.9	68.6	60.0	82.5	58.6	71.1	66.3	59.4	64.4	70.8	69.9	72.8	67.2	72.5	75.5	64.2	66.5	74.1	66.9	56.8	57.8	54.7	62.1	66.1	70.7	63.7	73.9	71.9	59.0	69.7	61.7	63.8	75.4	79.1	58.6
Sep 11	60.8	76.9	62.0	54.7	66.3	70.6	66.3	73.5	69.0	77.7	72.4	66.9	70.7	53.6	76.6	59.0	73.3	75.3	62.1	68.9	66.7	69.6	69.3	70.1	67.7	78.2	60.7	67.9	62.2	75.9	58.9	65.8	59.8	69.6	69.6	67.6	54.4	78.9	70.1	56.2	70.4	64.2	70.1	67.3	70.5	55.9
Sep 12	50.6	81.8	59.5	55.4	56.6	64.8	62.8	63.0	62.3	69.0	74.8	73.4	73.4	55.2	70.3	65.8	67.5	75.1	67.5	70.7	60.3	67.7	73.3	67.3	65.8	71.9	59.9	57.7	67.9	76.2	62.1	63.5	66.1	71.6	66.2	73.4	71.3	79.6	75.7	56.6	68.0	69.6	69.4	63.2	71.0	63.8
Sep 13	54.1	67.8	65.1	59.5	57.6	63.2	62.5	56.3	62.7	63.8	66.8	70.1	62.2	60.8	70.2	64.4	67.6	78.0	67.9	70.4	66.0	72.6	70.7	60.7	71.3	67.0	67.1	66.6	65.2	73.3	59.7	71.2	60.8	71.1	62.3	73.3	73.7	71.2	67.5	63.6	73.4	66.4	65.8	60.8	67.6	59.1
Sep 14	55.4	62.5	60.6	65.6	52.6	62.5	55.6	59.1	76.7	80.1	62.9	70.9	64.6	57.8	65.1	59.9	65.9	60.8	54.4	68.8	66.6	66.0	79.0	64.2	75.8	60.8	68.6	64.4	63.0	75.4	51.7	63.4	64.4	65.7	65.5	64.8	72.1	71.4	61.3	72.2	72.4	68.6	60.8	58.8	73.9	64.9
Sep 15	56.9	61.8	55.6	65.3	61.0	65.7	62.8	63.0	72.4	74.5	55.2	62.0	68.2	63.7	69.2	66.3	58.4	64.5	59.6	70.7	70.7	69.1	77.9	74.3	72.6	63.6	67.7	74.4	57.8	77.1	61.0	65.6	74.6	62.2	71.9	66.7	73.3	70.1	65.7	77.4	75.3	69.1	63.6	70.2	74.7	65.5
Sep 16	69.2	65.1	58.4	71.4	70.3	66.7	65.8	59.4	68.0	70.9	57.6	61.1	79.8	71.7	62.3	65.3	52.7	62.6	62.0	63.9	65.7	76.4	70.7	68.7	68.2	58.8	76.3	69.6	66.9	72.3	54.3	69.2	67.2	75.2	68.5	71.6	69.5	62.1	59.9	74.3	76.5	69.1	57.3	73.2	69.6	61.7
Sep 17	66.7	61.8	57.3	69.1	70.5	69.1	71.1	57.1	69.3	73.3	61.8	65.0	71.8	67.1	66.5	55.0	56.7	65.4	66.0	68.7	63.8	70.8	67.4	66.8	78.0	65.8	72.3	70.7	65.5	67.8	55.8	65.4	70.3	77.3	64.2	70.6	70.2	58.7	64.3	59.2	78.9	66.4	61.1	76.2	71.4	60.6
Sep 18	67.0	60.9	61.4	75.6	65.7	77.2	64.7	58.0	60.7	70.4	60.9	62.2	64.9	64.8	57.3	51.8	59.0	59.8	71.3	62.3	60.1	61.0	61.5	63.1	67.9	66.6	67.9	72.4	71.3	60.9	61.0	58.8	64.7	69.5	58.9	70.1	71.6	66.8	70.9	64.3	69.4	65.4	67.6	68.5	65.7	56.8
Sep 19	65.6	60.9	57.6	70.9	63.4	67.9	67.1	59.2	54.6	65.8	62.1	58.7	70.0	56.8	59.1	61.5	49.2	58.1	68.3	60.2	60.3	54.7	59.7	65.8	78.3	58.3	62.8	71.0	68.9	69.5	64.6	68.0	61.7	61.4	58.7	70.2	68.3	63.8	71.7	60.0	71.9	62.8	65.8	74.4	64.8	58.7
Sep 20	61.5	63.7	58.3	75.7	59.2	76.5	62.8	56.7	55.4	61.6	57.9	51.1	72.6	55.9	55.1	65.9	56.6	62.9	52.1	67.2	63.3	61.9	57.1	58.1	75.5	48.7	60.1	70.0	72.8	67.7	56.5	59.5	62.9	68.6	51.5	74.6	74.1	61.4	71.0	65.7	74.0	68.0	64.2	68.4	68.1	57.1
Sep 21	64.7	56.5	55.8	68.5	57.2	67.5	56.6	60.2	63.6	69.5	61.9	56.3	76.8	57.1	61.0	58.9	60.6	63.5	50.6	70.8	72.3	59.5	56.8	56.1	73.4	57.1	57.9	67.7	64.0	56.5	58.3	55.8	66.3	60.4	55.2	75.5	64.3	54.5	72.0	65.6	73.6	70.6	62.7	72.0	61.4	64.9
Sep 22	62.8	60.1	59.5	69.0	50.2	65.6	73.6	65.3	69.0	60.4	53.5	55.4	71.6	77.0	63.7	60.6	58.3	68.8	59.9	59.9	67.6	66.1	47.4	55.3	73.3	56.7	54.2	56.3	66.1	60.2	62.6	52.4	58.8	62.8	48.7	69.2	66.0	66.7	61.6	62.8	70.5	66.8	64.6	72.5	52.9	59.5
Sep 23	67.4	67.2	54.1	70.4	51.3	57.3	68.1	61.4	62.3	58.5	58.3	57.7	64.1	74.7	66.5	64.6	66.8	60.5	56.0	68.8	68.2	67.6	49.0	52.6	74.3	59.0	49.9	56.0	64.5	53.3	59.9	56.3	53.2	60.8	48.8	62.9	66.4	62.3	62.9	59.1	70.6	69.6	57.1	71.1	63.3	63.3
Sep 24	59.7	67.3	50.7	74.5	60.9	61.5	62.7	58.3	56.7	52.6	69.5	56.1	72.5	68.6	75.4	61.1	67.6	67.3	54.8	72.6	65.8	61.4	48.7	65.1	76.1	52.3	55.2	57.6	65.9	51.6	68.6	55.7	53.7	56.9	60.9	61.3	67.8	55.8	61.3	57.9	68.1	62.5	60.1	67.3	56.8	62.3
Sep 25	54.3	52.4	49.8	69.2	56.4	53.9	59.2	55.0	52.2	59.0	62.8	55.2	71.8	67.6	67.8	72.0	59.5	75.1	57.1	73.2	72.5	51.7	51.9	69.9	63.2	54.4	51.3	57.0	74.4	50.8	59.6	51.8	63.2	54.8	67.3	63.6	68.4	55.5	67.2	62.8	75.8	64.2	71.3	70.4	69.4	57.6
Sep 26	69.2	61.4	53.6	70.5	52.4	49.0	56.0	58.9	57.6	68.0	58.7	58.4	68.7	62.2	56.3	72.5	66.5	74.8	49.4	81.5	67.5	65.1	63.7	55.3	60.2	61.4	58.2	59.0	81.8	63.2	54.7	52.3	51.5	53.5	61.0	62.2	73.0	54.6	76.5	63.9	73.2	60.8	69.1	68.8	81.2	61.3
Sep 27	61.1	60.8	55.6	63.3	58.8	54.4	52.0	59.5	60.5	68.9	57.9	61.8	64.0	56.0	54.2	63.9	68.7	76.9	58.1	69.5	61.1	59.7	60.2	53.3	57.8	64.4	63.3	59.1	70.2	53.2	58.6	48.1	62.5	44.9	54.7	65.6	71.9	49.5	65.1	62.7	69.1	63.6	57.5	68.1	79.9	64.4
Sep 28	71.7	56.5	57.4	67.7	61.8	62.4	56.0	57.9	67.0	64.1	49.3	61.3	56.9	63.0	46.2	69.3	68.4	75.2	56.4	65.0	67.0	58.7	54.5	50.8	56.5	66.0	70.7	44.5	75.5	50.4	51.4	51.7	60.0	40.0	51.9	53.8	70.3	56.6	73.9	65.2	70.8	59.5	53.1	66.6	71.3	66.8
Sep 29	59.8	55.3	54.6	74.6	61.9	61.9	51.2	50.1	58.8	47.9	55.0	58.9	61.0	59.5	45.0	62.5	63.6	73.9	55.2	63.2	62.0	57.5	61.0	55.8	57.5	69.3	59.0	55.8	63.6	52.2	49.3	51.7	71.8	47.5	52.8	61.4	72.3	50.7	75.2	57.7	64.9	58.2	49.8	61.1	62.0	63.4
Sep 30	55.7	47.3	57.7	80.6	63.4	54.0	49.3	44.3	54.0	46.7	49.3	50.0	64.1	55.8	61.9	52.6	60.2	76.6	50.1	55.4	59.8	63.8	49.2	58.9	57.0	51.2	48.3	52.9	64.4	54.5	53.2	57.5	69.3	57.1	62.1	66.4	69.5	55.3	73.8	56.8	44.3	49.5	48.5	61.7	51.7	51.9
Oct 1	52.4	47.2	56.0	61.3	75.1	57.4	56.1	38.8	49.8	51.0	53.5	49.5	58.2	60.8	65.1	47.0	64.5	70.8	56.2	48.9	59.4	59.2	47.6	60.1	48.6	58.1	42.4	50.7	55.7	55.8	51.9	46.2	65.9	65.1	59.0	58.1	68.3	52.9	68.8	44.5	49.0	60.0	44.8	55.3	47.2	58.4
Oct 2	52.1	55.9	56.1	62.5	76.1	51.1	58.6	41.7	48.1	60.8	41.2	43.6	57.7	56.6	62.8	47.9	58.2	56.8	53.2	47.0	56.7	56.6	61.3	50.7	59.1	55.2	44.8	50.3	50.3	61.8	51.5	41.9	65.4	65.6	54.6	58.7	68.5	42.6	56.6	34.1	61.1	54.1	42.3	63.8	47.3	54.2
Oct 3	66.7	47.4	52.6	63.4	66.2	42.2	52.4	47.8	60.0	65.8	45.5	40.6	60.2	53.7	59.1	49.9	62.7	53.8	45.4	52.3	45.1	46.9	55.6	50.8	52.5	57.4	54.0	50.5	52.2	62.3	40.5	42.3	69.7	53.2	51.8	59.6	60.7	47.3	48.0	45.1	52.3	49.7	46.3	73.6	55.9	51.8
Oct 4	56.3	51.1	64.0	60.3	69.8	46.2	53.1	49.2	47.5	66.2	36.4	33.9	66.2	57.4	68.0	51.9	63.5	54.8	38.9	51.5	57.1	54.1	52.2	52.3	49.9	54.5	46.3	48.3	53.2	60.5	43.2	45.4	62.7	55.4	52.7	64.7	54.5	54.4	58.2	45.7	52.6	40.2	57.9	67.1	57.6	51.9
Oct 5	58.3	49.4	63.3	55.9	73.4	48.4	56.2	47.9	41.3	60.7	39.0	35.6	60.6	49.6	65.9	45.6	62.4	53.4	46.9	49.5	48.5	51.9	51.5	45.2	54.0	55.8	49.7	44.4	54.2	62.1	45.8	51.5	62.4	60.1	50.2	65.8	48.4	47.6	55.0	45.4	52.5	41.0	67.8	62.3	56.8	66.3
Oct 6	62.6	53.0	52.9	43.5	58.6	46.9	52.5	51.1	41.6	62.1	45.1	40.4	62.8	46.7	57.1	37.2	57.0	54.6	48.9	49.6	54.7	48.1	59.7	43.7	50.9	69.5	44.1	45.0	52.5	54.2	49.4	47.4	52.0	68.2	39.5	42.9	49.1	43.9	54.7	51.7	52.3	45.2	53.5	62.9	55.4	68.2
Oct 7	57.2	53.3	62.5	40.7	54.1	52.6	49.8	67.8	43.4	62.5	42.2	34.3	61.9	43.5	49.1	45.3	60.2	60.9	57.6	57.1	56.8	60.3	54.7	47.7	49.7	60.7	49.4	46.6	48.3	48.6	40.7	53.3	50.9	57.5	50.1	48.4	46.9	45.7	55.5	61.1	43.4	47.4	43.7	67.1	51.6	60.6
Oct 8	67.6	51.3	56.0	45.8	63.6	51.0	58.1	63.2	48.2	50.4	50.8	41.6	54.2	42.3	53.7	45.6	68.6	67.2	60.6	53.5	53.9	54.3	48.9	52.9	63.4	54.9	56.7	37.2	47.0	45.4	60.0	58.8	50.9	56.6	43.0	48.2	41.1	50.1	62.2	61.5	47.8	52.6	45.3	67.9	50.0	62.9
Oct 9	67.5	50.8	57.7	52.8	53.9	46.9	55.2	59.8	56.8	51.2	45.5	37.3	53.7	38.1	49.3	53.8	59.6	63.7	57.3	56.7	56.2	45.6	49.8	47.8	52.1	54.2	63.3	38.6	49.8	45.1	52.6	58.4	50.9	49.7	49.2	49.9	52.1	53.4	60.6	52.7	54.2	56.7	61.2	57.3	47.0	63.7
Oct 10	66.1	45.8	63.2	59.2	50.3	55.6	56.7	56.3	60.2	48.3	41.2	32.0	54.9	42.5	49.6	62.3	64.6	64.4	58.2	70.2	63.2	51.2	56.3	39.2	43.3	55.7	49.2	31.9	57.4	41.9	61.0	52.7	48.5	40.2	48.0	49.1	42.9	60.0	47.2	47.2	49.3	50.9	59.2	61.8	48.3	53.9
Oct 11	66.3	50.2	66.4	61.8	54.4	50.7	48.3	56.1	57.8	46.6	52.4	32.1	53.0	42.0	46.4	53.9	60.9	50.1	53.2	65.1	66.5	55.5	47.1	39.4	49.4	49.7	45.8	34.8	46.7	44.9	60.1	51.3	41.5	34.1	47.4	47.8	46.3	53.5	35.1	48.4	56.7	51.6	59.1	46.9	50.0	59.1
Oct 12	55.7	56.8	58.3	57.4	59.7	50.9	61.8	56.9	47.5	51.6	49.0	40.6	49.1	51.4	49.5	44.8	57.9	57.2	50.7	58.3	67.2	53.1	49.0	40.8	47.0	55.1	52.9	28.4	46.2	49.4	58.7	47.7	41.0	49.0	55.2	53.1	50.2	51.5	46.2	44.3	51.4	57.7	55.6	57.2	49.2	47.2
Oct 13	51.4	64.6	62.0	55.0	57.6	53.4	41.4	57.8	53.3	56.9	51.8	35.1	58.1	56.9	51.5	43.2	47.0	62.8	55.5	58.2	58.5	58.2	53.3	54.2	42.8	52.7	39.9	34.6	51.4	46.7	53.4	61.2	50.3	47.5	48.3	58.5	56.6	52.9	54.9	48.8	49.2	53.2	51.4	59.3	48.9	49.9
Oct 14	54.8	72.0	67.1	61.2	54.1	42.4	39.2	55.5	63.3	54.4	44.4	37.9	53.1	55.3	42.8	48.7	56.6	72.6	54.9	56.2	58.4	57.7	56.7	63.9	43.6	47.8	33.5	41.0	48.6	57.2	60.8	54.3	55.9	45.4	54.1	52.2	49.6	47.4	58.8	49.1	44.2	52.4	48.7	58.8	50.8	53.8
Oct 15	56.7	66.5	49.7	66.8	45.0	47.4	44.7	59.7	60.0	66.6	52.6	38.0	53.1	54.2	41.4	43.1	60.2	68.0	45.0	47.5	55.8	62.5	51.7	52.5	46.6	54.1	41.6	40.7	38.0	58.8	41.9	61.6	46.2	43.4	52.1	42.9	45.3	41.1	40.1	47.5	46.0	57.5	53.0	67.9	51.4	53.7
Oct 16	47.7	65.2	55.4	62.2	50.2	47.2	39.3	63.8	62.9	66.3	51.1	42.4	45.2	64.9	38.7	51.8	56.2	61.7	47.8	45.0	46.8	55.9	55.8	58.2	45.6	63.3	47.9	40.9	49.7	54.3	49.5	47.0	44.4	36.7	57.8	35.7	46.9	50.6	42.8	59.7	38.6	53.9	62.5	62.3	51.4	49.6
Oct 17	52.3	61.4	61.5	57.8	44.7	45.1	38.8	63.2	49.5	55.7	42.6	52.7	32.8	55.6	33.0	50.7	66.1	60.3	43.9	52.1	54.7	65.1	52.6	46.3	41.4	54.0	44.1	52.6	49.0	57.6	47.6	51.3	44.9	39.2	58.9	40.8	50.9	41.3	39.8	67.9	43.1	55.0	48.5	54.6	47.0	57.4
Oct 18	49.4	64.9	43.7	50.4	35.0	41.4	57.8	65.4	54.9	43.3	39.2	51.4	33.4	54.6	30.4	38.1	64.8	64.2	34.7	46.2	60.4	53.2	53.6	42.7	40.7	39.2	47.8	49.1	55.0	63.4	54.9	57.0	45.9	47.2	61.7	46.5	49.1	45.0	46.7	67.1	39.6	40.8	46.4	57.2	48.0	68.2
Oct 19	45.5	62.9	33.9	45.9	40.3	33.3	53.1	78.4	53.6	47.1	45.0	46.1	44.5	50.3	44.8	48.7	67.3	69.3	33.2	47.1	48.0	48.4	50.6	52.4	42.8	36.5	43.0	50.4	42.1	55.3	41.0	49.9	43.1	45.5	69.0	39.0	54.2	45.9	54.8	62.0	52.2	42.5	45.1	60.8	46.2	51.3
Oct 20	53.6	61.1	31.5	37.0	37.6	35.1	52.8	74.2	48.6	47.0	45.5	56.9	42.1	43.8	39.5	59.3	48.0	52.8	25.2	41.0	51.5	45.3	42.1	43.3	41.6	36.7	46.1	51.9	47.9	43.8	39.0	46.0	56.6	42.9	56.0	34.9	59.2	50.6	53.3	55.0	44.4	40.0	37.7	54.8	50.1	43.2
Oct 21	43.6	55.1	24.0	45.0	29.5	35.8	52.5	73.7	46.0	41.7	40.5	48.6	46.5	33.7	38.4	55.6	52.5	39.4	35.7	45.4	61.1	42.0	39.6	46.9	54.1	41.7	52.6	46.3	48.4	47.9	40.2	39.1	54.8	43.1	60.0	34.7	62.2	51.0	52.0	54.5	48.5	47.6	53.5	50.4	39.5	56.0
Oct 22	41.1	46.4	19.7	53.8	33.9	41.0	34.9	75.9	56.4	37.4	43.9	46.9	44.2	41.1	37.8	51.5	56.7	38.1	33.7	54.2	59.0	42.3	44.1	56.9	43.3	58.2	47.8	44.3	43.0	49.2	28.0	43.1	57.8	44.3	59.5	40.4	58.4	37.3	49.1	47.8	39.1	50.7	49.2	37.1	32.1	56.1
Oct 23	41.2	43.7	30.2	55.3	36.2	46.7	42.7	60.1	51.3	46.4	52.2	60.5	43.9	49.8	41.5	48.9	47.8	39.9	45.7	50.7	55.8	45.4	41.0	52.4	43.3	57.9	35.9	58.0	54.0	45.5	35.4	44.5	47.5	33.5	50.5	32.8	56.8	32.2	49.2	38.1	40.0	53.3	47.2	31.4	46.2	51.7
Oct 24	43.1	40.5	39.2	49.2	36.7	52.2	49.3	51.6	50.1	51.3	56.7	47.2	52.7	57.7	33.9	48.9	33.8	30.2	46.0	60.7	58.8	51.4	37.1	46.6	33.1	56.7	42.6	47.7	47.7	43.3	35.0	43.6	52.5	41.0	52.9	44.0	62.1	33.1	47.1	42.8	34.2	55.3	48.0	36.6	51.0	39.4
Oct 25	53.6	45.5	44.7	37.4	45.8	44.6	44.4	57.5	50.9	48.1	61.4	38.5	47.4	49.0	36.3	39.0	47.5	23.7	44.0	60.5	59.1	46.0	45.0	30.4	28.5	42.8	50.3	47.9	49.4	46.1	44.9	44.3	53.7	46.0	46.3	42.0	53.8	38.6	49.0	54.5	38.0	70.5	60.7	32.4	50.7	44.4
Oct 26	55.6	52.7	45.6	38.8	39.2	34.5	36.8	42.0	55.9	36.8	61.0	33.3	39.8	47.9	45.8	50.3	36.2	29.3	47.7	58.5	54.4	43.0	46.7	38.7	30.3	51.2	56.0	42.3	51.5	47.9	38.9	32.1	40.1	48.8	50.0	45.1	52.0	40.8	54.0	52.8	32.8	75.4	58.6	38.8	42.6	40.7

TABLE 5. SUMMARY AND EVALUATION OF DAILY TEMPERATUR[illegible] IN HELP MODEL 100-YEAR SYNTHETIC WEATHER DATA SET

YEAR->	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46
Oct 27	45.8	48.3	48.6	45.6	44.0	33.3	29.7	37.4	45.5	30.2	49.0	34.2	55.1	47.9	48.9	56.3	31.9	41.8	48.1	66.1	57.1	42.9	61.4	38.7	27.8	38.4	56.5	47.6	53.6	49.8	51.0	32.3	34.3	45.8	47.1	35.9	49.4	49.4	48.4	54.8	33.9	55.7	62.2	48.4	41.3	36.6
Oct 28	52.2	41.5	48.9	40.3	41.4	33.7	25.5	36.5	50.8	35.8	41.3	32.6	55.0	45.5	51.8	55.7	39.6	49.9	41.5	63.6	56.2	53.0	47.7	53.0	35.9	45.1	59.2	50.4	47.5	52.5	50.3	29.5	27.5	42.8	42.9	42.9	55.6	51.7	51.5	47.3	31.8	49.6	59.0	44.8	49.0	42.4
Oct 29	49.3	39.5	39.3	47.3	40.6	42.4	28.8	28.8	53.8	42.1	36.7	39.0	51.1	36.4	62.1	53.7	47.6	45.8	43.9	63.1	48.9	46.3	50.5	46.8	46.5	43.6	58.1	52.6	44.4	52.2	52.6	37.7	37.4	39.6	44.3	44.8	57.3	41.4	46.6	42.5	36.3	51.8	51.1	38.9	56.8	47.5
Oct 30	54.9	42.1	47.3	37.6	42.5	34.3	27.8	38.9	57.4	44.6	38.4	42.1	52.6	40.4	53.2	45.2	40.2	49.6	37.3	56.7	56.3	59.4	49.1	45.7	44.0	48.8	68.4	41.0	34.4	38.5	49.8	44.9	28.3	31.3	37.4	44.8	60.3	43.3	51.3	50.3	28.1	59.9	54.9	35.9	49.4	42.1
Oct 31	54.2	36.8	50.8	34.0	44.9	40.2	29.3	40.5	56.4	44.5	42.5	37.9	45.3	42.9	38.6	38.8	42.6	46.0	43.3	63.6	48.1	42.1	50.9	42.2	48.0	52.0	60.2	35.3	27.5	32.9	47.4	46.7	29.9	29.5	41.3	40.4	39.6	40.8	43.2	60.3	25.4	54.2	37.4	38.8	47.8	39.6
Nov 1	47.6	35.9	43.8	31.1	46.0	44.5	29.1	39.6	35.0	37.6	53.0	39.9	41.6	39.1	32.0	48.4	37.5	49.2	41.3	47.5	47.2	46.4	50.1	28.9	46.8	53.3	55.8	32.2	26.9	48.5	45.3	48.6	30.5	42.7	39.5	39.2	40.1	52.1	45.0	43.3	27.7	38.6	39.8	20.6	61.5	46.1
Nov 2	48.0	38.1	43.8	37.2	52.2	42.2	31.4	31.7	41.3	33.9	45.4	44.3	43.3	36.1	37.8	39.9	37.6	43.7	42.8	33.9	53.0	36.1	46.9	35.1	43.6	49.3	49.6	32.0	29.6	49.7	37.4	53.5	24.3	44.2	38.5	37.3	36.4	50.7	41.4	43.7	26.3	28.4	39.6	26.4	59.4	53.0
Nov 3	53.2	47.4	34.9	53.1	46.7	45.3	35.0	22.0	41.0	39.3	53.1	41.8	41.4	35.9	52.7	32.8	52.5	43.2	52.9	31.5	43.3	36.5	44.2	32.7	48.4	33.7	45.3	29.6	40.6	46.0	37.3	54.7	17.0	51.8	56.1	37.3	32.6	44.5	38.5	41.5	22.7	28.7	34.3	30.6	65.6	54.4
Nov 4	49.3	46.2	45.1	45.9	48.2	47.0	31.9	39.1	31.7	47.1	55.7	43.0	45.1	30.2	45.4	27.9	52.8	41.6	42.8	27.3	39.8	35.7	38.0	38.4	42.0	38.0	44.6	39.4	37.9	40.3	33.4	53.8	12.6	55.3	48.2	37.3	37.7	38.5	39.4	44.7	37.2	38.8	37.8	38.4	62.3	39.3
Nov 5	47.4	46.4	49.7	52.6	34.1	49.8	34.4	34.5	28.9	45.6	56.8	46.9	46.3	19.8	30.8	28.8	47.7	43.8	46.4	29.2	38.1	27.9	40.1	37.4	41.4	40.1	37.6	39.9	34.4	34.1	30.8	61.5	13.0	49.5	41.8	40.1	32.7	46.3	36.8	41.5	29.9	39.2	45.8	39.0	52.4	37.7
Nov 6	49.8	43.2	61.9	46.9	33.9	49.5	26.4	40.9	36.4	47.6	34.1	58.2	40.8	36.8	47.7	22.5	41.5	50.9	45.9	35.0	41.2	28.0	39.5	34.3	41.5	45.9	43.3	33.3	29.4	32.4	38.0	56.5	25.8	41.1	45.6	38.3	41.9	49.2	37.7	55.3	30.1	39.9	41.9	38.1	48.9	36.0
Nov 7	52.9	41.8	43.7	52.4	29.2	50.7	36.2	48.8	43.5	39.0	49.2	56.0	35.4	38.3	44.9	27.4	40.8	44.0	45.8	29.2	44.8	27.3	44.3	35.0	32.1	52.9	28.1	37.2	23.5	36.6	39.5	47.2	32.7	42.9	38.6	31.3	50.6	40.4	44.0	49.6	44.4	39.6	45.4	49.3	57.1	39.3
Nov 8	54.9	25.8	31.8	56.7	31.2	45.9	33.1	40.9	42.0	30.4	45.2	64.0	36.4	30.9	44.9	27.2	31.7	40.8	37.9	26.4	40.3	32.2	44.9	37.3	36.9	51.9	24.1	19.9	18.8	39.3	40.1	54.5	27.5	46.9	36.8	30.5	50.2	44.7	41.4	46.7	34.2	43.3	57.1	47.6	53.7	29.9
Nov 9	57.8	41.9	31.2	61.0	31.9	45.5	35.2	36.5	31.5	27.2	45.8	56.2	36.9	39.3	29.0	34.4	42.4	43.7	39.7	23.3	34.0	39.0	36.0	43.2	30.4	51.2	20.9	21.4	29.9	41.6	44.4	43.8	38.0	34.0	45.2	36.2	46.2	50.0	43.2	53.6	37.7	46.0	54.8	47.3	54.4	16.8
Nov 10	58.4	43.9	35.3	51.6	34.2	44.1	29.4	48.1	35.0	31.2	42.5	49.0	38.9	33.6	32.0	33.4	30.3	46.1	29.2	25.5	33.5	49.9	35.1	46.8	29.4	40.7	23.2	33.0	31.5	35.9	51.0	38.0	30.4	37.5	42.6	38.5	34.3	50.3	48.4	39.0	28.1	40.8	48.6	43.6	56.6	30.2
Nov 11	55.9	38.0	43.5	45.0	34.7	39.2	37.1	37.5	28.9	32.0	43.5	52.2	42.9	27.5	43.2	27.0	27.2	45.8	34.9	22.8	31.6	40.9	27.9	44.8	36.1	22.6	22.9	31.9	36.6	33.9	47.3	30.3	30.9	30.6	43.2	35.6	37.6	55.7	40.6	43.1	23.1	46.2	50.9	38.2	47.4	36.6
Nov 12	45.7	25.2	46.6	55.0	38.5	37.8	48.6	37.2	34.8	27.0	42.7	54.5	48.2	31.1	47.5	36.8	29.2	44.6	35.1	28.4	34.2	45.4	26.5	42.5	46.4	29.8	28.7	27.1	41.8	32.6	55.6	36.6	33.6	46.8	42.2	24.4	35.2	40.7	33.5	35.0	33.8	41.4	53.9	35.1	40.8	31.9
Nov 13	40.7	31.4	35.1	45.3	44.4	43.4	44.8	44.7	34.2	21.3	32.7	49.3	52.6	30.4	50.7	51.0	30.1	50.0	36.8	20.2	43.4	37.0	42.6	43.9	50.8	33.8	48.4	21.4	41.8	30.6	46.1	44.0	36.0	40.9	27.4	28.7	27.0	39.5	28.8	42.1	42.3	32.7	37.2	30.9	39.2	31.1
Nov 14	56.0	41.7	40.8	35.8	44.3	47.4	48.6	50.4	37.6	29.5	38.6	45.2	28.4	36.8	36.9	54.6	31.8	46.8	38.0	23.0	40.5	41.3	41.4	31.1	55.9	24.8	38.7	32.4	32.7	41.3	46.0	42.7	24.2	50.1	23.4	30.9	33.9	26.8	21.0	35.5	47.4	40.0	35.8	42.3	43.3	33.3
Nov 15	54.6	44.6	43.4	37.1	45.1	36.5	44.9	50.0	50.0	25.4	39.6	51.6	32.4	26.4	28.9	57.0	19.4	40.9	34.7	32.6	41.6	42.3	36.7	24.9	29.7	31.5	36.3	30.1	24.8	41.5	41.5	35.5	35.8	38.8	30.2	30.3	38.6	22.1	18.2	27.8	34.1	26.1	27.6	39.4	34.0	28.2
Nov 16	48.2	39.0	52.8	27.6	47.0	47.1	36.0	40.5	41.6	43.0	36.3	34.1	27.1	22.8	18.6	65.7	27.4	26.8	29.4	48.0	42.5	46.0	36.8	17.4	28.8	40.5	36.3	30.4	30.7	34.0	27.9	35.4	26.9	33.9	31.6	36.9	36.7	28.9	26.4	27.0	33.1	34.1	23.4	36.6	50.0	36.5
Nov 17	37.4	39.2	44.4	21.8	54.6	44.7	31.6	26.0	34.4	34.2	40.3	42.5	28.2	18.0	25.5	63.2	36.4	32.0	30.9	43.1	42.9	48.5	33.9	30.0	25.8	46.2	38.8	37.9	23.5	30.2	30.0	30.9	32.8	37.2	40.5	42.4	46.8	34.7	31.3	22.5	33.6	43.5	28.6	31.0	47.8	27.7
Nov 18	44.8	37.5	40.8	31.1	47.1	43.3	36.8	30.5	37.4	28.0	43.8	37.8	26.9	27.4	25.5	46.7	24.3	37.4	34.1	38.0	38.5	44.0	34.2	31.6	28.5	34.5	45.5	34.6	36.8	24.4	20.9	36.7	27.2	33.4	35.1	44.7	56.0	33.5	32.0	20.4	35.8	34.2	32.8	35.5	45.8	28.5
Nov 19	45.3	42.0	39.5	31.8	54.2	42.0	37.2	35.9	34.0	30.4	41.1	34.0	28.2	25.0	36.3	35.7	22.9	47.0	38.4	49.3	33.9	38.5	45.1	38.8	30.8	39.1	47.3	29.8	31.0	17.8	23.0	30.5	31.0	42.0	32.8	43.5	62.4	33.5	26.0	31.4	25.6	29.1	29.1	26.0	37.9	31.3
Nov 20	33.7	39.9	38.5	34.9	51.6	38.1	37.2	34.8	41.1	28.8	43.0	46.2	34.8	15.8	42.7	29.4	26.6	53.7	27.9	44.1	37.0	34.6	36.3	43.7	39.0	35.6	40.4	32.6	29.7	35.8	32.9	35.4	27.0	39.6	33.9	42.6	50.1	32.1	26.5	39.3	24.5	37.1	38.3	27.5	37.5	38.8
Nov 21	32.5	42.0	22.9	44.7	43.6	33.4	41.0	43.0	43.1	29.8	36.6	39.8	34.3	14.3	39.7	37.5	20.9	44.7	34.0	53.0	42.2	32.8	35.3	35.3	46.1	34.5	38.4	34.6	26.6	31.9	34.8	44.7	21.6	27.3	42.3	49.2	51.2	43.0	39.6	44.4	39.9	27.7	48.8	20.6	43.6	42.0
Nov 22	23.5	28.4	32.4	37.9	44.0	27.5	38.0	47.2	38.7	33.8	43.7	44.9	34.5	23.6	37.0	25.6	12.3	39.0	23.0	50.3	43.7	42.6	47.9	40.1	47.8	41.2	33.6	36.5	36.8	36.4	45.9	35.3	33.6	42.4	28.6	38.7	46.7	34.1	32.3	32.5	39.9	18.2	38.8	15.1	28.7	35.5
Nov 23	29.6	21.6	23.3	35.2	49.3	30.9	49.9	41.3	44.3	41.4	38.5	42.2	21.5	40.6	37.1	22.7	24.5	42.7	27.1	44.9	46.4	36.5	43.6	44.0	56.0	29.0	49.3	34.2	34.3	36.6	32.6	28.7	35.6	44.8	18.0	37.2	34.6	31.2	25.9	41.6	32.4	20.6	38.7	23.0	31.4	37.5
Nov 24	37.0	37.6	36.8	23.4	49.7	22.2	43.6	35.3	55.7	40.3	42.1	32.8	18.8	37.7	42.4	26.4	38.1	40.1	31.7	44.5	44.5	36.2	40.4	34.5	45.0	35.5	45.9	42.0	34.2	26.0	50.3	21.1	38.2	39.1	27.5	38.7	25.7	35.9	19.5	32.3	30.3	11.6	47.5	23.6	22.5	48.4
Nov 25	42.4	33.1	43.5	39.4	42.6	27.9	46.4	35.4	44.8	26.8	37.3	34.5	23.1	44.8	44.1	25.8	36.1	42.0	29.0	26.0	43.1	39.1	51.4	29.4	28.9	41.3	37.2	36.6	31.9	37.1	45.3	15.3	31.8	30.5	30.3	31.4	21.4	28.8	21.9	30.2	30.6	12.6	52.9	25.3	32.1	38.6
Nov 26	27.6	41.3	41.1	42.4	49.9	26.2	39.4	37.7	35.7	28.3	45.9	33.9	15.0	40.7	34.2	22.7	33.2	41.6	24.3	23.1	43.6	30.0	43.2	35.4	30.8	38.0	39.5	46.2	22.5	35.3	32.7	15.2	26.4	31.5	29.5	29.3	40.2	27.1	24.7	35.5	33.8	25.0	53.1	33.4	23.3	17.8
Nov 27	32.6	48.0	27.5	37.4	47.1	30.5	33.7	29.6	26.4	34.2	34.1	35.2	7.1	39.6	34.5	26.2	32.8	46.1	34.5	32.7	41.7	33.5	37.0	21.5	28.7	41.2	31.5	51.3	39.7	37.2	34.7	22.6	28.0	35.1	24.4	28.2	33.6	33.6	31.0	30.1	45.7	30.8	49.1	28.6	31.9	18.1
Nov 28	44.3	49.1	14.6	27.3	51.6	33.1	37.6	27.5	21.1	37.1	25.7	25.9	14.2	49.7	28.4	28.5	24.3	39.5	48.2	34.6	33.4	32.1	30.4	31.7	20.1	36.1	30.9	44.8	38.5	38.4	33.0	24.2	35.2	30.6	20.7	20.1	27.7	33.3	40.6	30.9	42.1	27.1	44.5	26.2	26.7	19.9
Nov 29	31.9	44.5	26.9	26.2	47.1	35.4	45.5	33.5	23.4	39.2	25.2	46.9	27.3	49.0	31.4	41.7	28.0	32.8	42.8	28.1	27.3	23.1	25.6	30.3	26.0	33.4	35.4	35.1	35.5	21.5	41.1	15.7	23.1	31.7	15.1	18.4	20.7	26.4	33.1	31.2	42.4	24.5	54.1	26.5	23.4	19.6
Nov 30	40.5	47.5	27.1	33.6	36.1	28.3	51.5	33.6	37.8	29.8	29.2	43.1	43.4	51.5	32.8	37.6	28.3	24.9	45.1	26.7	22.8	24.3	30.8	30.8	23.2	45.3	47.9	31.0	36.5	24.0	35.0	20.9	20.4	38.8	20.0	28.1	28.5	26.7	30.2	29.9	47.2	30.4	43.6	27.6	25.5	21.9
Dec 1	27.8	47.8	31.5	28.3	31.4	30.0	49.1	16.5	29.7	32.6	21.3	39.3	37.0	37.2	34.5	48.5	30.1	16.1	43.7	42.0	28.9	15.4	35.4	25.8	28.9	39.5	50.6	34.1	36.7	18.7	32.4	21.9	23.4	32.1	24.4	32.8	30.2	23.9	24.9	31.9	39.3	26.7	43.5	36.0	39.1	21.4
Dec 2	31.5	54.8	32.1	31.9	30.6	34.4	49.9	15.6	22.7	32.1	14.8	28.3	32.4	33.1	27.9	42.0	32.4	19.9	36.2	35.0	30.1	31.7	35.8	31.5	28.1	30.9	52.1	29.7	33.2	35.5	38.3	28.2	16.6	37.1	23.5	37.5	34.9	23.4	30.3	14.6	40.9	23.4	30.9	38.8	42.2	23.7
Dec 3	29.3	39.5	21.9	33.7	25.4	29.6	42.8	29.0	28.6	20.1	18.6	29.5	34.1	28.8	36.0	34.5	32.5	22.7	33.7	34.7	24.5	34.0	35.9	34.2	35.7	32.5	56.4	21.7	21.8	39.2	30.0	23.7	21.1	39.5	32.3	40.6	26.5	27.0	28.8	18.0	47.2	15.0	30.3	43.5	33.8	30.6
Dec 4	30.4	26.7	21.4	20.8	37.3	31.6	26.3	21.6	25.6	22.8	21.7	27.5	42.7	32.3	39.1	45.2	30.9	21.5	27.4	32.6	28.3	33.3	22.8	43.9	30.1	38.3	52.8	10.5	23.4	41.9	36.8	28.2	21.3	27.9	33.1	44.2	38.7	33.8	24.3	19.5	29.4	17.6	29.1	37.4	24.7	34.8
Dec 5	38.6	31.2	8.3	33.0	33.9	31.5	25.3	31.1	29.6	27.9	40.5	34.6	41.6	33.6	30.1	44.4	26.2	30.9	19.8	35.5	19.5	20.4	30.2	33.5	19.9	31.4	50.9	17.7	24.5	24.5	41.0	41.7	14.5	26.1	27.1	41.9	31.8	35.6	27.7	23.1	28.4	16.1	31.7	20.6	33.1	31.0
Dec 6	32.6	32.7	9.0	27.4	41.2	31.6	21.8	35.2	23.2	27.9	36.1	28.2	35.9	37.8	32.7	51.4	26.6	34.9	13.9	34.9	26.4	21.2	31.4	26.0	38.3	36.7	45.0	27.9	21.3	30.4	42.9	26.8	18.6	20.2	18.2	27.6	25.5	27.9	34.0	25.5	27.6	14.7	29.0	27.9	38.7	34.1
Dec 7	34.5	19.9	14.4	28.4	32.0	29.4	23.0	33.4	24.8	25.4	43.3	42.3	43.1	39.3	21.4	46.2	36.4	31.1	13.7	32.5	36.2	26.2	32.4	19.9	33.4	23.5	35.4	29.1	31.3	34.4	37.6	27.7	17.1	23.0	21.7	26.3	27.1	38.4	29.5	28.6	27.8	14.5	26.2	27.4	41.5	38.1
Dec 8	33.5	15.3	13.1	23.3	36.3	21.2	25.0	31.8	23.4	24.2	35.2	46.0	45.4	38.4	17.9	44.3	33.5	27.8	26.4	33.1	37.1	31.6	39.0	18.3	31.5	20.8	23.4	31.4	33.2	22.7	36.1	28.5	27.4	36.4	34.0	34.4	23.2	27.1	20.9	24.3	34.5	16.2	35.9	26.7	36.7	43.1
Dec 9	24.1	11.9	20.2	20.5	36.9	30.8	16.8	24.8	26.8	23.8	25.8	36.0	36.0	33.4	33.2	24.7	37.0	18.1	33.0	29.8	36.0	24.7	46.3	21.8	29.0	20.8	26.8	27.0	28.3	28.5	38.3	34.0	17.2	28.5	33.1	32.8	21.7	27.9	34.6	24.5	42.8	26.2	17.3	32.9	31.9	44.6
Dec 10	20.0	18.7	30.9	15.7	35.8	30.4	19.8	19.0	23.8	30.5	27.7	27.7	28.4	30.1	25.1	20.4	33.6	23.4	24.6	34.1	21.8	26.7	39.3	16.7	26.4	18.9	25.4	19.5	36.9	24.8	34.7	41.5	14.1	34.8	26.2	29.1	23.9	29.7	27.1	33.2	48.2	25.1	21.0	41.9	33.5	29.2
Dec 11	13.8	13.3	32.6	20.5	32.6	21.0	22.2	21.2	30.4	16.9	26.9	38.4	35.4	34.8	31.6	16.8	28.1	25.4	28.7	31.9	30.9	25.9	42.4	21.0	22.3	23.1	38.7	26.2	29.3	27.7	31.9	31.4	21.5	35.6	18.8	25.9	25.2	25.9	29.1	34.1	40.2	34.4	23.8	38.7	20.9	21.8
Dec 12	10.7	14.4	24.8	26.7	43.7	27.3	25.1	29.0	40.3	26.5	29.5	32.3	34.9	28.4	25.6	19.7	34.7	20.0	33.1	38.6	26.2	23.0	37.3	15.8	18.1	29.6	38.0	25.1	20.2	32.7	33.3	41.9	20.3	33.2	11.1	18.1	21.4	22.1	29.7	37.2	30.2	35.9	30.1	39.3	27.0	14.6
Dec 13	9.0	21.2	24.6	27.1	43.0	21.5	22.3	20.1	23.8	26.2	32.9	33.0	19.4	26.9	35.0	22.5	30.7	10.3	31.3	44.4	27.6	24.9	41.2	16.4	19.8	33.3	32.5	18.3	23.3	36.2	34.9	34.1	23.5	29.4	14.4	29.6	25.4	23.8	34.3	37.6	30.7	36.2	28.1	27.4	30.4	22.8
Dec 14	24.7	16.3	21.5	33.5	37.5	23.9	29.0	24.3	22.5	35.3	28.8	37.2	22.0	27.5	36.3	30.3	34.8	18.6	31.6	32.8	18.9	30.9	36.8	28.7	24.9	35.7	37.6	20.2	13.8	33.4	45.1	39.2	25.5	30.9	15.7	24.4	20.6	31.7	33.4	48.6	39.3	35.5	27.7	36.0	29.9	19.3
Dec 15	36.5	17.1	32.2	24.2	32.6	26.4	29.6	28.8	18.9	26.3	26.4	25.0	25.4	23.8	31.3	35.3	37.8	20.6	19.5	38.8	24.8	30.5	38.4	33.6	24.9	40.7	29.6	20.1	16.7	47.3	49.2	40.7	24.6	34.9	15.2	28.3	21.5	28.1	21.2	45.0	43.7	24.0	19.0	24.0	32.0	37.5
Dec 16	41.9	31.2	23.4	18.7	29.7	25.8	28.6	16.4	27.9	31.4	29.4	26.4	21.4	26.4	27.8	28.1	40.2	23.6	20.2	28.8	27.1	30.6	30.4	24.7	19.7	36.1	26.7	19.6	26.2	44.6	36.7	43.2	18.2	29.3	23.5	18.9	34.8	29.0	9.3	46.1	33.7	24.7	21.6	30.0	41.1	30.2
Dec 17	23.9	21.4	22.6	18.4	38.0	18.9	30.8	11.4	22.8	28.9	24.1	28.6	28.6	30.3	17.6	16.6	32.0	17.1	19.2	33.6	36.4	28.8	35.7	30.1	20.8	23.2	33.1	14.4	29.8	36.8	30.5	46.7	17.9	37.7	9.7	19.5	29.2	27.7	14.6	49.6	23.5	26.8	32.5	28.3	35.7	26.1
Dec 18	22.5	14.1	21.5	19.7	25.7	26.6	37.2	13.2	24.2	24.9	15.9	22.5	24.7	20.7	27.3	22.2	27.4	21.1	20.1	25.4	27.9	21.7	34.5	25.5	13.3	14.1	30.7	17.0	21.9	39.3	30.2	39.6	28.2	44.9	23.8	30.2	23.6	28.1	22.1	48.7	28.5	37.4	26.9	36.3	44.3	25.0
Dec 19	11.1	21.9	24.3	15.3	22.1	17.3	44.0	3.7	30.2	29.3	20.7	39.4	23.1	18.4	37.1	18.5	17.2	31.3	19.5	31.9	18.8	21.6	23.5	38.3	18.9	16.1	32.2	31.3	17.6	39.8	34.0	36.2	29.5	27.4	22.7	36.8	30.2	41.2	25.9	31.3	29.8	45.2	28.8	46.3	41.9	18.5
Dec 20	14.5	19.5	28.2	14.3	27.3	31.2	33.3	8.3	39.9	24.2	31.2	45.4	24.6	20.6	32.2	24.0	30.5	28.9	16.3	36.9	21.6	23.7	25.8	24.2	21.9	18.8	47.2	37.1	31.5	41.6	34.6	30.6	30.9	19.6	33.6	40.5	22.9	41.6	33.5	33.8	30.8	41.3	33.5	29.8	38.6	29.5
Dec 21	29.1	29.3	28.7	22.3	17.4	23.6	31.9	26.7	26.2	14.2	31.4	30.2	19.3	23.4	38.5	16.8	35.6	25.2	27.7	36.9	22.5	19.3	19.5	18.1	21.1	20.8	41.0	30.6	28.8	32.9	32.4	28.7	24.3	17.4	27.0	39.4	32.7	48.6	26.0	29.0	30.5	32.8	30.6	21.3	40.2	34.4
Dec 22	37.6	33.4	30.2	43.0	20.8	18.5	31.8	14.8	30.0	21.0	26.8	27.8	22.2	22.4	30.5	18.5	29.4	39.3	34.0	37.2	33.6	25.8	29.9	20.6	15.2	28.1	35.2	29.8	18.3	33.9	29.3	24.7	28.6	28.2	33.4	36.9	33.3	37.7	28.7	36.0	29.6	31.1	30.2	27.2	38.4	31.8
Dec 23	44.0	30.6	35.5	36.0	25.4	19.0	27.2	20.4	26.6	19.3	19.6	31.0	24.2	28.7	18.9	19.9	22.6	42.2	37.7	32.3	34.2	26.0	38.4	15.8	12.7	34.4	26.5	27.0	29.4	36.0	28.3	35.7	21.6	23.6	31.3	43.2	14.9	31.8	29.5	24.7	23.7	22.1	25.8	32.6	40.8	26.8
Dec 24	42.7	27.3	37.4	41.1	23.9	21.1	36.0	21.3	17.0	13.8	21.2	24.8	19.8	30.3	24.7	27.5	30.4	39.9	32.7	22.5	31.9	27.9	28.0	26.7	6.0	33.1	38.7	25.5	26.0	26.9	26.3	29.5	12.7	28.1	26.1	35.8	23.6	27.7	19.6	32.7	23.4	15.5	29.6	23.5	39.1	27.6
Dec 25	40.5	21.3	38.7	33.1	29.0	31.2	39.2	20.4	15.3	16.2	20.2	16.3	26.2	27.3	24.2	26.4	22.2	29.5	34.1	28.2	27.1	18.4	29.9	28.5	19.5	23.7	33.2	18.7	34.9	35.6	26.5	24.4	19.2	30.3	16.4	42.8	25.7	29.0	29.0	30.6	31.1	19.7	32.2	19.6	40.2	33.1
Dec 26	39.9	14.0	15.5	31.7	23.7	31.0	37.7	27.2	5.4	14.5	20.9	19.3	34.8	27.4	19.0	31.2	22.1	35.6	28.9	22.1	28.9	20.8	31.6	38.4	30.4	35.9	31.9	29.3	26.7	30.2	29.1	20.3	23.3	25.2	20.9	30.9	29.1	30.8	23.1	31.2	26.2	20.2	41.1	13.1	39.6	33.0
Dec 27	49.0	7.2	19.6	31.6	27.8	28.9	27.2	31.7	7.1	19.8	22.7	27.3	31.9	24.5	23.7	38.9	13.2	31.5	28.6	21.0	36.1	24.9	31.2	45.3	28.5	23.2	27.5	37.5	18.3	25.3	26.9	14.8	28.5	24.6	37.5	18.3	30.0	20.4	32.4	24.2	21.6	23.8	29.7	18.8	26.9	30.5
Dec 28	44.4	19.3	14.4	25.5	31.6	26.2	23.0	33.0	7.0	20.9	20.5	15.4	36.3	18.8	27.2	38.2	22.3	29.7	27.2	17.6	38.7	21.8	28.2	42.4	26.8	31.7	22.5	24.7	26.2	20.1	24.3	23.3	26.8	30.0	36.1	13.6	20.0	30.5	31.2	18.4	22.6	26.3	21.5	26.1	28.3	28.0
Dec 29	44.9	33.3	15.5	25.3	24.3	31.2	22.4	31.4	16.4	29.2	19.7	18.3	30.8	15.1	34.7	31.3	29.1	33.1	21.8	37.7	31.5	12.7	27.0	35.5	22.3	38.3	25.9	23.4	20.6	28.0	21.7	30.9	32.0	28.7	34.7	8.0	19.5	22.7	31.3	12.8	18.0	28.5	19.4	23.6	15.6	32.4
Dec 30	29.7	34.6	19.8	23.8	36.7	25.5	27.1	33.7	27.3	35.1	24.9	18.7	26.6	14.6	34.5	24.3	28.7	23.3	12.3	36.8	27.7	21.4	30.3	29.4	29.0	46.4	30.2	17.1	27.8	25.4	28.7	32.3	31.5	28.3	37.9	16.8	15.5	26.9	23.7	10.3	27.0	35.0	18.1	24.1	17.1	25.4
Dec 31	0.0	0.0	0.0	26.7	26.7	26.7	26.7	28.7	28.7	28.7	28.7	16.2	16.2	16.2	16.2	30.1	30.1	30.1	30.1	34.6	34.6	34.6	34.6	29.8	29.8	29.8	29.8	25.0	25.0	25.0	25.0	36.6	36.6	36.6	36.6	16.9	16.9	16.9	16.9	17.0	17.0	17.0	17.0	23.3	23.3	23.3

Mean	53.2	51.6	50.7	51.6	51.7	51.5	51.7	52.7	51.8	52.1	52.1	51.0	52.3	51.0	52.8	51.7	52.7	51.9	50.8	52.5	52.9	51.8	52.1	50.9	51.1	53.0	52.9	49.2	52.0	51.5	50.3	52.2	50.6	52.1	51.8	52.5	52.3	52.1	49.9	52.2	52.8	51.7	53.8	51.4	53.3	51.9
Min	9.0	7.2	8.3	10.4	11.7	12.4	16.8	3.7	5.4	13.8	14.8	10.8	7.1	14.3	16.2	14.8	12.3	10.3	12.3	14.5	18.4	12.7	18.4	11.9	6.0	14.1	6.7	10.5	9.2	15.4	6.7	14.8	12.6	14.2	9.7	8.0	14.9	13.4	9.3	10.3	17.0	11.6	17.0	13.1	12.9	14.6
Max	89.3	90.0	87.4	86.5	88.7	86.8	86.4	88.5	89.1	86.4	86.6	94.0	87.8	87.8	91.7	85.2	86.1	88.1	86.3	89.2	88.5	90.1	85.9	88.2	89.5	86.7	89.0	89.8	91.3	86.2	84.8	91.6	89.9	87.4	90.1	87.4	88.4	86.1	87.1	90.8	84.8	87.4	88.1	86.2	90.4	89.5

TABLE 5. SUMMARY AND EVALUATION OF DAILY TEMPERATURE IN HELP MODEL 100-YEAR SYNTHETIC WEATHER DATA SET

YEAR->	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93
Jan 1	34.0	32.5	16.8	38.5	23.1	31.8	32.0	25.8	32.5	37.2	30.0	35.9	38.4	24.5	21.4	39.6	44.4	27.6	24.9	27.0	38.5	33.6	30.8	25.1	31.7	18.9	22.1	28.3	38.5	23.1	29.8	40.0	31.4	26.7	25.2	26.9	36.3	50.3	34.7	19.9	28.2	17.9	36.7	42.5	24.1	17.6	29.8
Jan 2	34.6	27.6	22.6	35.8	37.8	30.5	28.7	27.3	27.8	31.4	27.4	28.8	40.8	31.1	18.9	32.8	47.8	26.2	30.0	35.1	42.8	27.0	27.9	17.8	33.1	28.3	31.2	29.3	33.3	16.8	27.4	42.8	21.9	31.9	29.6	39.4	33.3	49.0	34.3	20.4	25.8	34.4	27.1	43.3	34.2	18.1	20.6
Jan 3	37.9	29.3	28.8	33.2	35.2	39.1	32.3	33.5	23.9	18.1	26.9	25.3	43.5	29.5	20.1	22.2	49.1	32.8	30.2	40.3	36.6	29.1	35.2	25.6	38.2	28.2	21.7	29.6	25.7	20.3	35.1	37.7	32.7	35.5	30.2	35.5	27.4	53.4	40.8	25.3	41.1	36.6	25.1	41.8	33.5	29.6	12.9
Jan 4	37.4	42.8	16.9	31.1	32.9	29.6	37.2	39.2	35.4	22.2	23.8	26.3	35.5	26.0	29.9	35.0	36.7	36.3	21.2	34.5	39.2	29.7	39.6	33.9	33.5	30.9	18.4	31.2	41.5	27.6	45.3	40.2	29.7	41.2	32.0	20.0	31.5	41.3	34.7	20.4	34.7	35.5	35.7	27.9	38.2	28.8	22.5
Jan 5	36.3	43.4	19.7	33.1	33.3	39.8	30.1	33.1	29.9	27.3	36.7	20.4	28.4	29.4	23.7	27.2	36.6	39.8	26.2	35.9	38.8	25.1	27.9	22.8	29.2	39.2	24.1	25.5	36.2	24.2	38.6	40.3	33.6	38.5	26.1	18.8	28.6	33.5	31.3	30.1	33.2	37.4	36.8	28.9	33.4	33.9	35.5
Jan 6	39.9	45.7	9.5	36.1	35.4	42.8	36.4	32.2	26.7	35.6	32.2	21.8	22.9	27.9	26.5	27.0	26.9	42.3	25.1	27.0	40.0	30.4	28.6	20.7	26.0	36.9	23.6	22.8	43.9	22.8	28.0	44.0	39.1	31.5	20.3	16.3	17.9	26.5	33.3	23.7	38.6	33.5	42.4	30.9	30.5	28.8	29.7
Jan 7	28.1	36.4	10.2	19.8	38.7	42.5	34.0	32.5	28.3	17.4	24.6	24.9	27.8	19.5	28.4	35.4	20.3	42.9	38.0	23.3	37.4	23.9	28.7	24.6	23.4	41.1	27.0	30.1	30.5	29.9	34.0	38.3	29.1	33.5	20.9	12.9	18.1	27.8	23.9	21.4	41.5	29.2	36.1	30.7	32.7	34.1	27.3
Jan 8	35.8	27.1	18.0	17.9	35.8	33.2	34.4	32.2	27.2	27.2	33.0	25.9	36.3	22.8	22.9	29.9	17.8	40.5	32.6	23.9	35.8	24.4	30.5	20.8	31.9	30.1	26.5	31.6	24.6	30.9	30.1	30.0	32.3	35.3	22.8	15.7	20.8	36.3	18.4	28.4	32.3	34.7	31.4	27.0	17.7	26.5	35.8
Jan 9	43.0	27.3	31.9	24.7	36.5	39.2	28.7	30.3	27.9	20.8	30.5	22.4	30.1	22.7	23.0	24.5	18.3	31.2	34.7	21.9	41.8	24.7	32.1	24.1	26.3	39.4	25.1	30.8	22.0	29.6	33.0	20.9	27.0	35.1	23.2	16.1	28.8	36.4	26.4	24.8	35.3	25.0	33.0	27.4	14.9	42.8	45.9
Jan 10	29.6	22.3	25.0	23.5	40.4	36.0	32.6	26.4	29.9	30.9	34.3	24.2	27.9	35.9	18.3	27.1	20.2	30.0	37.9	32.4	30.3	24.6	27.5	35.6	25.8	43.3	17.6	29.6	21.6	23.6	24.1	27.4	24.0	36.7	25.7	9.5	16.2	33.7	36.7	30.4	41.2	30.6	31.3	34.7	20.8	41.1	32.4
Jan 11	30.2	34.6	32.1	29.6	41.6	28.6	37.6	27.8	22.6	34.9	42.3	30.8	29.4	34.7	19.3	26.3	12.2	29.9	35.7	33.9	29.0	25.5	24.4	44.5	21.4	35.0	27.6	27.4	30.6	30.7	26.0	21.8	30.1	33.8	15.1	10.1	21.1	33.0	34.7	36.2	29.6	31.6	35.8	40.7	21.1	32.5	27.1
Jan 12	40.1	31.4	37.1	21.5	41.7	41.5	44.0	28.1	25.7	41.9	38.9	39.0	28.1	34.1	25.7	28.3	25.8	23.3	39.1	39.5	32.7	23.5	35.3	37.2	15.1	32.8	27.7	31.7	27.0	21.2	27.5	18.3	27.0	25.8	26.1	21.2	27.5	34.7	31.5	25.0	39.9	36.5	32.3	39.8	29.3	38.5	29.3
Jan 13	38.3	27.4	37.5	15.7	36.2	28.5	29.5	15.3	18.7	44.4	37.8	25.8	19.2	32.7	20.9	40.9	33.8	32.3	36.2	38.8	38.6	29.5	34.2	48.1	26.4	40.4	27.7	33.6	24.9	24.3	32.8	16.5	25.8	23.8	28.7	25.5	31.4	38.0	37.3	31.6	32.6	32.6	27.9	42.1	24.9	29.0	33.0
Jan 14	32.4	21.5	31.7	22.9	26.4	34.5	43.5	21.5	28.8	39.5	30.4	33.3	33.4	37.1	17.4	28.7	32.2	40.7	39.1	30.2	41.1	42.9	27.7	41.6	17.7	44.8	21.6	25.3	27.7	25.0	29.3	20.3	24.6	32.1	33.8	29.9	32.3	46.3	39.1	21.2	28.3	26.8	25.8	46.8	28.2	34.7	26.9
Jan 15	23.4	27.5	30.0	15.8	20.2	35.7	24.6	29.9	24.2	34.8	38.6	36.1	34.4	36.9	21.6	30.6	31.7	32.9	42.7	37.4	31.8	37.8	39.9	44.3	30.1	41.1	30.0	31.1	25.7	27.7	32.8	35.0	34.9	31.7	22.2	25.6	25.1	32.8	45.8	17.3	28.4	32.8	20.1	40.7	23.8	38.8	33.3
Jan 16	22.5	29.1	27.5	21.8	21.9	37.2	33.3	34.1	15.5	38.0	35.6	40.2	24.1	37.0	26.1	42.9	23.6	37.4	28.5	31.6	27.6	31.6	40.0	43.8	26.6	36.8	37.1	24.1	35.5	28.0	36.5	41.5	31.9	35.3	23.8	21.4	19.6	35.3	44.9	12.9	25.1	20.1	29.1	28.3	22.2	30.2	28.7
Jan 17	16.2	34.2	31.5	27.1	19.1	39.2	33.3	33.9	23.2	25.0	40.6	29.8	23.3	29.7	43.9	42.0	34.4	37.1	32.2	21.0	30.9	25.8	42.2	46.4	32.3	33.8	31.0	27.3	36.5	32.5	40.2	43.7	32.5	36.0	28.6	21.3	22.2	26.0	32.7	31.1	29.5	22.2	32.9	31.9	19.3	22.8	34.8
Jan 18	10.7	35.9	29.8	27.9	27.1	40.8	34.7	34.8	23.3	24.7	48.0	33.8	22.0	28.0	36.0	35.1	32.2	30.9	30.5	22.5	33.7	36.5	29.3	33.1	28.5	40.9	42.5	23.0	29.4	30.3	36.2	45.9	34.8	34.9	37.6	14.7	33.2	31.9	25.9	32.1	29.0	16.3	23.4	31.6	25.9	22.2	35.7
Jan 19	23.5	36.1	27.6	33.2	20.3	27.5	30.0	39.6	28.1	28.5	45.9	38.0	35.6	30.8	20.4	38.3	28.1	26.3	25.0	22.7	20.5	37.1	25.3	31.2	24.4	26.9	38.7	25.8	28.8	24.8	31.6	29.5	30.0	37.7	27.1	23.7	25.0	23.5	15.3	22.9	35.6	32.9	18.7	26.1	26.2	23.7	34.3
Jan 20	17.8	25.2	31.7	38.5	21.4	20.5	26.2	42.2	33.6	27.7	44.5	42.1	36.2	31.8	27.3	34.9	30.2	11.5	33.7	29.7	19.7	34.5	25.3	30.3	24.8	28.3	36.4	24.2	26.7	33.6	35.6	29.9	36.6	30.9	38.8	28.7	29.8	30.3	20.0	28.6	34.9	26.6	23.2	23.8	30.1	27.8	39.1
Jan 21	24.3	20.0	31.5	33.2	10.2	29.8	32.8	37.2	30.9	26.8	34.9	21.4	40.7	21.8	27.5	34.7	34.9	15.1	36.8	34.5	19.2	20.6	34.3	24.3	19.7	22.6	36.8	16.9	34.4	33.4	33.3	27.0	42.0	26.6	27.7	28.8	33.9	24.1	24.7	24.2	35.0	27.4	26.1	28.0	25.9	33.6	37.1
Jan 22	19.2	22.1	40.6	37.3	11.4	33.6	24.6	36.0	29.3	27.8	34.2	34.5	32.1	25.9	28.9	36.4	37.0	27.1	36.5	34.9	17.7	23.7	30.4	29.8	31.6	30.9	39.7	28.1	36.6	36.2	21.2	24.8	43.8	31.2	29.4	18.3	35.6	17.0	21.5	20.2	30.6	22.8	34.5	34.6	29.8	36.6	46.9
Jan 23	22.6	20.1	49.2	35.6	23.0	31.2	20.6	41.7	33.5	32.7	26.3	32.5	34.1	29.1	25.2	38.2	23.3	30.7	33.9	32.1	23.2	19.8	39.6	38.2	32.2	36.3	32.2	31.3	37.0	35.2	30.9	24.2	37.3	34.1	32.1	18.6	27.1	28.0	31.1	25.5	31.1	17.5	39.5	44.8	37.2	28.9	31.6
Jan 24	24.9	21.2	43.7	25.8	26.3	34.6	31.9	35.7	28.1	25.8	20.3	26.1	23.6	22.0	23.6	28.6	27.0	30.6	42.3	39.4	12.0	27.9	38.0	46.3	34.4	36.9	21.7	30.3	33.3	32.9	32.4	27.1	32.9	46.0	31.1	20.1	18.7	21.6	34.9	25.2	30.0	16.7	32.1	36.3	37.3	29.7	29.8
Jan 25	36.8	32.1	39.6	30.5	21.9	35.4	21.9	41.0	22.7	36.6	24.0	24.8	17.4	21.4	40.8	32.1	23.0	34.0	51.2	32.6	24.9	24.5	37.2	44.5	35.1	28.1	17.7	20.9	30.1	35.4	40.7	28.8	27.1	40.7	32.7	10.9	26.9	22.3	26.6	27.4	24.2	22.7	33.9	32.0	33.2	20.4	35.4
Jan 26	36.3	42.1	33.1	36.3	18.2	25.2	20.5	32.6	14.4	42.0	29.9	27.7	21.8	15.9	46.6	36.8	29.6	27.1	45.3	30.5	27.8	18.6	22.9	38.9	29.2	41.3	13.4	16.7	30.8	34.3	42.3	30.4	23.4	26.7	31.7	25.5	30.0	31.0	31.6	34.1	22.9	19.2	38.3	30.7	42.1	17.9	43.6
Jan 27	32.6	38.6	27.3	30.3	25.3	27.3	23.8	24.7	16.8	30.5	28.7	28.5	17.6	19.7	46.1	31.8	26.1	32.2	46.3	21.6	24.1	26.3	26.8	39.4	35.2	35.1	15.7	13.8	34.1	37.0	37.0	32.4	25.8	26.6	30.6	22.4	26.9	36.9	28.3	36.6	33.3	24.9	41.6	18.6	47.9	13.4	40.3
Jan 28	27.6	42.9	28.6	27.5	30.8	34.1	21.4	35.3	18.8	23.9	35.1	29.0	15.1	27.9	33.8	33.7	16.0	27.3	31.1	26.0	19.9	14.5	23.0	41.2	30.8	35.7	15.1	18.4	43.0	28.0	38.6	32.4	33.5	26.3	31.2	20.5	28.3	25.9	24.3	36.6	25.9	21.2	38.5	29.8	33.0	19.1	44.9
Jan 29	26.4	43.0	38.1	27.7	30.0	24.1	28.3	34.7	23.8	34.4	39.9	29.0	19.8	21.1	38.0	39.0	17.5	26.5	23.9	25.4	12.9	23.1	36.3	35.4	26.1	46.8	23.0	24.6	36.4	26.1	30.4	33.4	42.2	20.3	26.0	27.2	32.1	34.5	19.9	36.4	21.7	15.4	32.6	35.7	36.0	14.8	36.2
Jan 30	25.1	34.1	30.7	35.4	36.8	18.2	21.1	22.5	26.1	35.9	37.2	26.8	22.7	21.5	29.9	31.6	20.9	18.9	21.1	25.0	10.3	37.0	32.5	38.9	26.8	46.8	20.0	29.9	34.9	18.1	33.0	31.7	35.5	15.1	15.9	29.4	24.2	23.6	26.4	29.8	26.6	23.0	39.8	26.0	35.6	19.2	32.5
Jan 31	32.6	30.6	34.5	39.5	43.2	27.7	27.3	19.9	23.3	38.8	30.7	23.7	23.7	30.3	37.5	27.9	23.6	24.8	22.3	36.0	20.1	24.6	24.2	30.8	24.5	39.4	20.5	33.4	34.3	25.4	35.2	24.8	41.9	16.9	20.7	26.5	20.4	28.4	22.3	37.6	28.0	24.3	44.9	37.3	31.0	14.9	36.0
Feb 1	25.7	38.2	41.8	28.8	38.1	26.8	31.9	18.7	23.2	30.8	30.7	24.9	24.9	23.4	23.1	32.5	29.6	26.8	27.8	29.4	35.2	25.5	31.0	25.0	20.4	21.8	20.5	33.4	31.5	21.5	33.7	21.6	36.7	13.0	27.5	28.0	17.2	22.0	26.0	43.6	32.3	17.8	43.8	28.0	28.2	19.5	32.6
Feb 2	30.9	40.7	30.1	30.5	37.0	34.7	29.1	15.9	29.5	23.1	31.4	21.7	23.7	24.5	19.9	24.8	26.4	19.6	34.4	23.3	26.1	27.0	40.0	18.5	17.7	33.9	28.8	34.0	37.6	24.0	29.2	21.9	32.5	21.5	20.7	24.7	23.0	20.1	40.8	28.8	29.4	18.9	31.3	38.2	25.7	23.4	32.0
Feb 3	28.6	38.3	22.0	29.4	47.2	35.0	30.7	24.3	26.7	20.1	31.0	25.2	20.1	33.4	14.9	28.2	28.8	30.6	28.5	29.5	35.2	29.1	38.1	22.2	22.8	33.3	37.6	35.0	42.5	23.4	36.9	36.8	26.7	22.3	24.8	22.3	29.5	20.2	40.7	34.4	31.9	23.8	25.5	28.5	31.3	17.6	29.1
Feb 4	39.4	34.4	32.3	29.6	32.4	37.4	39.5	30.9	29.8	28.5	32.1	22.6	20.6	36.1	24.8	29.1	22.7	29.1	35.8	22.9	40.4	34.5	24.4	14.8	33.0	39.7	29.3	34.3	42.7	22.3	30.8	33.5	21.1	32.8	24.4	13.4	31.2	22.4	31.0	34.8	26.7	26.8	31.7	21.5	25.4	20.6	34.8
Feb 5	38.0	38.5	24.4	26.1	33.5	35.3	36.9	28.8	34.2	28.9	31.5	27.7	27.3	33.7	25.7	32.3	20.7	30.0	33.7	12.9	32.4	31.5	43.9	28.6	31.6	37.2	23.0	24.6	36.5	24.2	37.8	22.4	21.6	35.3	24.3	11.8	32.0	24.0	39.4	23.7	28.6	31.8	35.3	25.9	30.6	18.1	28.4
Feb 6	31.0	35.6	28.8	32.6	38.9	26.7	43.7	28.1	45.9	21.5	30.0	32.4	29.9	34.4	30.7	38.4	29.6	19.4	36.7	8.6	22.5	23.9	43.9	35.2	29.7	39.5	23.6	22.4	38.3	28.1	34.3	27.3	24.2	40.1	30.2	13.6	31.2	26.5	29.7	32.1	22.5	31.7	29.6	26.2	21.1	26.5	39.6
Feb 7	39.8	36.2	40.9	28.4	39.7	25.4	37.5	36.9	34.9	20.2	33.0	32.5	34.5	45.2	22.0	36.2	31.2	20.3	53.5	12.4	26.2	24.5	49.6	35.8	26.7	27.0	39.7	18.6	46.6	42.8	35.2	31.2	23.3	25.0	30.1	21.7	31.0	33.3	39.5	37.0	24.2	25.2	28.8	20.5	25.0	21.6	30.3
Feb 8	36.9	35.5	45.4	28.1	33.5	14.6	24.8	46.6	34.1	22.0	39.7	49.5	27.6	37.1	27.1	31.0	33.2	23.5	40.3	20.4	37.7	13.9	40.5	27.4	30.7	29.4	32.8	33.7	36.7	38.7	39.1	30.8	22.0	31.5	30.9	20.9	28.1	32.1	32.4	37.4	20.7	29.6	25.0	21.8	27.1	13.2	25.5
Feb 9	30.5	40.4	47.0	27.1	28.9	24.3	26.8	42.6	19.0	22.3	21.9	34.2	22.4	26.5	32.4	24.4	35.5	27.2	25.0	21.4	32.3	26.4	43.5	22.6	38.8	36.7	37.6	32.0	33.9	49.2	37.2	27.7	16.2	30.2	42.2	18.6	24.6	31.6	42.2	41.9	21.4	33.8	25.3	29.9	23.3	19.0	18.6
Feb 10	35.2	35.8	36.5	24.7	22.6	18.0	23.1	33.4	24.6	26.5	25.6	33.1	22.1	25.0	47.2	25.7	22.4	36.5	34.1	21.4	25.9	30.4	49.4	27.9	36.6	28.0	29.0	31.7	41.7	43.4	41.4	26.4	17.5	38.4	32.6	21.3	24.1	33.9	31.8	42.5	18.4	31.6	32.5	38.7	19.3	23.4	14.5
Feb 11	34.1	34.2	32.8	29.9	11.3	25.8	21.5	47.4	27.2	20.0	28.8	36.2	18.4	30.5	36.0	30.0	39.0	31.1	39.7	29.1	26.9	28.5	51.0	34.9	34.4	31.3	42.8	28.4	34.7	39.2	48.9	28.5	29.2	39.4	50.1	29.9	22.9	29.0	40.5	47.7	16.3	44.3	26.3	33.4	17.6	25.6	14.5
Feb 12	25.6	23.0	25.9	31.9	26.0	19.1	25.5	34.9	30.4	27.7	28.3	25.9	24.2	39.0	28.0	27.4	44.2	25.4	43.8	20.3	22.3	36.4	43.8	38.8	41.7	35.1	52.0	29.1	31.1	34.7	35.9	20.6	33.8	26.0	34.4	34.0	28.2	26.6	51.1	39.9	18.0	60.6	30.0	38.8	16.4	26.4	14.7
Feb 13	27.4	24.3	26.8	38.9	27.5	18.0	27.5	41.9	26.7	24.4	28.8	30.6	28.9	44.1	29.7	22.8	44.3	26.2	45.8	33.2	26.1	22.4	40.1	32.8	40.5	29.5	40.3	35.6	26.9	35.8	35.6	30.7	34.9	28.9	31.3	32.0	24.8	25.9	44.4	25.9	21.7	45.6	24.5	41.7	13.3	40.0	16.5
Feb 14	34.8	17.6	27.1	47.2	28.1	26.7	31.8	50.5	28.4	29.1	48.6	51.6	23.6	48.3	24.8	25.2	40.6	28.9	41.7	30.9	24.4	16.4	28.6	27.3	31.9	31.3	37.5	30.3	27.0	35.8	31.3	30.1	28.6	36.2	24.1	41.6	28.8	37.1	42.9	22.4	25.1	45.8	27.0	30.4	15.6	38.1	21.2
Feb 15	38.4	30.0	22.4	43.2	27.3	27.4	37.3	45.8	34.6	23.7	40.6	54.3	30.1	44.0	17.2	23.8	40.4	27.2	29.5	39.9	29.5	11.1	18.3	22.5	23.7	24.3	43.8	26.5	30.9	36.4	33.9	35.7	29.1	34.2	34.9	29.1	24.7	32.2	41.3	24.2	16.9	47.8	21.9	39.9	25.8	36.9	24.8
Feb 16	33.9	19.4	26.4	46.2	32.5	29.7	34.6	39.1	32.9	28.7	45.7	48.1	33.9	38.2	23.5	21.6	38.5	17.9	42.3	32.2	31.6	12.1	23.3	21.7	27.4	33.7	42.9	24.5	31.6	41.0	38.3	22.8	27.1	38.1	39.0	27.7	26.5	39.5	36.8	27.2	8.6	47.5	29.5	32.2	38.9	44.5	31.1
Feb 17	36.4	17.9	28.3	49.3	34.2	25.7	37.5	36.3	25.8	21.3	25.7	46.3	31.1	46.7	22.7	24.3	40.6	24.8	45.1	29.9	25.8	22.6	25.5	32.8	28.1	30.1	47.3	29.9	35.2	31.7	39.1	34.3	22.9	39.4	36.8	37.3	22.3	51.1	36.5	34.4	21.4	48.8	39.7	42.8	46.1	36.3	27.5
Feb 18	32.7	21.0	37.2	41.5	33.6	24.3	38.2	31.0	33.3	29.6	39.1	34.6	33.4	47.9	25.7	29.9	43.3	27.8	48.1	32.0	27.8	25.5	33.2	37.6	24.0	29.9	40.3	33.5	45.2	39.5	47.4	32.7	21.9	38.2	39.0	30.4	23.6	50.4	30.1	37.4	25.0	53.5	39.3	31.5	31.1	40.7	32.9
Feb 19	39.2	39.8	22.8	42.2	41.2	24.5	29.3	37.0	34.0	23.1	37.0	28.1	33.8	55.0	30.0	31.9	36.2	34.1	44.8	27.4	29.4	22.7	36.4	33.5	39.3	28.8	39.6	27.5	41.1	47.1	40.8	28.9	19.0	24.7	32.7	30.0	25.5	46.1	29.2	39.2	30.3	42.3	39.2	35.9	26.7	38.6	31.7
Feb 20	36.2	32.4	19.8	36.2	37.8	21.1	46.6	41.6	29.0	28.6	37.4	25.2	30.9	43.2	41.3	23.2	39.0	27.8	39.6	25.5	21.8	26.7	32.8	36.9	42.8	24.5	35.6	32.6	40.5	39.4	32.8	41.7	23.6	29.1	40.3	32.3	33.2	29.0	30.6	43.7	37.7	46.8	44.4	25.8	33.7	32.8	36.8
Feb 21	23.2	25.3	25.8	43.5	25.6	20.2	43.4	40.6	33.1	36.8	40.9	29.5	29.1	42.3	41.5	27.8	36.6	33.1	31.3	25.5	21.6	33.6	20.2	41.6	36.1	25.7	36.7	32.9	38.0	37.1	35.7	26.5	26.8	35.3	40.9	26.9	34.4	29.7	31.2	41.2	23.5	40.5	40.7	22.2	38.1	35.2	36.5
Feb 22	27.7	47.9	26.1	35.6	23.1	25.7	52.5	36.7	32.8	39.0	44.0	34.0	35.8	48.6	37.5	30.3	28.4	30.4	31.5	30.2	29.8	39.3	16.6	44.0	43.7	25.3	25.5	34.7	37.4	27.6	29.1	36.5	31.1	36.6	36.1	32.1	29.9	31.3	22.8	29.7	33.0	45.1	29.6	33.0	31.5	43.0	36.3
Feb 23	23.3	45.9	35.3	32.7	30.5	32.4	43.3	40.5	42.1	36.4	40.2	40.4	33.1	53.4	40.2	30.3	21.2	21.1	26.8	33.8	27.0	33.1	27.3	40.0	35.7	17.5	24.6	29.0	43.9	25.3	41.5	33.0	27.1	29.0	18.7	31.5	29.1	30.3	24.9	37.0	26.7	38.4	40.2	36.6	29.4	51.2	33.6
Feb 24	33.8	37.1	21.3	37.5	32.0	22.7	43.1	40.4	34.2	43.4	44.3	25.5	39.9	36.9	38.1	38.9	22.0	21.7	30.2	35.7	18.3	36.4	39.2	35.1	37.6	14.1	24.0	26.8	40.5	47.3	38.6	30.7	34.4	42.2	21.0	26.8	25.2	27.9	36.5	33.5	24.0	32.7	41.3	36.1	19.6	48.5	22.6
Feb 25	32.7	40.7	20.9	37.5	36.2	29.8	37.8	37.4	30.2	49.2	30.3	26.4	33.7	28.3	37.1	33.8	24.5	31.1	32.2	30.0	25.9	37.3	41.7	34.8	29.5	11.8	19.2	33.6	31.1	41.1	30.8	35.9	33.6	44.8	24.8	38.1	28.2	31.0	31.1	24.9	29.7	32.4	38.6	32.0	21.3	49.1	34.6
Feb 26	16.9	33.4	22.8	34.6	40.1	37.9	33.3	40.6	32.5	41.7	31.3	32.5	49.4	22.2	48.0	42.2	20.7	35.3	37.1	38.1	29.0	29.6	43.5	36.0	36.1	22.1	23.3	37.6	35.7	52.6	40.2	25.4	35.2	43.9	32.0	36.6	24.4	39.3	45.8	39.0	43.0	37.1	39.8	33.6	33.1	41.8	41.8
Feb 27	19.6	39.2	24.0	29.5	45.2	46.2	34.2	41.9	34.0	40.8	41.4	32.5	35.8	25.9	51.1	40.6	25.3	30.7	34.4	25.2	35.9	39.6	38.3	27.1	35.4	27.1	28.9	30.9	31.5	52.1	39.9	26.2	25.2	39.0	33.5	43.5	28.1	30.6	39.1	29.0	46.5	33.9	46.4	27.3	24.1	40.8	34.6
Feb 28	19.6	38.7	19.7	21.4	42.3	47.8	28.3	43.7	21.8	36.7	39.3	38.0	28.7	31.9	49.4	35.9	30.4	32.4	31.8	35.0	28.7	42.3	46.8	28.9	41.2	25.3	21.7	35.2	26.6	42.4	46.3	20.8	37.6	33.1	38.2	41.9	30.2	35.2	35.3	40.8	44.1	44.0	35.1	40.5	40.1	47.9	32.9
Feb 29	25.1	35.2	31.9	25.6	40.9	47.4	29.5	39.1	27.4	54.2	42.4	47.0	35.2	27.3	47.9	31.3	33.0	38.2	37.0	38.9	30.1	37.2	46.7	29.2	35.3	34.4	38.4	34.3	36.3	39.3	48.3	30.9	53.0	33.4	34.7	36.0	29.8	44.1	47.1	42.6	51.7	48.3	44.7	47.7	53.5	43.1	39.1
Mar 1	20.1	34.2	25.7	28.3	35.6	48.9	31.4	37.6	28.4	45.3	44.3	49.8	37.3	38.9	41.0	28.9	33.0	50.9	30.1	28.0	34.9	36.2	33.3	34.6	30.4	35.8	35.0	36.2	48.4	36.7	31.1	32.0	50.9	44.7	40.3	39.1	37.6	39.5	34.9	48.4	47.2	33.6	48.6	39.5	47.8	42.6	36.6
Mar 2	33.6	27.0	35.0	37.8	32.0	59.4	41.3	40.8	42.6	39.3	28.2	42.8	47.1	31.1	48.6	29.2	36.0	55.0	33.2	40.5	47.6	39.1	21.1	31.3	41.2	35.6	43.8	31.7	34.3	48.6	24.3	42.4	54.2	36.3	31.0	36.0	30.7	35.7	33.4	46.9	43.6	34.3	37.8	36.7	47.4	53.7	35.3
Mar 3	40.6	38.5	31.8	41.7	40.5	54.4	33.0	36.4	38.7	47.0	30.0	36.4	56.7	16.5	52.2	34.1	43.3	41.3	35.0	51.1	51.4	36.2	26.1	34.3	41.2	35.0	41.3	38.6	32.6	51.0	18.9	36.5	56.0	34.0	27.8	37.1	33.6	31.8	32.1	40.8	53.2	34.5	42.5	43.1	43.9	46.7	40.1
Mar 4	24.8	38.9	42.4	41.0	30.8	52.4	32.7	28.0	37.7	42.6	36.5	37.1	48.0	23.6	56.5	25.8	39.2	35.7	40.3	46.9	57.5	38.4	31.0	28.5	47.0	34.9	45.1	44.4	24.6	40.2	25.2	48.1	56.3	42.9	35.2	33.9	25.2	36.6	31.7	42.1	46.0	28.5	46.1	43.8	34.2	42.9	43.6
Mar 5	28.3	37.2	52.6	38.4	45.7	42.3	33.7	38.1	39.5	30.7	32.7	35.8	46.0	29.9	49.7	29.0	40.5	53.2	33.5	57.9	48.6	38.6	29.6	28.8	57.3	34.1	47.6	39.5	37.3	34.8	39.2	56.4	38.8	43.9	30.5	32.2	25.5	27.6	37.6	37.3	39.5	38.8	46.8	40.2	29.9	33.2	38.7
Mar 6	33.3	39.9	42.2	44.2	50.3	31.5	40.4	47.1	44.5	23.1	36.4	39.1	37.6	33.7	58.7	22.4	35.8	35.1	42.1	57.3	33.1	44.1	33.1	33.3	51.4	37.5	47.7	40.5	40.4	40.7	39.4	52.9	40.9	32.0	35.4	37.1	24.5	34.8	24.6	39.7	48.0	37.1	45.6	50.6	36.8	33.5	32.1
Mar 7	38.9	32.2	49.9	42.6	43.9	38.5	34.2	45.0	55.3	30.3	33.4	40.0	27.2	42.0	56.3	19.2	27.1	39.6	47.6	51.2	37.2	53.0	32.5	27.0	47.6	40.9	43.0	37.4	44.3	41.9	36.4	59.3	44.8	37.7	41.4	39.0	34.5	33.8	15.1	36.5	43.4	32.1	45.8	44.8	38.6	41.0	35.3
Mar 8	31.1	36.2	55.0	38.7	42.5	34.0	29.8	48.4	40.9	37.4	43.6	33.3	29.5	44.7	56.2	22.7	15.6	47.7	33.8	47.1	50.8	51.4	26.5	28.8	38.3	41.4	38.9	34.3	44.3	52.0	42.6	59.5	44.8	41.5	43.2	48.1	33.3	37.3	15.2	31.6	48.0	35.0	39.1	37.0	28.0	44.4	35.9
Mar 9	30.8	37.3	40.4	43.9	40.7	38.2	44.6	39.4	45.0	40.2	38.8	36.5	29.0	52.4	45.7	29.1	27.5	56.7	35.9	43.6	39.8	46.2	19.0	34.9	38.9	50.6	31.2	32.7	30.3	41.6	39.5	61.2	39.5	43.8	50.5	54.2	18.5	35.2	19.5	30.0	37.9	43.0	32.0	45.3	38.9	34.5	47.8
Mar 10	20.8	47.0	48.9	34.7	27.8	47.0	46.9	38.8	35.5	42.3	37.0	50.1	38.1	50.2	37.9	24.8	34.3	59.1	28.7	31.5	42.8	36.3	24.3	32.6	30.4	52.8	34.3	54.2	31.5	34.5	43.1	55.4	46.8	35.2	44.2	46.4	30.9	43.0	28.7	24.2	22.8	45.0	39.4	51.8	29.8	39.6	42.2
Mar 11	22.6	49.6	47.6	49.0	28.6	27.5	58.0	42.1	44.2	39.3	33.1	38.1	45.3	46.9	43.3	32.2	40.0	56.8	37.9	29.7	31.6	34.2	39.1	36.5	33.5	43.1	29.6	44.4	34.7	49.1	46.9	46.4	49.4	36.2	39.8	35.6	27.1	46.3	24.9	18.8	36.9	45.5	32.1	45.5	34.1	41.7	39.4
Mar 12	21.4	53.3	42.6	43.1	35.5	16.1	50.5	47.3	41.4	34.2	42.6	26.7	46.6	43.6	45.3	39.6	35.4	55.0	39.0	31.3	38.5	35.5	42.3	27.1	49.6	47.0	37.2	42.6	33.0	46.8	47.6	39.9	43.7	35.7	50.3	40.0	32.0	32.5	28.3	19.2	44.7	51.1	34.2	42.6	40.6	43.1	39.1
Mar 13	21.3	56.5	32.1	43.7	37.3	24.3	47.1	56.0	41.3	44.2	37.0	26.4	40.9	42.2	44.6	40.3	35.5	49.2	41.2	32.7	35.0	42.2	40.6	31.5	46.2	54.1	27.9	45.2	36.5	50.2	61.3	44.1	51.9	28.5	40.9	39.1	35.1	43.0	26.1	18.3	53.8	36.9	37.1	42.2	41.2	39.6	34.1
Mar 14	27.9	44.0	45.5	47.3	30.9	29.7	46.5	44.4	52.8	43.5	37.8	29.7	44.0	43.8	44.4	34.3	42.5	53.1	46.3	31.9	37.9	45.9	39.9	38.3	45.7	47.3	26.2	46.7	38.2	40.6	41.5	48.6	48.2	29.3	39.9	40.3	40.3	36.6	38.2	20.8	47.8	35.9	34.7	43.1	40.0	39.6	19.5
Mar 15	23.3	40.3	32.9	46.8	42.8	40.6	38.6	38.8	39.7	39.3	36.3	33.4	49.9	35.2	49.0	37.5	55.7	43.8	36.5	33.9	45.0	41.9	41.5	35.3	47.0	51.2	18.6	48.6	39.4	38.0	39.7	48.5	61.8	32.7	29.3	46.5	34.6	36.9	35.3	33.9	43.4	41.8	37.4	50.9	31.3	39.8	21.5

YEAR->	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93
Mar 16	37.0	35.6	35.2	46.1	37.7	48.7	35.2	43.1	37.3	44.8	32.5	35.1	62.4	35.3	50.3	36.9	58.2	38.4	23.8	33.2	46.3	38.8	38.3	36.7	44.8	56.8	26.9	39.4	39.1	38.9	39.3	42.8	51.7	36.0	37.2	49.9	39.9	36.5	43.7	37.5	45.0	25.8	56.0	40.5	41.5	31.0	31.4
Mar 17	39.0	24.1	52.2	37.3	37.9	52.1	28.5	48.5	43.9	53.3	34.3	39.4	59.3	27.0	48.1	44.4	56.8	24.4	43.3	36.1	36.1	40.8	42.9	32.3	50.0	42.0	32.7	48.7	37.8	30.6	38.8	52.0	52.4	39.2	56.8	51.7	39.3	33.6	46.4	39.5	34.5	33.6	53.5	42.9	50.6	44.1	33.2
Mar 18	41.8	31.1	47.2	35.2	44.8	52.9	26.4	39.6	48.6	44.4	34.2	43.4	55.4	33.6	46.6	46.4	49.3	31.6	40.8	42.6	36.4	41.0	36.9	32.1	41.2	46.5	33.5	42.6	32.1	27.5	48.1	54.2	57.4	36.0	63.2	55.5	37.8	38.1	38.7	32.6	40.3	45.2	55.2	46.3	43.4	37.8	41.9
Mar 19	43.5	37.2	50.2	38.4	34.1	54.0	32.8	53.9	55.4	52.1	40.9	34.7	55.1	42.3	52.2	52.9	38.8	24.2	41.1	43.0	28.1	41.9	42.0	45.6	44.8	44.9	49.8	43.8	32.0	30.3	56.1	53.9	51.1	42.8	57.4	45.6	38.6	42.7	36.9	25.0	29.8	45.6	66.0	40.5	47.7	36.5	53.0
Mar 20	42.7	51.6	41.5	34.1	38.5	60.0	27.5	52.3	36.5	38.6	38.8	30.0	40.1	29.9	50.1	57.9	45.6	35.0	42.3	51.2	32.5	39.3	55.8	47.7	37.7	44.0	60.2	55.3	28.1	34.8	53.0	44.9	42.8	38.0	46.1	39.0	45.0	31.2	38.1	37.0	38.9	39.9	64.6	39.9	38.0	38.0	49.3
Mar 21	43.4	43.3	28.0	37.4	37.3	50.8	40.1	56.9	51.8	31.9	45.6	27.4	45.7	42.6	47.9	37.5	47.3	39.6	41.0	57.8	32.1	35.5	59.2	43.2	37.2	54.6	57.7	39.1	25.7	41.9	44.1	44.8	53.4	39.8	48.4	40.9	35.1	33.1	27.3	32.5	39.4	33.5	64.0	47.9	40.2	30.0	51.7
Mar 22	43.7	35.2	31.1	44.9	45.4	59.5	37.9	50.1	55.7	45.4	47.5	29.1	52.0	49.4	34.5	44.9	33.2	36.5	49.7	40.3	48.0	39.5	54.0	44.2	41.8	48.3	51.8	41.6	37.9	38.7	46.7	49.3	47.2	36.7	54.1	48.0	38.6	52.7	32.7	36.5	41.2	48.3	66.0	48.8	32.1	32.5	50.2
Mar 23	44.3	36.7	33.2	44.9	43.6	56.1	34.5	58.2	37.8	41.4	31.7	33.6	54.2	49.8	38.9	44.8	35.0	44.0	47.1	53.7	51.5	42.9	47.4	49.9	35.1	47.5	51.7	44.8	34.2	28.9	54.3	53.7	43.8	43.5	49.2	42.9	44.1	59.2	33.7	45.9	42.2	58.4	53.3	55.1	42.8	37.3	44.9
Mar 24	50.1	45.5	26.7	48.8	30.8	47.8	32.9	52.1	33.4	42.9	38.7	30.1	54.1	50.1	43.8	45.9	41.8	53.7	47.7	38.0	61.7	27.7	52.4	41.6	41.1	50.7	50.7	42.4	45.8	30.3	62.4	45.3	35.7	54.7	47.4	47.2	38.5	48.8	36.8	42.3	45.6	56.6	44.8	43.7	53.7	36.0	51.9
Mar 25	49.0	33.7	29.1	39.8	35.4	52.5	47.1	56.8	23.2	48.3	38.1	39.8	61.3	32.0	42.8	36.0	44.9	49.3	37.2	50.3	60.8	31.5	38.0	46.9	50.9	63.7	48.1	50.1	43.8	30.6	59.0	51.1	31.9	51.8	43.5	51.2	44.0	59.2	40.8	39.1	39.5	54.4	46.5	50.9	51.4	35.1	48.1
Mar 26	53.2	31.5	39.9	29.8	41.1	47.3	40.9	47.7	22.1	48.4	33.8	42.5	55.2	33.9	44.3	39.0	40.1	50.8	48.3	55.0	55.2	36.7	40.9	47.8	57.3	53.9	43.5	47.3	44.9	30.5	54.5	39.6	35.4	56.5	61.2	44.9	47.3	57.5	40.1	44.5	36.9	56.5	56.4	50.9	52.8	43.2	51.7
Mar 27	59.1	39.0	39.5	37.3	52.0	57.6	49.1	45.0	35.9	33.1	32.3	44.0	53.8	37.9	43.8	41.8	37.3	37.6	50.1	61.1	48.1	41.0	37.6	51.8	41.0	50.7	40.5	36.4	34.3	32.0	58.8	40.3	48.6	54.0	63.4	57.3	57.7	55.2	42.7	41.3	39.1	40.3	44.5	61.5	63.3	40.1	39.8
Mar 28	42.3	53.4	43.8	43.4	47.4	45.3	44.0	50.4	46.9	38.6	34.5	40.2	47.9	35.1	52.4	43.0	43.0	38.0	51.1	61.8	51.1	38.2	44.5	55.8	56.2	42.2	31.7	50.8	43.7	27.4	48.7	43.7	43.4	55.1	61.9	60.5	52.7	47.8	38.3	54.1	36.9	51.7	43.9	47.2	61.5	42.2	54.7
Mar 29	43.6	51.8	46.9	56.4	42.6	60.3	49.0	39.4	45.3	37.0	50.5	49.2	40.0	42.6	55.5	51.0	41.9	47.2	52.8	57.1	55.1	40.2	51.5	42.5	54.3	34.7	31.3	59.0	35.9	29.8	45.3	59.0	44.7	58.7	59.8	60.4	52.0	44.0	35.0	47.8	50.6	50.1	43.5	53.1	52.0	48.0	54.7
Mar 30	45.5	35.6	52.7	56.8	41.5	60.5	46.3	36.4	48.0	39.2	56.7	51.7	54.0	38.8	55.1	57.4	39.9	46.5	41.8	53.8	47.5	44.8	56.6	40.6	59.0	39.1	40.3	57.6	27.6	35.4	60.0	49.7	38.3	53.9	63.6	54.3	41.2	43.1	31.7	55.6	61.8	39.9	43.2	38.7	40.9	50.1	54.9
Mar 31	54.8	37.3	43.1	52.9	43.8	52.6	34.6	41.0	41.2	46.5	41.0	37.5	47.2	40.2	43.9	50.3	26.7	36.6	34.6	48.0	34.6	53.5	55.8	44.2	50.3	45.6	51.4	51.2	33.6	37.1	57.4	53.7	29.8	59.4	56.9	56.4	52.4	49.5	39.0	46.4	54.3	50.8	46.7	43.3	30.9	48.3	50.7
Apr 1	59.2	38.6	50.6	51.0	40.7	51.5	39.6	33.6	42.6	46.5	42.3	26.1	45.1	38.9	54.4	48.2	40.5	39.4	43.0	52.7	31.2	41.9	57.9	45.2	55.1	40.1	49.0	43.4	43.1	44.6	33.3	48.4	38.4	47.9	55.0	45.9	46.2	29.6	35.5	47.2	59.1	60.6	54.1	43.2	38.0	41.7	50.8
Apr 2	57.2	40.3	47.1	51.7	38.8	60.5	33.5	28.0	45.7	47.2	49.0	27.4	34.9	50.9	67.3	43.8	31.3	43.2	37.5	42.8	33.3	42.2	59.8	39.4	50.0	48.1	67.1	56.5	45.5	49.9	49.6	37.1	41.6	34.5	58.8	55.5	49.2	36.8	27.1	50.3	62.1	47.7	60.3	48.0	45.9	52.8	59.0
Apr 3	50.0	48.4	48.4	44.5	43.6	51.6	55.3	32.5	46.9	52.5	43.5	34.9	34.4	55.9	65.9	38.3	30.3	46.9	32.1	50.2	58.9	36.7	49.1	38.4	42.7	41.2	67.8	44.1	35.2	42.0	49.8	35.0	41.0	49.3	59.3	52.0	60.6	31.1	25.5	42.1	55.3	48.7	58.6	37.3	50.6	53.6	49.2
Apr 4	50.2	49.7	47.6	48.9	45.0	54.7	53.6	33.2	30.3	53.0	38.4	43.4	30.9	58.4	60.7	44.1	38.0	45.7	48.1	48.5	62.5	51.0	47.0	39.3	49.7	49.4	56.2	45.2	37.6	53.0	40.0	38.3	51.3	52.8	59.1	56.2	56.1	25.9	26.1	46.9	48.6	65.0	62.0	44.3	43.2	53.8	40.5
Apr 5	52.3	43.9	38.0	44.8	49.8	46.0	48.3	40.5	29.5	46.6	37.5	39.4	39.6	63.5	61.5	46.1	32.3	37.6	56.4	52.7	70.8	44.5	42.8	40.8	41.1	49.3	55.2	55.2	46.0	61.9	40.7	38.0	52.9	45.6	47.9	52.7	55.0	34.3	31.0	46.8	45.6	42.0	42.1	49.3	56.4	65.7	42.9
Apr 6	45.6	40.7	35.9	46.4	53.3	46.7	47.7	46.2	34.7	47.6	35.6	43.3	45.6	54.0	51.9	33.3	34.3	42.0	39.8	50.0	63.1	41.1	53.7	55.1	44.2	55.8	50.4	46.6	47.0	63.3	28.4	40.3	56.0	38.4	44.6	45.4	50.0	47.9	33.7	56.6	50.7	41.8	47.8	57.7	48.9	68.7	34.1
Apr 7	32.7	27.3	34.6	42.5	42.2	58.3	36.0	44.3	51.3	52.7	42.9	46.7	50.8	48.6	60.1	37.6	33.8	34.6	35.4	54.3	61.3	44.9	43.9	42.4	48.0	40.1	39.5	48.0	48.8	51.0	40.2	48.0	51.0	42.3	43.6	46.1	45.4	53.5	31.2	54.8	59.4	43.8	54.6	48.4	47.0	63.2	36.7
Apr 8	38.6	36.1	39.0	41.4	35.2	46.1	41.1	44.4	38.4	40.3	35.0	53.5	52.1	35.6	60.4	36.7	36.4	45.5	43.7	58.2	60.2	41.3	38.6	51.8	42.7	54.2	44.3	53.0	41.2	56.2	38.8	57.2	53.1	30.8	32.1	48.9	56.7	39.6	36.5	62.5	56.6	47.7	54.5	61.0	48.8	64.6	39.6
Apr 9	33.9	37.8	46.5	42.7	41.9	42.6	54.3	43.6	52.0	43.6	44.4	46.4	56.1	36.0	57.6	44.9	51.3	48.8	45.2	54.6	64.9	44.6	38.3	58.3	29.4	60.3	61.8	57.7	47.8	58.5	44.9	61.1	40.3	24.9	37.1	40.0	61.2	50.8	42.5	61.8	65.4	44.8	39.1	49.9	44.2	55.6	44.1
Apr 10	40.7	46.1	48.8	57.4	42.9	39.1	49.0	44.2	47.5	44.7	52.8	46.6	57.3	36.6	57.2	50.5	57.7	43.7	42.2	57.4	51.8	40.9	43.8	56.0	36.0	61.5	55.4	61.8	53.7	61.4	51.9	62.2	48.6	36.1	51.7	41.7	58.6	52.0	46.4	50.8	50.8	46.0	43.8	53.2	56.0	47.9	40.1
Apr 11	44.9	51.0	42.4	60.5	43.3	46.8	43.1	36.6	46.5	42.5	60.0	45.2	53.1	34.4	62.1	53.4	51.2	53.5	36.2	60.1	56.5	44.3	46.8	45.0	44.3	55.3	36.5	46.4	53.1	57.3	50.4	64.5	50.8	28.1	45.7	56.9	58.3	61.4	47.2	37.7	51.8	45.4	40.5	55.8	45.9	41.8	34.9
Apr 12	45.3	49.7	35.0	59.0	53.7	47.1	36.0	37.0	39.6	39.3	59.1	36.4	57.4	31.8	56.3	45.5	48.7	54.5	38.0	52.2	60.3	40.0	57.9	39.2	52.0	49.5	30.0	45.6	59.0	59.2	59.0	58.8	41.8	33.3	47.1	50.4	57.2	58.6	48.7	39.2	45.0	44.2	47.9	64.0	52.2	39.0	38.8
Apr 13	40.8	52.9	33.6	58.1	50.9	45.9	43.5	42.4	37.0	44.8	57.2	38.3	45.0	37.4	52.4	44.8	43.8	62.6	42.2	45.9	46.0	43.4	66.8	48.7	39.6	60.0	42.7	49.8	60.9	59.4	44.7	66.7	39.8	41.0	47.0	42.4	51.0	56.5	55.0	41.8	39.1	54.1	42.5	66.9	55.1	31.9	39.9
Apr 14	51.4	54.3	42.1	47.2	57.0	55.1	39.4	52.1	40.9	33.7	56.3	45.3	41.0	37.6	46.5	44.1	52.0	65.4	52.6	49.1	43.2	40.9	69.8	47.8	44.2	57.9	46.4	49.8	52.2	61.7	52.6	59.4	50.4	50.2	53.4	57.3	50.2	55.0	41.7	54.2	54.3	53.5	37.0	56.5	57.8	42.5	48.0
Apr 15	50.8	45.7	43.1	49.9	54.5	56.2	48.7	43.2	37.9	47.2	53.9	48.4	48.7	49.0	54.7	55.2	56.3	63.0	57.2	56.4	37.8	45.8	74.3	48.4	39.3	56.0	58.7	47.9	59.8	50.9	52.9	62.1	53.2	50.9	58.5	59.4	52.9	58.5	52.5	52.5	51.4	57.7	34.8	68.2	47.2	41.9	52.8
Apr 16	48.1	43.8	37.3	54.1	57.7	51.7	41.4	48.4	50.6	48.9	44.3	54.3	62.2	43.9	49.0	50.0	60.1	53.4	53.5	59.4	35.8	57.6	80.4	54.1	50.7	52.0	51.2	44.3	71.3	52.0	42.2	60.3	60.0	42.7	48.9	62.4	45.1	42.7	55.2	49.5	47.8	67.9	42.1	57.6	40.7	36.7	48.7
Apr 17	55.1	63.2	41.5	56.5	51.2	47.1	37.8	52.9	45.7	44.2	49.5	52.9	50.7	50.5	62.8	47.2	53.6	43.9	56.2	44.4	50.0	54.9	79.8	53.5	51.8	62.4	50.3	48.0	64.4	49.1	38.3	53.7	62.6	45.1	44.3	53.8	56.3	38.6	50.1	48.9	46.0	73.7	42.4	57.1	45.7	39.5	46.3
Apr 18	62.2	58.0	39.6	59.9	53.2	44.5	41.3	52.3	38.8	49.4	51.1	46.6	47.5	53.6	62.0	52.2	54.2	54.5	58.4	45.7	53.5	49.9	79.9	47.2	39.1	59.3	49.1	34.3	58.0	62.1	42.7	52.6	59.3	52.0	43.4	50.2	63.5	45.3	48.7	42.4	55.1	65.3	52.9	69.0	36.6	50.5	48.6
Apr 19	53.1	52.1	44.3	66.1	56.0	43.7	32.2	55.1	35.8	48.7	46.3	49.9	42.2	53.6	55.5	60.1	54.7	58.0	42.5	39.9	52.0	53.1	72.1	45.4	44.2	52.9	49.5	44.7	63.7	53.2	46.8	43.0	60.1	64.1	37.1	48.1	61.8	47.9	58.7	48.8	49.1	58.7	45.7	70.1	37.7	52.9	49.7
Apr 20	47.2	52.6	46.9	59.4	59.0	46.9	42.1	49.6	44.2	60.4	58.2	49.0	32.6	54.8	51.9	55.2	57.0	48.2	44.7	45.5	56.6	52.9	65.4	45.0	40.1	53.9	56.7	44.9	57.9	55.2	56.2	43.7	60.0	63.0	44.5	52.3	67.5	60.5	56.2	54.0	46.0	57.0	39.1	69.1	43.8	49.5	53.0
Apr 21	54.8	55.5	40.4	62.2	64.1	41.0	47.9	49.2	45.0	51.6	48.1	48.2	38.3	51.7	51.0	55.6	66.1	44.4	40.7	51.6	59.1	48.2	61.1	61.8	45.1	52.0	63.2	44.8	56.1	57.1	56.0	48.9	57.3	55.1	40.3	54.7	69.1	57.1	63.7	56.7	58.9	57.0	39.4	67.2	41.0	47.2	56.0
Apr 22	53.7	64.7	49.8	58.8	61.9	40.3	44.6	54.1	47.4	55.4	54.9	48.4	36.6	43.8	51.4	56.4	68.4	57.3	63.7	52.3	50.4	51.4	56.2	53.9	35.5	60.4	55.5	45.9	54.0	56.1	44.4	47.4	56.3	39.5	45.3	55.0	60.1	64.4	56.0	54.8	47.3	53.0	46.8	59.7	40.1	37.2	45.6
Apr 23	52.9	64.9	52.7	52.7	67.5	37.0	51.8	52.5	53.9	66.7	51.0	50.4	51.9	48.1	52.8	58.5	52.8	53.9	63.8	54.1	50.9	57.6	49.4	52.6	43.3	52.0	67.2	46.7	48.4	51.4	52.4	45.3	45.0	50.5	56.1	66.8	67.7	70.4	52.6	49.8	52.0	50.0	45.5	60.7	44.9	47.3	48.4
Apr 24	57.8	68.6	50.1	58.7	64.8	40.0	47.6	50.3	44.6	51.5	58.2	52.4	49.2	41.6	51.1	51.5	57.4	48.0	60.9	47.8	49.5	57.3	50.3	53.9	44.9	55.5	57.7	57.0	39.6	53.6	46.1	52.7	53.8	61.3	59.6	63.8	61.3	68.5	53.7	49.5	50.6	55.0	41.8	63.4	51.4	53.5	45.8
Apr 25	57.9	60.5	47.2	69.8	48.6	47.1	50.0	59.0	57.9	55.6	55.9	47.4	41.2	48.8	51.4	50.2	58.0	49.7	52.6	52.7	55.4	52.3	56.7	43.4	33.7	54.7	65.9	51.8	38.4	49.9	50.2	56.0	58.8	56.5	59.5	58.8	60.1	55.7	46.2	48.4	54.6	54.4	47.5	73.1	47.9	55.4	52.3
Apr 26	54.8	47.5	58.7	81.4	55.3	48.7	51.6	47.5	63.1	58.7	60.0	48.0	49.5	47.3	48.3	45.2	46.7	46.3	53.9	41.7	55.7	58.9	53.8	49.1	44.9	62.1	60.8	52.6	35.5	49.0	46.0	50.9	64.2	60.7	60.9	50.4	57.0	63.1	49.5	60.4	49.8	49.0	49.5	70.0	58.6	44.7	52.1
Apr 27	51.1	51.0	59.4	64.2	55.9	41.6	43.2	45.0	61.9	53.9	57.5	44.8	64.1	46.6	43.8	51.3	44.6	63.0	62.9	37.7	62.7	52.5	49.0	54.5	50.8	62.5	58.5	49.1	47.8	44.3	49.9	57.2	51.5	57.1	55.3	55.1	54.4	63.7	59.8	65.4	55.0	49.6	52.4	63.3	62.6	47.4	52.0
Apr 28	51.2	53.3	52.9	50.4	56.3	49.4	45.5	43.4	55.7	57.4	50.2	50.3	59.7	46.4	54.1	52.2	49.9	66.4	58.1	48.0	57.9	44.8	37.5	46.8	54.1	59.7	66.4	56.3	46.0	37.3	48.6	51.0	50.9	50.3	59.0	50.6	55.7	59.6	58.8	60.5	52.7	49.3	48.1	63.6	58.0	52.4	59.4
Apr 29	53.9	58.5	56.3	61.0	51.7	51.5	53.1	52.4	61.1	59.9	44.6	48.6	57.9	47.0	42.7	57.0	56.6	66.8	52.8	49.5	62.7	47.5	44.9	59.0	60.8	56.6	65.1	54.7	49.1	43.0	53.9	60.6	51.6	50.9	58.7	51.3	59.1	61.8	55.8	57.7	57.5	53.6	61.1	57.8	49.5	52.2	55.1
Apr 30	53.8	47.8	62.5	57.2	55.3	59.5	63.7	49.0	51.9	61.2	49.5	51.6	56.9	52.2	42.9	61.0	47.7	60.6	49.9	48.9	50.9	52.2	43.3	53.1	60.2	55.2	59.7	56.4	47.8	50.4	63.1	53.2	53.8	54.4	60.9	44.7	48.8	56.6	55.7	47.8	52.0	52.9	62.0	55.4	54.8	58.7	47.6
May 1	50.9	52.9	58.0	68.8	52.8	58.9	66.6	36.5	62.3	55.3	56.3	68.4	50.7	54.9	46.3	53.5	52.1	54.9	53.2	43.7	58.9	51.3	39.5	57.0	63.7	60.9	44.5	51.3	56.2	61.9	55.6	60.0	47.3	48.3	52.8	49.6	60.9	58.3	49.6	43.9	51.7	51.8	64.6	55.4	57.7	60.7	39.8
May 2	60.8	56.0	61.8	65.6	63.6	57.6	62.8	43.7	57.5	54.2	64.0	55.8	50.5	54.8	42.6	64.4	44.1	53.4	54.1	43.6	50.2	65.3	39.8	54.2	55.2	59.2	33.7	48.2	60.2	59.5	54.4	58.1	54.0	51.4	53.6	57.3	47.9	56.7	49.9	41.3	53.1	52.8	66.3	50.4	62.4	62.5	27.0
May 3	67.9	43.3	48.6	56.9	52.6	57.9	64.9	56.5	65.3	50.8	50.5	44.3	58.0	65.0	45.0	59.8	43.1	44.8	61.4	43.5	60.4	64.4	48.6	61.7	54.8	70.6	39.3	44.5	53.2	54.8	49.1	56.8	62.1	49.3	57.0	62.8	38.8	68.3	38.9	45.9	46.1	51.5	64.7	56.1	58.6	67.1	45.6
May 4	73.8	36.7	47.9	63.8	51.6	58.5	65.6	57.5	67.7	49.4	49.0	49.9	60.7	57.7	46.9	59.1	49.1	49.1	50.0	49.5	57.6	61.7	60.4	54.0	62.4	64.5	47.2	41.5	49.4	49.3	52.9	53.4	70.5	64.9	58.5	55.2	45.5	67.9	50.7	55.7	45.2	55.3	62.6	52.2	64.3	65.7	47.2
May 5	71.8	37.5	62.6	63.3	56.4	58.7	57.9	66.3	55.5	68.8	45.2	50.8	57.0	60.0	54.9	64.0	39.9	52.5	48.1	53.6	64.2	60.5	63.1	45.0	48.5	63.6	48.6	51.9	49.9	58.8	63.0	48.8	58.2	59.8	65.2	55.4	46.3	67.2	61.3	49.2	39.8	55.7	70.7	61.9	58.2	61.7	48.8
May 6	81.7	47.3	67.8	57.9	55.2	64.0	57.6	66.5	57.1	74.2	49.5	48.7	59.8	53.8	55.6	61.1	51.4	52.7	53.4	55.4	59.5	60.1	61.5	49.2	53.1	68.4	53.1	62.9	54.4	59.1	59.5	58.0	69.4	57.0	64.6	62.6	50.6	65.6	54.1	51.9	47.0	48.3	61.5	62.0	58.8	69.1	49.2
May 7	80.4	54.0	74.7	50.5	51.6	66.9	53.3	64.5	56.2	67.1	43.2	51.3	59.4	54.6	60.8	60.7	57.2	50.1	50.1	57.5	56.1	59.3	62.6	56.9	52.2	61.4	62.6	57.6	66.5	60.1	70.1	47.0	54.7	63.1	71.0	54.9	41.9	69.0	56.0	53.1	39.0	55.8	64.7	57.6	70.6	66.6	55.4
May 8	79.4	50.4	75.5	48.8	51.3	74.4	57.8	50.4	54.3	59.5	51.9	56.4	51.6	56.4	59.4	52.2	63.3	60.2	54.0	49.6	59.9	58.8	62.7	51.3	50.6	54.2	53.8	49.7	68.1	57.0	67.2	48.9	62.8	59.0	71.1	64.7	49.2	66.7	55.7	50.0	41.6	54.2	71.5	62.6	59.8	67.0	47.4
May 9	77.8	52.4	64.7	49.9	58.3	68.7	56.3	51.9	56.8	74.6	48.1	48.9	49.5	70.1	64.0	49.0	65.8	56.6	60.1	58.1	56.9	64.4	56.2	56.2	60.8	41.4	51.7	55.2	78.6	64.0	63.2	54.1	55.0	64.8	64.0	61.2	58.8	66.9	50.8	56.3	53.9	60.0	60.5	58.4	70.7	75.4	46.7
May 10	65.3	58.8	59.0	57.0	54.2	60.0	55.5	48.6	51.4	77.8	45.0	42.3	47.8	66.4	66.4	48.7	63.9	53.3	64.9	65.2	65.1	66.3	54.5	58.6	63.7	58.4	44.9	65.1	70.5	54.2	61.3	54.1	55.6	57.0	57.6	54.0	59.5	66.0	50.5	52.4	48.8	53.1	55.4	63.2	67.3	79.8	49.7
May 11	62.5	58.0	59.9	58.7	57.9	59.0	59.8	55.3	57.0	73.4	50.4	39.8	42.0	80.2	61.0	63.9	64.6	63.5	63.4	62.5	57.4	72.8	59.7	46.3	60.9	51.7	46.2	55.9	62.1	55.6	60.6	60.2	58.7	63.9	58.1	56.6	58.5	70.4	63.7	56.9	54.8	56.8	60.4	62.5	62.9	67.3	34.6
May 12	57.6	57.4	59.6	58.0	58.4	63.8	58.7	59.0	57.0	66.8	53.8	60.0	48.8	77.2	73.9	55.1	69.5	61.1	54.7	60.4	50.3	69.7	57.4	48.5	62.3	52.7	43.9	55.4	59.1	64.0	65.2	54.4	63.7	59.6	56.8	43.6	66.6	74.3	60.6	59.3	62.0	51.4	61.5	57.8	61.1	61.4	41.5
May 13	54.0	59.9	48.2	64.9	58.3	56.3	64.7	56.8	60.8	57.0	56.7	65.9	38.6	78.9	64.2	62.7	62.5	63.5	59.8	62.2	52.5	64.8	58.8	44.8	58.2	51.7	41.9	53.1	54.8	58.6	70.3	55.5	61.1	58.0	57.9	54.9	66.2	80.0	65.6	76.7	66.6	58.8	67.7	58.6	63.5	67.5	51.0
May 14	57.6	60.9	53.2	66.9	52.7	62.2	62.5	63.5	54.4	54.2	59.1	57.2	38.3	70.4	59.9	62.4	58.9	56.3	56.5	64.8	58.1	71.6	60.6	41.2	60.4	56.4	45.7	49.3	54.5	55.2	62.4	49.3	60.2	55.8	66.9	67.5	54.3	70.8	68.3	72.6	63.9	57.6	63.4	57.2	59.6	59.5	55.5
May 15	48.5	58.1	55.7	67.5	58.4	62.7	61.8	52.6	54.8	59.5	52.5	62.5	46.6	72.9	61.8	67.5	68.0	64.0	54.8	63.8	59.7	74.1	66.0	57.3	61.6	61.3	54.7	56.4	60.8	57.5	67.7	50.5	64.8	57.0	69.8	62.6	48.4	81.5	60.9	69.1	55.0	58.0	58.2	62.9	59.5	64.1	51.3
May 16	56.5	58.5	56.6	67.6	64.2	53.2	57.8	53.0	55.5	53.3	47.4	62.2	51.2	64.7	63.3	66.5	72.0	64.6	68.5	62.7	60.3	76.1	64.9	55.6	49.1	61.1	48.3	61.8	65.5	50.6	66.2	48.1	65.7	52.8	64.1	59.0	51.9	75.6	52.0	66.7	59.7	58.3	60.1	59.7	53.7	77.7	58.0
May 17	61.3	60.8	59.8	57.0	59.3	57.0	53.1	60.9	55.9	49.9	55.7	50.2	49.7	65.1	63.2	54.3	59.3	63.8	66.5	62.0	52.3	71.9	65.8	58.8	56.6	56.5	49.3	66.2	66.2	56.6	58.7	49.2	57.1	60.7	58.4	61.4	60.0	68.0	53.5	65.5	58.5	52.3	62.1	60.7	59.3	73.0	60.6
May 18	62.0	69.3	67.1	52.5	64.0	48.5	49.3	56.0	57.6	55.0	67.0	60.1	53.0	66.3	72.0	49.1	58.2	58.6	57.2	56.3	59.3	67.3	69.9	51.3	57.0	63.6	50.3	62.9	56.6	57.8	58.7	52.2	65.0	62.5	60.2	54.4	65.2	72.5	66.1	62.6	62.4	61.9	69.6	54.3	63.2	74.2	63.3
May 19	65.8	65.7	61.0	53.8	64.7	57.8	49.0	57.7	60.5	59.8	68.9	58.0	52.7	55.5	58.4	63.2	70.9	67.7	65.8	63.7	57.5	65.0	66.0	46.4	60.0	73.3	50.8	66.3	65.1	62.7	61.3	52.3	56.0	53.8	68.7	55.4	61.8	65.9	66.3	68.2	64.7	53.4	61.3	62.9	61.5	60.4	59.1
May 20	62.3	65.7	58.8	63.2	67.3	59.3	56.7	60.8	65.2	66.4	71.6	57.8	55.8	57.3	47.0	62.4	75.9	63.0	61.3	64.5	62.4	68.2	64.0	52.0	57.5	69.4	46.6	65.3	69.5	61.7	57.4	49.8	56.4	50.3	67.3	64.6	70.3	74.2	62.4	69.7	57.5	53.9	57.0	53.9	67.8	59.7	67.1
May 21	57.7	65.8	57.5	53.8	61.0	52.9	53.0	62.2	68.8	72.5	72.7	53.8	63.5	58.1	50.8	66.7	76.5	63.6	64.7	69.6	63.6	62.6	63.7	57.9	73.0	65.6	59.3	67.1	66.1	73.0	63.1	60.3	48.2	60.5	67.0	68.0	65.5	59.6	65.4	67.8	67.9	54.7	59.8	60.8	70.6	54.9	71.4
May 22	59.8	58.1	64.2	66.7	70.3	45.6	57.5	68.3	62.9	80.4	61.2	61.3	70.2	50.9	53.8	66.3	78.8	62.7	69.3	71.4	59.4	65.4	61.7	62.5	66.3	71.0	56.4	72.2	72.8	68.7	65.2	62.0	60.5	60.1	60.4	68.9	66.1	67.9	59.3	71.8	74.6	49.5	56.0	59.0	69.4	60.9	68.4
May 23	57.7	63.7	59.5	54.1	63.3	51.3	59.2	69.5	57.8	82.2	67.4	55.2	53.9	57.4	57.3	56.3	67.2	61.9	63.3	68.8	64.4	57.3	65.3	66.1	61.4	67.1	53.8	74.2	75.2	68.4	60.6	69.1	60.7	58.7	69.1	66.6	64.0	67.3	59.1	70.7	73.6	52.6	62.2	65.8	66.0	56.9	63.0
May 24	70.1	68.9	61.5	55.0	65.0	60.5	67.7	63.4	65.7	77.0	62.1	58.9	55.4	55.4	62.8	69.6	66.8	64.8	60.1	66.0	64.2	53.4	65.9	72.4	62.6	65.1	62.4	73.2	70.6	69.1	60.9	69.8	57.7	63.4	64.1	68.2	69.7	64.3	60.1	67.2	79.2	61.6	58.8	64.3	49.1	62.1	74.2
May 25	57.5	70.4	56.5	53.0	67.3	58.1	72.0	65.2	70.1	80.6	70.5	59.6	58.9	62.6	57.3	64.9	59.9	61.1	65.4	60.1	62.9	58.9	60.0	65.1	63.0	61.6	69.4	63.9	62.7	71.0	59.2	70.7	61.8	66.6	67.1	61.2	77.0	65.7	67.2	68.7	75.7	60.7	58.0	75.1	55.0	68.6	72.2
May 26	61.3	67.3	57.1	56.0	69.6	59.8	69.3	58.1	78.6	78.1	64.2	65.3	60.7	54.6	65.1	61.2	62.8	57.5	66.8	72.5	70.3	54.5	63.8	69.6	65.3	64.5	67.5	66.1	69.3	70.7	56.7	60.1	53.4	68.8	67.0	52.1	75.8	51.6	64.6	68.0	71.6	65.3	67.3	70.2	62.2	64.4	70.2
May 27	66.6	56.5	60.0	59.7	64.1	60.9	79.0	59.3	78.4	81.2	69.5	69.5	63.9	63.2	59.7	56.8	67.3	58.1	69.6	73.4	77.3	64.6	60.7	72.4	71.1	68.9	70.1	68.9	67.7	66.5	61.4	67.5	60.9	72.0	71.2	47.5	77.0	49.7	68.4	66.4	74.8	65.1	71.3	67.0	61.8	67.1	64.4
May 28	72.4	61.9	65.6	59.5	64.3	55.6	76.5	57.2	67.6	77.2	66.0	69.4	69.7	63.9	64.3	61.0	70.5	65.1	64.2	55.3	70.5	61.5	65.7	76.9	71.2	70.9	71.3	62.4	68.0	68.7	57.3	66.0	62.0	65.6	57.0	61.2	71.6	57.3	68.6	68.0	68.9	63.3	60.5	67.5	61.7	61.3	51.1
May 29	77.2	65.6	62.3	64.9	62.1	52.8	75.3	64.1	62.4	76.9	73.3	75.1	71.3	70.5	67.1	66.6	79.3	66.5	67.6	62.9	71.2	57.4	61.1	76.3	69.2	74.2	61.8	60.4	64.9	66.6	66.5	62.8	62.1	64.9	58.8	58.6	69.9	55.6	62.8	69.3	61.8	64.2	66.4	68.3	64.6	56.4	57.7

TABLE 5. SUMMARY AND EVALUATION OF DAILY TEMPERATURE IN HELP MODEL 100-YEAR SYNTHETIC WEATHER DATA SET

YEAR->	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93
May 30	77.8	59.0	67.1	71.4	58.9	65.5	66.7	64.2	65.5	76.2	67.6	75.4	65.7	73.0	66.9	67.5	74.9	69.3	68.4	63.9	71.5	65.5	60.3	82.3	69.2	66.7	54.2	59.4	66.2	56.7	65.6	72.9	62.5	67.5	67.3	63.4	62.4	61.1	58.9	65.8	71.2	67.6	57.9	73.2	69.4	63.9	60.2
May 31	73.2	58.9	64.4	71.4	66.3	58.5	71.7	66.4	58.8	68.9	64.7	72.0	66.7	66.1	61.4	64.1	63.2	59.7	66.3	56.4	73.7	67.8	56.4	74.5	67.4	57.9	52.1	63.4	71.0	62.8	57.6	68.9	60.8	64.6	58.7	66.2	70.6	64.7	53.7	69.8	64.1	64.8	64.5	74.3	69.5	65.0	59.6
Jun 1	75.2	55.5	54.8	80.6	66.9	67.6	67.8	70.4	58.5	77.9	71.8	65.4	63.2	60.2	70.4	65.7	69.5	64.1	66.9	62.0	73.1	55.2	54.5	67.9	75.9	61.6	61.0	63.8	62.7	63.2	62.7	75.1	63.1	65.0	62.2	67.2	67.3	60.1	60.9	75.5	63.6	64.2	66.1	75.4	62.6	66.6	61.0
Jun 2	72.4	58.1	59.5	77.2	67.0	70.7	65.8	70.1	61.8	72.4	67.4	58.1	67.3	58.6	73.4	73.7	72.1	69.3	64.7	64.2	70.2	58.9	63.3	64.2	71.1	70.9	62.5	70.3	57.8	57.8	65.6	70.3	68.5	55.8	59.7	65.9	73.5	62.2	61.5	67.2	63.1	64.0	68.1	72.3	58.9	57.4	71.6
Jun 3	72.6	64.2	58.2	74.9	73.6	61.6	71.9	77.3	64.2	76.7	62.2	53.8	69.0	65.8	76.1	76.0	70.2	69.8	64.8	70.4	68.2	60.4	72.5	67.2	62.9	73.1	62.1	67.3	49.6	68.6	62.8	71.7	68.5	58.5	58.2	72.6	66.8	60.1	66.3	67.5	65.3	64.6	67.9	78.7	60.9	52.6	76.4
Jun 4	72.8	61.1	64.0	73.2	73.2	67.7	66.8	77.4	64.9	72.6	69.8	62.6	70.5	62.3	72.0	70.2	61.5	67.8	61.4	64.7	66.7	64.9	64.6	75.7	66.3	69.6	66.4	69.7	52.3	68.9	60.9	68.4	62.0	58.0	58.3	73.6	74.9	60.6	71.6	66.8	58.8	64.1	68.0	69.0	62.5	64.1	74.3
Jun 5	71.0	59.5	57.0	71.7	68.9	61.6	68.7	69.8	64.2	67.1	64.8	62.9	59.4	67.8	71.8	67.9	61.0	68.3	62.1	69.1	61.1	62.5	57.0	72.2	71.4	68.1	62.6	63.3	52.5	61.1	60.9	65.4	67.1	54.8	58.4	65.0	65.1	61.3	73.8	71.2	56.0	71.6	74.7	77.1	60.5	67.0	74.8
Jun 6	70.1	65.9	65.2	76.6	66.2	54.2	69.3	73.6	67.3	69.7	70.3	69.5	67.1	68.3	61.1	59.1	65.5	62.7	57.7	68.9	63.9	72.7	68.6	68.6	64.6	64.3	61.7	72.0	55.3	62.8	64.1	70.4	64.5	60.6	54.9	64.7	57.9	65.4	74.1	72.8	55.7	76.7	72.5	71.3	62.0	66.7	75.4
Jun 7	79.4	72.6	70.0	78.1	63.7	58.9	55.8	70.2	67.5	66.5	69.5	72.1	66.3	64.5	67.1	64.9	59.0	68.1	68.9	64.9	65.4	77.7	68.6	70.8	68.2	69.5	59.6	71.7	68.6	61.1	61.8	68.8	63.3	63.1	64.6	67.3	55.1	64.4	71.1	66.7	67.3	70.4	75.4	67.1	64.0	73.8	62.6
Jun 8	78.0	66.5	68.1	81.8	70.8	70.2	56.1	63.5	64.2	58.5	66.8	75.2	60.8	70.6	67.6	70.6	62.2	66.6	73.1	62.8	66.1	78.0	72.0	64.4	68.3	62.8	60.7	68.9	63.5	67.7	60.4	67.1	69.9	68.7	72.7	73.5	60.3	68.6	67.8	74.7	69.0	73.7	73.0	68.9	68.6	74.7	70.7
Jun 9	70.4	67.3	69.4	80.0	76.5	69.5	61.5	71.0	63.4	63.0	66.9	75.0	66.6	75.6	69.2	68.1	59.9	64.8	73.5	59.9	60.7	77.8	82.4	62.7	61.5	63.7	58.1	67.6	67.2	76.2	60.1	69.4	72.2	70.3	75.8	71.1	59.9	64.9	62.1	68.5	70.4	70.2	70.7	68.1	68.1	79.6	68.6
Jun 10	65.1	67.4	74.0	82.6	72.2	73.3	62.0	69.2	64.1	67.9	69.0	63.8	67.7	73.8	74.3	63.9	67.6	65.1	67.0	67.5	54.5	74.9	78.5	64.9	62.4	71.2	62.7	68.5	74.0	77.5	57.6	73.0	63.5	72.1	68.0	75.4	68.8	63.5	71.1	73.1	65.9	72.7	68.0	59.8	70.7	71.6	68.6
Jun 11	68.8	66.9	70.3	73.5	68.4	69.5	62.9	71.7	62.1	64.1	71.4	65.0	55.5	78.4	74.1	71.4	67.6	62.1	67.7	72.5	60.0	69.6	73.3	73.3	60.2	68.5	63.4	70.3	64.1	70.2	51.3	73.0	64.7	74.2	64.6	71.5	67.3	68.8	69.2	68.6	68.6	69.4	66.2	57.4	69.7	66.5	69.8
Jun 12	72.2	74.1	72.0	67.5	61.3	70.0	68.9	66.6	67.3	57.6	69.5	66.5	57.7	80.6	68.9	71.3	69.0	65.9	74.0	67.4	54.0	71.5	75.2	65.9	63.6	69.3	66.0	66.3	60.6	74.1	55.6	76.1	67.0	78.5	63.6	71.4	62.7	67.9	62.1	65.6	63.7	68.2	68.7	61.7	67.6	72.6	70.1
Jun 13	69.9	69.2	71.1	69.2	70.8	66.8	68.6	72.6	61.3	59.1	68.4	71.0	63.3	80.9	80.2	64.7	65.2	65.7	72.8	68.5	53.2	67.8	75.0	73.2	66.2	77.4	62.3	67.9	59.1	78.5	66.3	75.2	62.3	74.7	66.3	65.9	66.3	70.9	64.9	69.0	72.7	68.4	58.7	66.9	73.6	68.4	70.6
Jun 14	72.7	70.6	70.3	70.0	70.1	60.0	63.2	73.1	75.1	58.8	69.0	75.4	64.3	83.1	74.8	73.3	75.2	73.6	72.9	71.4	63.2	72.9	80.4	68.3	68.7	75.4	67.8	63.1	58.2	78.4	68.7	71.6	64.5	71.1	64.9	60.3	69.0	70.3	67.5	65.8	66.3	66.5	66.4	66.1	82.4	69.6	66.4
Jun 15	78.3	67.8	68.4	61.6	70.2	66.6	61.2	70.2	72.1	72.1	70.0	79.7	65.7	81.4	68.7	71.8	74.5	71.8	76.1	69.5	68.4	68.1	72.4	74.9	62.9	67.0	72.7	64.5	54.3	75.9	75.3	74.9	64.5	75.1	71.6	65.1	66.9	68.1	65.0	71.7	63.5	68.5	67.1	66.2	78.2	76.0	73.6
Jun 16	79.9	66.6	66.1	57.5	73.5	68.0	66.5	73.9	77.1	66.9	68.7	78.6	66.4	78.9	67.7	69.4	79.4	79.2	68.6	74.3	72.9	64.8	69.9	77.8	71.4	66.2	72.2	65.9	66.8	79.5	72.0	74.1	63.7	75.8	74.8	68.8	69.9	72.1	62.7	68.6	59.6	66.0	76.0	63.8	79.8	79.6	76.2
Jun 17	79.5	67.0	64.1	61.4	73.9	70.1	66.3	76.6	78.3	62.7	71.9	75.7	69.8	77.8	62.3	68.8	77.5	73.7	70.9	78.7	73.1	66.6	65.9	70.1	66.8	63.6	69.9	75.2	69.8	69.2	72.7	74.8	66.6	72.3	72.4	74.4	69.4	64.5	72.0	61.0	62.3	65.9	74.6	63.9	69.2	79.9	79.8
Jun 18	76.4	63.7	73.7	67.4	71.5	76.2	77.3	64.7	79.8	57.8	73.0	81.8	71.2	78.2	68.1	66.5	75.6	72.9	74.4	78.0	70.5	67.5	72.6	77.5	64.6	67.1	65.1	70.3	69.1	74.4	75.2	75.9	64.9	66.3	70.5	70.0	68.2	68.1	72.8	60.8	61.6	67.9	69.3	64.6	73.9	72.0	79.3
Jun 19	78.2	65.5	79.7	65.1	74.8	69.5	73.3	64.7	80.3	64.1	76.8	81.7	71.6	78.9	67.8	66.9	76.8	72.1	70.6	76.1	68.4	65.7	67.2	73.6	66.4	64.1	71.0	72.5	68.8	67.0	75.5	75.5	63.0	62.2	67.1	70.8	60.1	70.3	70.8	66.1	66.5	66.0	70.4	74.2	79.9	66.9	72.3
Jun 20	76.7	58.5	78.7	64.0	76.3	72.7	76.6	60.6	79.3	72.2	77.2	81.0	76.9	72.3	66.1	68.8	70.7	81.5	67.0	69.1	64.9	65.6	69.2	68.0	68.3	73.7	66.3	74.9	68.0	67.4	71.8	73.4	60.3	64.7	63.3	72.5	58.2	78.0	74.0	71.6	68.1	59.6	71.7	75.9	73.4	74.1	68.4
Jun 21	75.3	61.9	75.0	69.1	77.6	72.2	75.8	61.6	70.7	72.7	74.5	81.7	74.0	63.4	67.5	73.9	69.7	72.3	70.0	66.7	69.2	65.9	67.2	70.5	74.6	65.2	72.3	74.1	71.8	67.1	73.2	75.5	71.8	65.7	62.8	75.0	64.2	77.2	69.6	69.8	61.6	59.5	70.9	70.2	79.6	74.9	63.9
Jun 22	82.5	69.1	73.7	73.9	68.8	73.9	76.0	68.3	72.8	65.7	72.8	76.9	77.6	73.3	61.0	78.3	68.5	73.8	72.4	70.1	70.5	62.9	67.9	71.2	76.2	70.5	63.1	75.9	65.3	72.9	76.2	79.9	69.8	67.1	65.9	73.9	68.6	71.4	68.7	69.4	74.0	60.2	66.8	70.5	70.1	73.6	64.6
Jun 23	77.3	76.1	77.7	69.0	66.7	69.0	75.4	73.6	74.3	67.3	72.6	76.9	72.7	72.2	61.9	78.6	69.7	69.0	70.8	71.4	69.4	65.5	58.5	63.4	72.6	76.1	77.7	71.4	67.9	76.6	73.5	80.8	69.3	72.7	66.6	70.9	62.3	62.0	68.8	70.5	72.6	70.0	66.3	63.5	72.7	73.0	68.7
Jun 24	69.2	69.2	79.3	74.4	64.7	66.5	67.9	74.5	64.3	72.8	75.6	69.6	75.8	72.6	60.4	80.9	72.2	68.2	71.8	71.1	68.4	70.1	68.2	72.9	69.0	70.8	75.5	75.2	69.3	80.7	74.3	79.8	70.5	78.8	70.3	69.9	65.4	66.2	64.7	70.4	71.5	71.1	63.4	75.8	73.2	74.5	78.0
Jun 25	68.2	69.6	74.7	73.6	74.3	64.4	63.8	74.6	64.7	72.1	75.0	71.1	70.7	73.7	61.3	78.9	74.8	68.6	63.8	69.8	71.0	66.9	66.6	71.5	76.6	68.9	71.0	72.2	67.0	79.5	83.2	70.9	67.4	76.0	75.2	73.0	66.9	73.1	68.6	68.5	79.1	70.1	64.5	72.5	76.2	73.5	74.2
Jun 26	65.7	79.1	70.3	67.4	70.8	66.8	72.8	70.8	70.4	78.0	76.2	71.4	71.0	59.8	73.4	71.5	66.1	71.6	63.2	66.1	71.7	70.8	73.8	74.7	[illegible]	76.1	66.6	72.5	68.1	75.7	84.6	77.9	66.1	73.5	71.4	69.2	69.8	75.7	67.2	74.3	72.2	68.0	69.2	70.8	68.8	69.7	69.2
Jun 27	61.5	67.9	74.1	67.0	69.5	63.5	71.4	77.1	65.2	78.9	76.1	72.7	73.4	68.4	67.1	67.9	77.1	63.3	70.1	66.6	59.6	73.8	68.6	77.8	70.9	80.7	67.5	74.1	76.9	75.1	78.8	77.4	71.7	79.5	68.2	67.8	66.6	74.3	72.1	68.5	75.1	72.6	73.0	71.2	73.8	68.0	[illegible]
Jun 28	64.3	76.9	67.2	77.9	70.2	70.7	63.8	72.6	67.7	69.5	75.7	71.5	71.2	73.6	73.1	70.7	79.2	74.0	67.1	65.3	56.7	71.6	69.6	74.9	68.5	76.3	67.9	74.9	75.8	78.1	76.2	77.0	65.8	79.4	70.0	73.5	62.1	80.1	72.4	76.5	73.3	72.3	69.4	78.5	65.2	70.4	71.2
Jun 29	59.9	72.5	69.3	80.3	73.3	77.4	68.4	70.2	76.7	75.6	78.7	71.1	69.4	73.1	71.1	69.3	78.3	68.1	73.6	64.8	61.2	72.9	69.8	78.9	66.5	74.4	68.8	63.0	67.1	84.0	81.5	73.8	67.8	78.0	74.9	72.5	65.1	78.3	69.1	77.2	75.9	72.7	75.4	76.3	64.4	74.3	70.6
Jun 30	68.1	66.2	76.8	81.4	75.4	69.8	76.5	69.5	81.6	74.5	73.8	73.8	81.9	71.3	80.1	78.8	75.7	70.1	78.7	75.1	73.5	66.9	68.7	84.2	75.3	68.7	78.0	74.8	74.0	75.5	78.6	76.3	75.0	76.3	74.3	71.1	68.4	79.0	74.3	68.8	80.5	75.9	87.4	77.0	72.2	70.2	65.0
Jul 1	71.6	72.8	83.1	79.0	78.1	74.5	80.4	72.5	75.7	81.1	81.6	74.1	83.1	75.1	80.5	72.4	77.9	83.6	82.1	79.2	72.5	74.9	70.6	89.2	73.5	77.5	73.3	78.4	76.6	79.2	77.8	79.5	80.3	79.7	83.7	78.9	77.1	71.9	73.7	74.8	82.4	77.8	80.3	70.5	77.6	73.5	67.4
Jul 2	73.5	78.4	80.6	79.6	79.3	75.2	79.8	76.0	76.6	77.5	80.2	75.8	80.5	78.5	78.3	78.5	80.6	83.1	77.0	79.2	68.5	76.1	71.0	91.5	72.9	77.7	74.0	79.4	80.1	75.6	80.3	81.9	79.1	77.7	85.9	75.8	76.3	80.4	74.7	74.9	86.5	71.7	84.7	70.6	78.2	76.0	71.2
Jul 3	76.6	79.5	81.1	80.2	75.0	74.5	82.3	80.7	79.7	76.2	81.4	76.8	82.9	81.2	83.3	78.5	84.0	78.8	77.9	87.7	69.2	80.1	74.1	93.1	76.5	76.2	79.8	75.1	78.3	75.5	69.7	79.9	78.1	78.1	81.2	77.6	73.3	78.1	80.1	74.4	88.5	79.8	74.8	69.3	81.4	80.0	79.7
Jul 4	83.1	79.3	83.4	80.3	77.8	72.1	84.1	84.1	81.4	74.9	82.5	80.3	74.8	77.7	83.1	80.4	80.5	75.2	77.3	83.6	72.5	79.6	75.0	84.4	77.0	77.1	82.3	77.0	80.4	74.3	72.2	81.5	76.4	74.7	79.8	78.8	76.4	78.9	80.5	83.5	85.7	76.0	77.9	79.5	85.4	83.7	77.6
Jul 5	76.9	75.2	79.9	71.2	70.1	75.7	78.8	79.0	80.5	75.7	87.6	78.1	78.8	81.9	84.1	86.0	86.2	74.6	77.3	78.8	73.4	77.9	76.4	87.4	78.7	78.0	79.4	81.1	76.5	71.2	76.2	79.7	75.8	75.9	78.8	80.6	76.1	80.8	82.7	83.0	87.5	78.4	77.5	74.5	76.8	81.8	81.5
Jul 6	76.2	75.9	80.0	74.3	71.1	77.0	78.8	77.4	83.1	83.7	86.5	81.1	76.4	76.4	78.9	79.0	82.2	73.6	74.6	70.1	73.6	80.8	78.3	85.9	81.1	73.2	78.3	79.9	76.5	77.9	73.2	79.7	77.6	74.3	79.0	77.5	78.1	78.9	85.7	83.9	90.0	82.7	74.9	83.6	71.1	84.2	82.3
Jul 7	76.6	77.5	82.2	74.3	75.4	76.5	72.4	75.9	79.4	77.8	90.5	80.4	74.6	74.6	75.7	83.4	80.5	74.7	66.9	81.4	74.3	77.9	76.3	86.5	82.5	75.8	83.6	79.0	78.6	81.9	83.3	76.3	76.7	75.6	79.7	70.0	82.7	79.1	79.8	82.9	85.3	81.3	74.7	79.0	74.0	83.8	85.4
Jul 8	76.0	73.2	81.3	76.5	80.1	75.8	71.5	74.4	82.2	78.1	86.8	86.0	74.0	73.9	84.0	84.3	79.6	78.2	67.3	82.8	73.3	81.0	79.8	78.8	81.3	79.6	83.0	82.2	76.3	82.5	83.7	73.1	81.5	75.5	75.9	67.9	79.7	80.4	88.1	87.4	83.1	83.3	82.1	77.9	72.8	81.5	80.1
Jul 9	77.0	70.7	82.0	78.6	82.6	71.7	73.5	74.4	84.0	81.2	89.1	81.8	72.4	77.9	86.3	83.7	73.4	78.1	76.6	77.6	75.2	84.3	78.7	76.3	82.9	79.3	82.1	75.8	73.1	71.4	82.8	81.4	78.9	75.7	77.1	66.4	83.6	82.9	79.2	85.4	81.7	78.1	77.4	79.7	77.1	81.5	73.9
Jul 10	70.6	73.9	75.9	79.1	73.8	83.6	77.5	74.3	83.6	83.1	88.4	83.9	74.8	77.0	79.0	79.2	79.4	80.1	74.4	74.8	75.6	81.9	81.2	73.4	79.1	76.0	83.6	75.0	84.5	82.1	79.6	79.4	83.1	71.8	81.5	73.1	76.9	77.0	84.6	85.5	73.4	81.0	75.7	82.6	75.9	74.4	77.4
Jul 11	70.1	76.7	81.6	77.8	74.1	82.2	76.0	75.2	81.0	84.9	86.8	77.9	72.8	81.7	82.0	78.9	78.9	80.0	69.1	80.4	78.5	80.5	77.3	76.1	74.9	79.0	86.3	77.5	80.8	82.8	85.4	78.4	84.6	80.2	81.7	77.1	81.3	73.5	84.7	76.5	73.7	69.9	79.1	83.5	72.6	71.9	77.5
Jul 12	79.9	76.7	78.9	80.8	81.3	81.0	76.2	77.3	83.1	81.2	88.0	82.6	77.3	81.9	84.6	79.1	76.1	74.4	71.8	83.1	79.8	84.8	76.9	75.9	71.0	81.1	82.2	77.8	82.4	84.7	80.6	74.2	81.9	77.4	84.3	73.8	79.2	75.6	86.8	82.6	76.1	73.5	87.3	78.7	77.0	71.4	78.6
Jul 13	76.8	78.0	77.9	81.9	76.6	76.7	79.3	77.4	82.3	80.8	83.9	81.2	71.3	79.4	79.5	76.3	74.9	75.8	72.7	83.0	78.6	76.9	76.7	76.4	73.6	78.5	77.7	79.1	82.7	78.6	80.9	83.0	80.3	78.5	81.0	74.4	76.1	73.8	78.0	80.5	75.4	74.7	84.5	77.9	75.8	76.0	84.3
Jul 14	82.4	75.6	76.3	71.1	73.1	83.8	78.6	76.8	80.1	75.2	79.6	86.8	81.1	77.5	84.4	86.0	82.0	75.3	76.5	77.7	75.7	80.7	79.7	72.3	68.8	79.5	79.2	80.9	80.5	80.1	72.8	79.2	77.8	72.8	77.1	74.3	77.9	73.2	78.3	86.0	78.1	78.5	83.2	80.5	76.3	76.1	83.9
Jul 15	77.6	76.6	81.6	78.2	77.6	82.9	81.8	81.7	75.8	71.1	81.1	85.1	82.6	75.0	82.9	84.5	84.1	71.4	82.8	77.3	76.4	79.5	77.9	73.4	80.9	75.1	81.6	80.3	77.6	78.6	78.9	79.0	72.6	74.7	79.3	76.7	82.5	73.0	71.7	82.4	78.4	80.5	83.5	76.1	78.8	70.5	78.7
Jul 16	82.3	74.8	79.4	74.1	75.4	79.5	80.0	84.2	75.1	72.4	77.0	83.9	77.4	72.4	81.2	87.1	83.5	70.7	85.3	75.7	74.1	79.0	81.6	74.6	78.4	77.4	84.3	82.7	83.9	79.3	79.4	77.4	70.3	73.3	76.9	73.9	84.2	76.7	73.0	81.3	74.1	78.4	86.4	77.4	74.4	75.8	78.1
Jul 17	81.2	76.5	77.5	78.0	79.8	75.0	80.5	81.9	70.3	83.1	77.2	78.9	79.2	73.0	82.5	84.7	76.6	72.3	85.4	73.7	76.7	83.8	82.4	78.4	82.1	74.2	83.1	77.8	85.6	84.7	77.6	80.0	73.0	74.8	70.0	77.6	79.2	77.0	79.1	83.6	74.9	79.2	83.9	78.4	72.6	78.9	81.3
Jul 18	85.1	79.8	81.5	76.2	81.3	71.2	78.7	84.7	74.6	84.2	85.5	85.0	82.2	73.8	79.9	78.9	77.1	73.5	84.3	69.7	76.2	81.9	78.4	85.2	83.8	73.1	87.7	75.6	84.6	84.2	80.0	80.0	72.7	76.6	71.5	76.5	73.9	79.0	72.6	83.0	75.5	80.1	87.0	77.8	76.4	81.3	80.9
Jul 19	85.5	78.0	82.4	71.0	80.7	79.9	73.6	87.9	71.0	84.7	87.2	91.6	77.5	77.8	80.6	74.5	78.4	74.9	87.5	75.2	78.1	81.1	80.6	79.7	82.5	79.6	83.5	80.3	81.8	81.7	78.9	83.2	74.2	76.3	75.9	78.1	81.7	80.9	72.0	86.1	74.0	79.8	78.1	74.1	78.9	82.5	78.0
Jul 20	81.3	82.6	79.7	75.9	80.2	80.0	81.4	86.2	69.9	80.9	85.7	88.5	84.6	78.0	82.0	78.1	79.2	81.3	82.3	78.2	85.1	73.3	71.0	83.6	80.2	76.9	76.6	75.6	78.5	77.8	79.7	87.0	76.7	75.7	81.7	74.4	86.1	85.6	79.4	82.5	70.9	82.5	72.4	71.3	77.0	85.5	82.4
Jul 21	81.5	76.5	83.3	75.2	81.2	81.7	80.9	79.3	66.8	77.9	85.0	84.1	85.1	81.0	80.9	79.1	82.9	79.5	82.6	79.5	88.1	77.5	76.1	84.6	83.6	79.7	79.7	75.3	85.1	77.2	79.6	79.4	77.5	78.7	82.4	84.5	83.9	85.5	78.4	80.4	69.4	87.0	82.1	73.3	79.4	85.4	85.6
Jul 22	81.8	82.4	81.5	77.5	82.0	76.9	82.8	79.0	69.6	74.7	79.4	83.0	82.7	79.1	84.6	81.4	78.1	79.0	82.9	78.7	83.7	77.3	77.3	81.2	84.4	74.4	83.8	81.6	74.3	72.5	75.8	82.4	83.5	78.2	78.0	78.5	81.7	80.5	82.3	74.2	75.5	85.1	83.5	78.5	80.9	81.6	86.5
Jul 23	80.7	81.9	79.3	80.9	78.3	83.8	82.0	75.7	76.9	71.9	80.8	84.1	80.7	82.1	84.4	82.0	79.1	75.4	83.4	75.9	82.9	74.4	77.1	84.9	81.4	77.1	82.2	78.3	76.6	82.3	81.6	82.2	76.0	80.6	83.5	76.2	80.3	80.6	79.4	74.8	80.3	83.2	82.1	84.1	83.0	77.8	83.0
Jul 24	81.1	84.4	76.5	79.1	75.2	87.1	80.0	78.8	80.9	80.5	81.3	80.7	72.6	83.4	76.5	82.3	78.4	77.6	81.2	78.6	79.4	74.2	75.5	85.1	83.4	81.4	79.5	78.0	83.5	85.5	79.3	83.1	79.4	79.0	82.5	77.0	84.4	79.4	79.7	79.5	80.9	79.3	84.1	85.3	78.5	78.3	80.0
Jul 25	84.3	84.8	82.1	88.2	67.8	86.2	80.3	76.4	74.1	79.6	77.9	84.2	76.7	87.1	81.5	76.0	77.9	75.5	76.6	78.0	78.9	77.2	75.6	83.7	80.4	80.1	86.4	82.7	82.5	83.4	79.1	82.6	83.3	75.7	84.3	74.8	80.8	79.8	78.1	80.0	84.2	78.2	84.1	82.3	78.8	76.3	77.9
Jul 26	80.3	85.2	79.0	85.3	71.1	81.5	78.2	77.0	65.4	78.7	75.1	73.6	84.5	87.1	77.6	72.5	76.6	77.6	78.1	70.7	72.5	77.8	79.8	79.8	82.3	74.2	86.2	83.9	83.5	75.9	80.4	85.8	81.9	74.7	84.6	74.5	76.6	78.9	75.6	82.4	87.0	74.8	84.2	75.6	78.5	78.7	83.1
Jul 27	79.6	79.4	82.1	82.1	76.9	85.3	84.1	77.9	67.1	78.4	75.4	75.8	78.6	86.2	74.4	69.8	74.8	75.7	78.6	78.0	76.7	80.2	75.7	73.4	84.0	78.0	81.6	80.9	77.9	79.4	73.7	89.2	82.3	73.9	80.0	72.7	76.0	79.4	77.1	79.1	87.3	73.2	80.2	71.1	76.5	78.3	84.0
Jul 28	75.0	77.5	77.1	78.8	72.5	85.2	80.1	76.0	71.4	73.5	79.7	83.5	78.1	86.5	74.4	73.6	76.2	76.6	73.7	79.6	79.2	82.9	75.9	66.8	71.9	75.2	82.8	84.4	82.2	76.1	77.8	88.9	73.6	73.0	74.5	78.9	74.3	83.3	79.6	79.7	79.6	66.5	81.3	79.3	74.4	80.2	80.8
Jul 29	76.2	77.9	75.3	81.9	69.4	79.3	77.1	76.3	75.5	70.4	83.2	79.5	84.9	84.4	77.1	74.6	80.0	72.0	76.2	77.2	75.9	81.9	83.2	70.6	76.5	79.1	78.6	81.9	77.9	78.0	72.4	84.4	75.5	71.4	69.8	74.3	80.0	76.3	82.3	80.9	76.6	74.4	75.0	78.4	77.5	85.5	81.0
Jul 30	81.7	78.5	72.3	78.4	78.3	76.3	79.3	79.0	74.5	69.5	80.7	73.6	80.4	85.2	77.2	75.7	78.4	75.2	77.9	80.5	79.1	79.8	85.5	76.2	78.8	82.0	84.8	76.1	79.2	76.3	75.2	84.2	77.0	64.9	78.2	75.9	83.2	82.9	84.1	73.1	72.0	75.6	78.0	71.7	75.5	81.3	81.8
Jul 31	78.3	79.1	75.4	79.6	81.2	80.4	81.2	80.3	75.4	77.7	78.8	75.3	72.2	75.5	70.2	73.6	79.6	75.2	79.5	75.2	77.7	80.3	82.8	83.6	79.1	78.8	86.9	82.4	82.0	81.8	82.1	90.1	71.5	74.7	78.4	79.5	82.2	81.8	80.1	84.7	76.7	77.3	87.6	70.6	77.3	80.2	76.6
Aug 1	77.2	83.2	73.5	72.7	79.5	79.8	82.4	81.5	76.8	82.3	78.8	72.0	73.9	82.9	71.1	82.0	81.0	74.8	77.9	82.6	76.0	77.6	70.5	82.1	84.6	85.2	84.5	81.3	83.0	86.8	85.1	89.8	77.1	79.4	75.6	81.1	79.3	77.4	83.7	82.0	71.0	85.2	90.0	73.5	76.3	83.2	83.6
Aug 2	78.7	81.1	72.4	74.6	83.6	85.9	80.4	77.6	79.4	82.7	76.4	72.6	76.4	78.6	75.0	75.3	75.5	77.6	76.3	80.9	85.3	77.8	70.7	86.5	77.9	86.1	77.3	85.7	85.2	79.7	82.2	89.1	79.5	73.9	77.6	79.6	84.1	78.6	83.4	84.9	76.9	86.9	90.1	76.1	79.5	80.1	75.8
Aug 3	76.2	81.0	71.7	79.9	86.5	78.7	85.1	78.2	83.4	84.7	79.2	80.7	78.2	80.0	79.5	75.0	71.4	78.3	73.2	81.9	81.1	79.1	74.0	82.2	72.9	75.7	86.3	79.1	84.2	76.7	83.5	85.8	83.3	76.3	80.6	77.4	82.7	77.4	73.0	74.6	74.6	86.0	86.7	84.7	82.7	75.1	76.1
Aug 4	76.1	83.5	72.2	74.9	81.7	76.1	79.0	79.5	89.6	85.8	77.7	81.5	76.1	75.4	76.1	83.2	74.8	78.7	78.9	80.7	74.5	80.1	76.3	83.0	79.8	81.0	84.8	78.2	83.9	85.1	83.4	83.9	85.5	76.1	78.7	80.9	79.6	83.4	77.9	71.7	76.8	85.2	84.9	75.8	84.2	71.7	77.0
Aug 5	72.6	80.6	72.1	76.6	86.7	75.1	82.3	83.8	80.1	78.6	74.4	77.3	80.0	78.0	74.3	82.7	77.4	72.8	70.5	78.2	72.2	84.1	80.6	82.5	80.1	86.5	83.3	79.9	79.5	79.2	80.8	79.6	80.0	82.1	78.6	86.5	79.6	83.6	83.0	81.6	79.6	84.4	87.9	76.0	84.5	70.3	80.5
Aug 6	72.5	71.6	79.0	76.7	85.5	74.8	79.5	83.5	84.7	84.0	84.0	70.6	78.1	77.8	80.9	81.6	76.3	68.9	67.6	75.6	85.0	77.3	79.1	80.1	76.3	89.4	80.0	77.2	76.2	80.2	80.8	77.4	75.7	84.7	78.7	83.4	81.0	76.6	83.7	82.6	79.0	83.4	83.9	80.9	78.9	72.5	79.0
Aug 7	74.8	76.2	83.6	73.9	86.3	73.2	73.3	85.2	78.6	87.5	74.1	74.6	74.8	67.7	80.7	79.5	72.0	63.6	70.9	72.5	84.4	84.1	81.8	85.0	77.0	88.5	78.8	79.2	65.5	80.4	80.4	74.8	78.6	85.6	79.3	81.6	74.3	73.8	86.0	86.4	81.3	79.2	75.4	81.3	78.7	74.9	76.9
Aug 8	79.0	71.6	82.9	73.3	90.3	72.1	70.0	85.0	76.2	86.9	78.2	71.0	79.6	66.6	75.8	83.4	76.4	68.4	73.9	71.2	83.8	86.0	82.3	83.3	78.0	87.1	81.1	76.7	82.9	82.5	79.2	80.6	75.9	83.7	78.0	81.2	71.4	72.0	89.1	78.9	79.9	80.8	82.8	73.8	76.7	72.7	76.8
Aug 9	78.6	75.4	86.2	70.3	85.6	77.4	73.4	84.2	84.9	87.9	79.5	70.0	82.7	66.4	81.3	75.6	80.8	72.7	73.2	70.3	86.3	80.4	82.9	86.1	80.2	79.2	75.8	77.4	84.4	81.6	77.9	78.8	84.5	84.2	81.4	85.9	64.4	75.4	84.5	75.3	79.0	71.7	79.5	81.1	82.1	78.3	78.0
Aug 10	80.4	76.3	75.6	68.8	80.1	80.0	74.8	80.9	79.7	90.1	81.1	74.7	88.6	73.7	83.9	71.7	79.4	71.7	72.1	73.8	77.9	76.7	86.7	89.0	76.6	81.9	75.9	78.0	82.4	80.2	79.1	83.9	83.9	81.9	83.4	82.8	67.4	80.1	77.3	76.8	76.0	73.7	76.5	77.1	79.4	75.3	79.0
Aug 11	80.5	75.8	78.1	70.5	76.6	81.7	79.3	73.5	81.5	85.1	77.9	70.8	91.2	70.5	85.1	67.1	81.9	76.4	78.0	73.0	76.7	87.0	75.8	88.4	74.0	74.6	76.0	75.4	84.8	75.8	75.5	88.5	82.1	83.7	82.5	86.5	76.4	75.0	76.6	74.1	76.7	72.1	64.3	68.0	82.2	73.0	75.6
Aug 12	79.2	74.1	72.9	74.1	81.8	75.2	82.0	82.4	73.6	85.1	75.9	71.3	82.3	74.0	86.8	70.7	86.6	75.5	75.7	69.6	78.7	87.2	69.7	92.5	74.8	69.4	81.3	73.7	79.9	82.2	80.8	85.3	76.1	78.4	82.6	90.8	73.0	72.2	76.2	73.6	71.9	73.8	69.9	63.9	79.2	69.0	76.9

TABLE 5. SUMMARY AND EVALUATION OF DAILY TEMPERATURE IN HELP MODEL 100-YEAR SYNTHETIC WEATHER DATA SET

YEAR->	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70
Aug 13	77.0	80.2	73.2	78.8	77.3	77.8	83.9	79.6	74.6	77.7	76.7	73.6	71.9	74.6	78.9	74.0	82.3	76.0	76.2	66.8	73.5	79.4	78.2	76.3
Aug 14	83.7	80.0	76.8	74.4	76.2	74.8	83.1	71.4	67.8	74.7	77.4	75.0	75.2	77.4	77.9	72.9	85.5	66.8	69.9	68.9	73.6	80.6	77.7	78.9
Aug 15	76.6	77.0	75.0	76.9	71.2	70.0	82.3	75.4	73.4	77.2	73.5	75.1	78.3	76.1	83.2	78.3	76.9	73.2	75.3	74.9	76.3	72.7	76.1	79.7
Aug 16	76.6	82.5	73.7	82.5	80.5	66.9	84.1	77.8	69.2	77.4	73.2	78.6	80.1	73.1	85.8	77.0	80.7	73.8	82.4	68.0	72.6	76.5	73.1	74.9
Aug 17	82.9	77.7	73.9	81.7	83.9	70.1	81.9	77.8	69.8	79.6	68.9	78.3	82.5	73.4	75.4	78.7	78.1	68.6	78.7	73.1	70.0	73.4	73.4	71.8
Aug 18	79.5	76.9	75.3	78.1	80.9	67.9	81.7	80.9	75.2	77.6	72.5	71.7	79.5	71.0	77.6	78.8	80.1	70.2	66.2	75.8	78.3	75.2	73.9	76.5
Aug 19	79.1	78.8	82.0	78.6	84.9	71.0	85.1	80.7	75.7	74.9	74.4	77.5	76.3	81.3	66.6	80.7	82.9	71.2	67.2	76.8	74.4	82.3	78.2	77.0
Aug 20	77.8	77.3	80.3	76.6	78.4	78.9	84.8	83.6	69.6	76.3	76.6	82.4	80.7	75.5	68.7	80.5	77.7	72.5	74.5	74.2	77.6	75.7	74.7	72.4
Aug 21	76.7	79.3	78.8	70.0	76.3	81.0	81.3	76.2	69.5	78.3	75.9	80.1	81.7	87.1	70.0	79.0	75.6	71.3	82.6	67.9	78.2	74.5	77.1	77.0
Aug 22	81.1	77.2	73.0	73.9	81.2	72.6	79.5	81.1	73.0	84.7	72.0	74.5	82.4	81.9	72.4	78.3	79.6	78.9	76.8	75.8	71.1	75.6	80.6	80.2
Aug 23	81.0	76.4	74.5	74.0	73.9	77.5	81.6	77.4	75.6	76.1	76.9	66.9	81.6	74.8	72.7	77.7	79.8	81.6	74.1	72.5	71.7	77.6	77.8	80.1
Aug 24	75.0	73.3	74.2	76.6	72.0	78.3	73.2	79.3	75.2	77.7	76.5	68.7	82.9	78.2	70.8	69.6	79.8	81.7	70.8	74.6	78.4	80.7	75.2	74.3
Aug 25	74.0	73.0	78.2	81.1	71.1	75.1	78.5	72.5	76.7	75.8	70.2	60.7	76.9	77.6	67.6	76.6	83.0	88.3	73.6	77.3	66.2	82.5	71.9	76.3
Aug 26	75.6	68.2	73.3	85.6	71.3	73.0	65.6	80.1	83.5	82.0	70.0	69.6	77.5	76.2	76.0	81.2	78.4	84.9	71.9	68.1	72.8	79.1	75.1	75.8
Aug 27	74.6	69.7	75.0	84.4	76.5	68.1	76.5	72.0	79.9	71.4	80.4	61.9	78.9	69.2	79.2	79.7	77.6	75.7	71.8	75.7	76.4	77.1	70.2	76.9
Aug 28	76.5	68.4	82.1	87.7	66.9	66.6	81.1	69.6	73.2	70.6	80.8	62.5	71.3	70.8	76.7	68.0	70.5	65.8	65.8	64.0	71.0	70.1	66.9	78.6
Aug 29	74.2	73.5	81.8	79.6	66.5	63.0	80.8	68.7	70.5	64.0	78.2	66.2	75.5	69.8	77.5	63.5	70.3	71.0	68.1	63.7	73.2	75.4	74.6	68.7
Aug 30	69.1	74.7	80.5	77.6	67.2	75.5	75.1	70.9	79.2	71.4	81.1	66.7	76.0	66.0	82.0	63.9	63.9	69.1	68.0	67.4	70.2	74.1	78.8	66.4
Aug 31	61.9	78.6	73.0	69.9	63.4	73.6	70.6	56.5	75.6	63.4	73.8	67.5	70.8	68.6	82.7	62.5	65.4	69.0	65.9	65.6	72.7	74.3	73.8	64.6
Sep 1	60.3	73.8	66.5	70.7	66.5	71.0	73.4	60.8	72.5	59.7	77.8	64.1	64.2	59.8	74.7	60.0	59.9	66.6	72.8	57.8	68.1	76.5	66.6	67.2
Sep 2	66.4	74.4	52.0	66.5	63.3	68.6	68.7	56.5	69.9	60.3	78.5	68.7	67.8	63.0	69.3	61.5	73.6	70.7	66.6	61.1	60.6	71.2	67.3	70.2
Sep 3	68.7	73.7	61.8	69.7	72.9	64.7	61.2	55.4	67.5	52.4	66.1	64.1	65.7	61.0	70.4	60.4	67.6	76.8	68.3	63.9	68.6	70.4	59.9	74.5
Sep 4	62.7	74.7	64.3	64.7	68.5	69.2	63.9	55.8	58.3	62.1	64.3	66.9	68.9	62.0	69.0	60.3	68.9	74.6	62.3	61.8	66.3	75.6	69.8	77.3
Sep 5	66.5	85.5	68.4	78.9	70.6	76.1	66.4	52.1	55.7	54.4	61.0	61.4	78.1	65.7	69.3	61.5	67.6	75.1	65.0	70.9	68.8	69.4	60.7	67.8
Sep 6	66.2	77.7	62.5	75.7	69.9	77.0	64.1	58.5	53.9	61.1	69.2	62.5	81.4	65.5	69.2	57.6	71.8	69.1	70.5	59.5	73.6	72.4	57.4	64.5
Sep 7	66.6	76.6	63.5	67.6	67.7	79.2	68.7	62.0	56.6	70.3	67.4	50.7	77.4	73.4	64.2	61.5	68.4	66.1	63.4	64.2	65.0	69.8	62.3	60.6
Sep 8	64.4	74.6	59.8	69.0	62.7	70.0	68.8	58.1	56.0	71.7	77.6	62.0	69.3	73.8	74.2	72.4	71.0	64.5	62.9	62.9	67.5	67.1	63.8	52.7
Sep 9	54.9	66.4	57.0	63.3	60.5	74.6	61.5	56.3	57.2	80.8	68.5	65.0	58.4	84.0	71.3	65.0	72.3	62.9	64.7	70.9	61.0	65.2	61.6	55.3
Sep 10	53.7	68.2	62.7	65.7	68.2	76.4	56.4	64.7	64.2	70.4	77.0	69.2	59.4	78.4	69.3	64.4	62.6	66.4	58.8	69.0	67.6	64.3	67.3	55.6
Sep 11	59.0	65.3	65.2	76.3	77.5	80.6	54.2	64.2	66.8	71.8	69.0	67.1	64.5	67.7	68.8	63.7	69.9	65.8	62.1	71.5	65.1	66.3	68.1	48.6
Sep 12	68.0	66.1	65.2	75.2	70.5	69.6	59.7	67.8	74.4	73.1	52.3	76.0	71.6	72.7	75.5	65.0	61.1	60.0	63.7	68.1	59.6	64.9	67.0	53.4
Sep 13	75.0	72.9	59.9	71.3	63.4	64.7	59.2	71.1	67.4	68.4	56.7	65.1	69.9	75.2	84.3	59.3	64.0	65.8	58.5	68.2	60.9	60.6	71.3	53.8
Sep 14	63.9	70.1	65.0	67.9	64.1	73.0	61.7	65.1	58.3	62.9	63.3	70.9	77.3	70.5	73.0	56.8	58.8	66.6	64.0	68.7	63.1	64.5	69.0	60.0
Sep 15	59.4	73.0	57.4	74.4	53.1	80.5	55.0	60.5	61.3	57.8	61.2	71.4	82.0	73.4	77.1	54.4	59.3	67.5	69.2	74.3	57.8	74.0	65.5	58.1
Sep 16	62.6	80.1	60.5	74.8	52.3	75.9	53.1	56.7	55.4	65.8	70.1	67.4	80.4	69.7	76.4	60.1	57.8	66.4	64.7	74.3	64.2	68.3	62.3	56.1
Sep 17	54.7	68.1	74.7	76.6	56.0	77.2	68.3	59.1	57.5	62.5	63.6	75.7	73.7	71.5	82.7	64.5	60.9	65.6	66.6	69.9	74.3	63.2	60.7	54.4
Sep 18	49.1	68.5	77.9	67.6	67.6	71.2	66.1	62.1	54.4	59.2	57.0	68.9	63.7	73.7	85.8	64.9	62.7	61.5	62.7	77.2	76.6	56.4	58.8	44.1
Sep 19	54.4	64.7	72.2	76.5	71.6	68.3	69.9	60.5	55.0	60.3	51.0	65.1	63.6	70.4	72.3	66.9	58.3	67.7	60.4	75.7	81.5	65.1	57.9	51.6
Sep 20	54.2	57.9	75.4	71.6	73.8	68.0	63.5	49.1	51.4	64.5	57.5	62.2	63.9	73.7	68.6	75.7	62.9	70.6	59.8	73.7	74.5	63.6	55.0	63.8
Sep 21	58.7	60.4	71.9	75.1	71.0	77.1	65.6	47.9	53.3	66.4	60.6	58.8	56.7	78.5	74.1	63.5	67.9	73.9	62.1	66.1	57.1	58.8	65.1	58.0
Sep 22	64.1	64.3	70.6	72.2	64.2	75.4	61.3	54.4	51.8	57.7	64.7	49.4	60.5	69.9	75.2	63.4	63.5	69.9	59.6	71.1	60.0	64.5	62.7	64.4
Sep 23	70.1	62.6	62.4	64.3	68.9	70.3	49.1	61.4	56.4	69.4	61.8	51.5	66.1	56.1	66.1	61.9	65.9	63.3	55.8	79.5	66.0	70.9	63.8	52.1
Sep 24	63.0	71.8	67.7	69.5	71.0	68.8	61.1	61.5	47.2	64.0	61.4	53.7	77.5	63.7	54.5	64.9	67.3	53.8	65.7	71.1	68.8	73.7	64.0	61.7
Sep 25	62.1	67.3	67.3	71.1	59.3	71.7	71.8	61.8	55.5	68.6	60.6	59.9	67.0	68.7	56.4	59.0	69.0	56.6	58.7	71.5	63.6	74.9	57.3	61.2
Sep 26	62.2	65.0	67.8	70.4	65.9	70.0	67.2	51.8	52.6	53.4	55.1	67.2	67.6	63.7	60.9	74.4	77.2	57.4	56.2	69.4	67.7	74.5	46.6	57.1
Sep 27	64.6	57.2	69.0	60.4	57.1	64.8	61.4	53.5	41.7	55.6	61.6	69.8	65.1	58.7	59.7	57.4	77.6	62.6	65.0	60.7	61.3	70.3	47.1	75.1
Sep 28	58.1	64.8	56.6	56.6	62.4	73.6	63.8	55.3	47.3	62.4	63.7	62.3	52.6	59.8	58.7	56.8	76.2	64.5	60.8	58.9	69.0	66.3	44.0	75.9
Sep 29	53.7	66.1	58.7	61.5	55.8	65.7	73.5	51.6	53.2	67.3	62.3	72.7	46.9	55.4	55.6	64.5	76.2	57.9	71.6	66.2	63.7	61.0	49.3	68.2
Sep 30	57.9	66.3	55.1	51.5	49.2	67.9	62.0	57.1	63.4	71.8	65.1	68.7	40.8	58.0	43.8	59.5	71.1	56.3	58.3	62.6	57.2	67.7	58.2	63.8
Oct 1	42.4	55.8	51.2	46.3	55.1	49.9	68.9	68.4	54.0	63.4	55.9	67.3	37.7	59.9	54.7	54.9	76.6	54.4	57.3	57.9	61.3	52.6	50.6	56.2
Oct 2	45.4	57.2	57.8	62.2	63.0	66.3	66.5	63.5	46.6	57.6	55.4	65.6	39.3	62.1	53.5	57.6	68.5	50.8	51.1	61.9	63.4	47.2	45.4	57.0
Oct 3	45.3	63.4	58.2	51.4	56.7	67.7	68.8	62.3	48.7	59.5	63.5	64.3	45.6	65.0	57.3	55.1	60.6	59.6	55.7	61.3	56.7	42.0	55.3	50.9
Oct 4	53.1	67.3	56.2	50.7	52.0	66.4	66.8	61.4	49.9	70.8	58.9	70.3	45.5	57.7	57.6	49.2	57.1	47.1	58.3	62.2	56.0	39.5	51.4	57.5
Oct 5	52.2	72.0	55.7	57.2	52.4	59.5	68.7	65.4	35.8	70.0	60.8	63.1	46.9	54.9	61.8	45.1	54.2	57.5	54.7	65.0	61.9	44.2	60.4	53.9
Oct 6	61.3	76.2	56.3	42.7	48.5	55.2	72.2	56.7	35.1	67.6	61.0	54.1	33.1	53.5	58.2	58.3	50.3	50.8	48.5	52.2	63.3	56.0	62.3	62.6
Oct 7	57.6	64.8	52.5	44.9	56.3	48.1	75.3	64.0	42.2	65.0	58.9	50.9	39.0	58.1	64.2	59.9	54.7	48.4	41.5	61.8	64.2	66.7	59.6	56.5
Oct 8	62.5	61.5	46.6	48.7	54.3	47.9	73.5	51.9	42.7	54.4	57.3	46.2	43.4	58.8	58.3	57.6	57.9	48.0	37.7	64.2	67.2	53.2	64.1	38.4
Oct 9	50.6	61.8	58.9	54.3	55.7	45.9	69.3	46.1	49.2	60.0	60.5	53.2	44.9	47.4	43.6	63.4	60.5	48.8	50.3	56.4	59.6	53.4	52.7	42.6
Oct 10	63.2	56.6	62.5	50.8	59.6	55.1	73.2	44.1	46.4	65.1	65.0	46.1	51.0	50.3	33.1	60.7	58.6	44.9	52.6	48.0	54.7	53.7	44.1	38.7
Oct 11	52.8	49.3	65.1	55.7	62.3	49.4	57.6	49.9	53.3	68.6	68.8	44.3	48.6	58.6	36.1	55.3	61.8	53.2	52.3	49.9	52.5	53.7	41.0	43.5
Oct 12	49.4	45.0	56.2	58.0	59.2	43.2	67.6	51.3	52.5	78.3	72.2	46.2	55.3	45.6	36.2	55.9	54.6	52.0	58.7	56.3	40.4	49.7	40.3	51.4
Oct 13	43.8	41.9	58.2	49.7	53.9	48.2	57.8	58.5	44.5	78.3	64.2	50.1	52.5	54.8	41.2	54.3	46.6	50.0	56.5	56.2	41.6	61.1	45.6	52.8
Oct 14	45.0	38.3	48.5	54.7	57.6	47.5	51.5	49.1	50.4	71.2	58.3	42.6	62.8	55.1	44.6	43.7	61.7	51.0	50.2	40.0	34.3	61.4	50.1	51.9
Oct 15	53.5	34.6	45.1	56.2	58.4	54.7	56.3	42.4	41.9	58.4	66.6	32.1	59.5	58.7	43.2	35.3	59.4	43.4	43.5	34.6	42.1	63.3	64.9	44.3
Oct 16	53.2	43.0	48.9	53.5	59.0	62.8	47.4	33.2	41.8	53.3	63.6	40.7	60.1	52.2	36.2	46.1	59.1	45.1	42.6	38.0	55.0	66.2	54.8	44.0
Oct 17	48.7	38.0	58.2	53.2	45.8	65.5	55.6	32.8	44.5	52.4	60.8	38.8	47.0	42.1	45.7	52.5	61.3	52.4	43.4	32.5	55.2	54.0	62.4	48.9
Oct 18	51.3	51.4	55.2	52.9	38.6	68.5	53.8	37.5	47.5	55.9	70.3	38.6	48.3	41.5	52.9	40.1	65.4	50.8	54.8	40.1	46.7	44.1	53.8	54.7
Oct 19	61.6	60.7	47.1	48.1	48.2	54.7	43.4	41.0	54.2	46.4	66.2	49.9	40.7	40.5	54.8	41.0	56.1	58.0	55.1	36.9	48.0	52.4	42.2	44.8
Oct 20	56.8	53.0	43.3	55.8	48.0	54.4	44.9	42.7	56.2	38.6	64.0	45.4	43.6	49.8	53.3	33.4	54.9	60.2	56.0	42.7	42.2	61.3	52.1	40.3
Oct 21	58.1	49.7	40.4	57.9	49.1	56.8	49.3	47.3	65.2	37.1	56.3	42.9	35.6	62.0	51.3	42.7	46.9	59.3	49.8	41.7	55.6	45.4	47.6	42.2
Oct 22	55.5	49.7	35.5	51.9	51.4	59.8	43.7	38.5	58.6	44.2	54.9	34.4	42.9	56.3	53.1	34.9	46.0	51.2	57.7	40.4	56.4	46.3	41.8	49.0
Oct 23	46.9	37.7	34.9	46.7	46.5	54.8	47.5	37.5	58.9	37.7	51.0	30.6	37.7	58.7	42.9	41.2	49.6	49.3	59.3	50.3	48.8	60.9	37.5	42.2
Oct 24	61.4	43.9	44.6	50.8	44.8	53.8	51.2	46.7	55.9	35.7	52.1	32.8	41.0	62.4	46.2	34.8	58.4	43.4	60.3	49.1	57.5	54.1	40.2	39.1
Oct 25	53.9	50.2	52.3	46.3	44.4	37.2	42.0	51.9	51.8	38.2	50.6	30.7	43.7	47.2	48.7	42.1	42.5	38.8	58.2	58.8	49.6	58.2	35.9	31.4
Oct 26	47.3	41.8	48.6	60.3	25.9	40.2	40.3	41.6	54.5	32.7	47.4	37.7	47.1	44.7	46.6	42.1	47.8	49.0	49.0	52.2	32.2	53.1	33.2	32.4

YEAR->	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93
Aug 13	72.5	72.3	79.7	72.7	81.7	79.5	85.0	84.5	79.2	88.2	73.6	79.5	74.7	69.0	75.9	79.0	80.3	73.9	67.7	69.9	69.8	67.8	78.7
Aug 14	72.3	70.1	79.9	68.2	74.1	79.0	92.1	84.8	76.8	87.3	78.9	80.3	72.3	73.9	80.4	77.2	74.7	75.4	67.9	69.0	72.1	69.1	82.0
Aug 15	75.8	69.9	78.4	75.2	78.8	81.4	86.0	86.6	83.3	82.8	75.3	76.5	81.4	82.9	74.8	75.0	74.2	76.1	67.2	70.3	71.4	72.0	83.3
Aug 16	71.6	69.3	73.4	74.7	77.1	76.7	82.2	77.3	79.7	75.6	74.4	78.7	79.0	79.6	73.2	72.2	75.6	76.2	72.9	69.9	70.7	76.3	81.2
Aug 17	75.0	70.7	75.9	80.6	74.5	76.8	81.5	82.2	77.7	77.3	74.6	83.0	78.5	81.4	73.8	74.2	69.0	69.3	70.2	77.3	74.0	73.4	73.7
Aug 18	77.3	73.7	75.5	74.5	75.1	79.6	84.4	75.9	83.5	79.5	77.0	79.5	84.8	80.6	74.5	75.8	61.4	72.9	70.9	76.3	75.0	69.6	79.3
Aug 19	77.2	81.6	77.1	73.6	71.7	75.8	82.3	72.5	83.9	83.2	72.0	77.5	73.9	82.7	76.5	81.7	68.8	72.0	73.7	74.9	79.3	76.2	72.4
Aug 20	83.2	81.4	79.6	79.5	71.2	80.8	78.5	70.8	82.0	83.0	70.6	76.9	73.7	85.1	78.4	81.3	72.2	72.2	73.8	77.6	78.6	76.6	79.3
Aug 21	86.9	74.8	77.5	72.1	71.2	79.1	76.9	70.4	70.7	84.6	72.9	67.6	76.2	86.0	76.5	81.8	73.0	73.9	73.3	73.3	87.1	71.3	79.7
Aug 22	80.2	78.0	80.6	74.5	66.8	81.6	74.5	63.7	72.5	80.9	69.0	67.1	82.0	81.0	70.9	82.2	79.4	75.3	75.4	79.6	82.7	74.5	81.1
Aug 23	75.4	76.8	69.9	67.3	80.7	75.8	68.9	63.2	77.7	78.6	73.7	64.2	81.2	79.8	66.1	75.1	75.9	71.8	69.6	75.9	80.7	76.4	85.9
Aug 24	79.1	74.1	71.9	67.8	79.4	83.3	70.9	69.2	67.6	74.4	76.2	68.2	85.2	83.5	75.2	81.2	78.5	74.2	72.1	77.1	82.2	74.6	84.4
Aug 25	83.5	78.4	77.0	68.0	82.0	81.0	64.8	70.1	74.5	73.7	79.8	66.7	81.1	80.4	70.6	83.6	78.9	68.8	73.8	73.0	86.3	71.6	71.8
Aug 26	75.5	75.6	69.7	61.2	79.9	73.6	68.2	81.6	74.0	74.1	77.1	72.4	84.8	77.0	74.6	84.3	74.9	73.5	72.1	76.4	84.0	71.8	77.0
Aug 27	72.8	75.8	75.4	64.9	75.6	70.9	66.8	76.8	80.5	79.1	75.6	74.2	82.5	75.3	79.4	77.8	84.8	65.2	68.3	71.1	85.0	63.6	74.1
Aug 28	72.6	74.0	71.2	56.1	75.9	71.6	73.1	75.4	83.6	79.5	74.1	70.2	85.4	76.4	74.0	82.3	80.4	65.7	65.4	70.7	89.1	72.1	72.9
Aug 29	71.8	83.9	63.8	71.0	76.2	64.8	68.2	77.6	79.7	85.2	74.7	75.3	85.0	74.6	72.6	82.8	78.4	74.1	71.1	73.8	80.1	71.9	72.6
Aug 30	69.8	78.6	64.6	72.6	68.2	68.3	71.8	85.3	81.7	77.0	64.6	79.1	78.5	81.3	72.1	82.1	71.5	79.1	71.7	73.9	73.6	80.5	68.1
Aug 31	61.3	79.5	56.1	65.7	65.6	72.6	70.5	80.1	65.1	69.4	65.8	73.4	72.4	79.4	64.6	77.6	70.4	74.4	74.0	66.3	72.6	73.5	59.1
Sep 1	62.2	64.2	59.2	72.3	68.9	63.3	66.7	76.0	69.4	59.4	64.0	75.4	77.6	63.5	58.4	79.5	67.7	68.4	76.1	69.3	77.0	73.2	58.2
Sep 2	57.7	71.6	63.2	75.1	73.3	70.7	65.8	73.5	60.9	67.6	72.9	77.7	70.3	69.9	59.2	83.0	72.8	62.5	73.0	74.7	69.0	76.4	61.9
Sep 3	63.6	67.8	67.5	72.9	74.5	77.5	70.0	70.5	65.5	68.9	69.7	78.0	70.5	59.6	59.8	74.0	65.2	56.6	72.4	71.4	73.1	65.4	72.2
Sep 4	68.6	65.6	66.9	75.4	72.2	68.3	65.6	73.8	70.7	69.0	65.4	71.5	73.9	63.7	56.6	67.6	63.6	61.4	73.3	60.5	75.9	71.7	70.6
Sep 5	67.5	63.7	69.8	72.7	76.2	61.5	67.0	80.5	72.0	66.9	68.3	69.9	67.5	65.1	65.0	68.3	67.4	54.3	76.9	68.6	79.0	75.2	72.8
Sep 6	64.0	64.6	66.9	75.4	73.9	63.2	71.5	81.4	63.7	66.8	72.0	67.7	71.1	62.0	65.7	67.4	67.9	49.2	74.3	66.9	73.8	78.5	65.2
Sep 7	59.2	60.8	78.9	58.5	68.6	71.3	75.2	83.0	73.7	66.5	69.1	71.9	70.2	62.0	66.9	52.2	67.7	59.6	75.3	60.8	69.7	76.1	66.0
Sep 8	50.0	62.5	74.1	62.4	70.2	74.5	75.3	65.9	66.9	74.8	67.5	65.7	64.7	70.9	63.3	59.1	70.7	66.5	80.9	57.3	68.7	77.6	70.9
Sep 9	55.1	66.4	69.6	64.4	62.0	64.5	73.4	80.3	68.0	79.6	65.3	68.2	65.3	71.8	65.2	62.7	67.5	72.7	79.4	56.4	66.0	69.9	67.0
Sep 10	51.9	64.8	66.3	59.3	67.0	72.7	73.2	82.0	68.5	83.4	60.4	71.6	72.5	58.0	60.8	66.3	77.3	69.7	73.3	60.8	65.1	64.4	69.0
Sep 11	61.4	61.4	56.3	66.5	63.8	65.4	68.4	76.2	67.0	70.7	63.7	66.6	70.1	63.0	60.4	57.3	68.8	61.1	72.4	67.1	70.5	75.1	66.7
Sep 12	68.7	61.8	70.3	73.6	61.1	66.9	62.1	71.1	65.5	68.4	57.4	65.8	61.2	65.9	62.1	60.3	69.6	69.8	66.5	66.6	78.0	71.9	66.6
Sep 13	62.8	54.3	63.5	68.3	65.7	57.8	62.7	73.4	62.5	65.7	57.5	69.4	60.9	62.1	66.7	60.5	75.2	68.7	73.3	65.8	74.8	69.1	73.2
Sep 14	61.8	57.9	67.6	71.2	62.9	66.1	62.3	65.0	62.6	71.5	60.5	75.6	66.0	53.9	66.1	65.2	75.0	73.7	68.5	63.3	81.7	68.5	77.6
Sep 15	62.0	67.6	64.3	66.2	64.7	72.7	68.0	63.1	56.8	73.2	66.8	74.8	74.1	56.6	61.2	58.3	73.0	69.2	67.8	55.7	73.2	68.3	64.0
Sep 16	52.8	67.4	58.5	74.9	61.9	70.5	64.0	56.5	61.9	66.2	65.6	74.0	78.1	61.3	60.9	54.5	73.0	62.1	71.1	56.2	75.7	64.1	68.4
Sep 17	63.6	69.1	53.5	75.0	58.2	60.6	64.3	60.7	63.4	72.6	64.6	63.6	75.8	53.3	59.1	67.3	74.4	70.2	75.5	48.0	65.2	72.0	63.3
Sep 18	56.4	69.5	49.5	67.1	66.9	69.6	54.9	50.8	64.1	70.3	64.0	60.4	75.2	69.9	59.4	66.7	74.2	68.5	70.3	48.9	58.3	73.3	57.1
Sep 19	61.5	69.9	51.1	64.2	71.7	70.8	56.3	54.2	65.1	68.0	59.1	64.6	75.6	63.9	61.5	60.2	74.0	62.4	74.7	58.2	58.5	64.5	54.8
Sep 20	68.1	72.5	55.2	62.6	60.2	56.2	57.8	58.6	59.8	68.9	56.6	66.2	65.6	55.4	71.8	57.2	70.4	71.8	68.6	60.9	67.0	59.6	55.3
Sep 21	67.0	66.4	61.7	65.4	63.4	55.2	63.0	59.4	55.8	67.2	61.9	71.5	69.5	58.6	58.9	61.0	76.7	62.1	63.8	63.7	71.1	64.4	51.6
Sep 22	55.2	62.3	68.8	62.2	65.4	65.0	67.8	68.3	52.7	72.3	56.0	79.4	69.2	72.8	59.4	62.8	78.8	58.5	58.9	71.2	63.0	59.0	59.8
Sep 23	58.4	62.5	64.6	62.9	58.9	67.5	65.7	66.5	49.4	77.3	62.2	71.2	62.0	66.2	63.0	57.1	76.7	63.6	62.8	69.1	61.9	51.0	64.9
Sep 24	62.1	61.9	68.3	57.0	69.8	59.8	68.5	62.2	46.5	72.9	57.5	69.5	56.1	72.2	51.7	61.0	64.6	61.1	67.6	70.5	55.4	50.5	62.6
Sep 25	62.0	54.7	75.3	58.2	69.5	57.3	79.1	58.6	57.2	69.1	61.3	72.6	60.9	61.3	58.3	61.3	57.8	55.1	68.1	70.2	56.5	59.9	68.6
Sep 26	66.5	62.4	60.9	50.4	60.2	64.6	73.4	60.0	67.2	68.3	63.8	72.6	58.1	62.2	54.3	55.6	54.4	58.4	73.5	67.0	58.8	65.7	58.1
Sep 27	73.5	56.5	57.5	53.1	61.0	58.1	86.5	62.9	64.6	76.6	64.4	60.4	56.5	66.5	62.0	56.5	61.4	65.5	65.6	66.5	60.3	64.9	50.3
Sep 28	80.1	61.2	63.1	54.1	56.7	54.8	73.7	62.5	70.5	68.8	59.4	56.7	65.5	60.4	60.4	57.9	59.7	75.4	65.1	58.4	51.8	74.4	53.0
Sep 29	65.3	55.1	68.0	56.6	57.6	59.1	72.9	52.2	64.6	62.8	67.4	50.7	66.9	66.1	55.5	56.5	55.7	73.4	54.5	62.4	59.9	70.1	61.5
Sep 30	51.1	55.0	57.1	63.0	49.4	62.6	60.8	51.5	64.6	70.4	55.9	53.4	64.2	68.3	57.3	65.5	53.6	72.7	51.6	55.7	57.5	73.8	51.2
Oct 1	61.9	63.7	55.6	55.7	40.6	53.1	64.7	67.2	70.1	60.2	62.7	56.2	61.8	56.9	49.4	67.2	54.1	61.7	57.4	53.1	62.3	59.2	45.4
Oct 2	58.2	62.7	63.6	49.0	51.5	38.3	60.3	62.4	63.3	59.8	57.4	52.2	56.3	55.3	57.9	60.6	50.1	55.1	55.4	54.0	67.6	49.7	44.7
Oct 3	53.7	56.7	50.3	55.8	51.2	54.8	55.8	57.8	59.0	64.9	55.9	56.2	54.4	60.7	58.7	59.4	58.3	51.8	59.7	61.5	68.5	52.7	57.1
Oct 4	60.9	61.7	51.8	56.2	58.9	60.6	67.7	62.3	63.8	68.9	54.7	52.8	61.3	57.8	61.4	53.1	60.0	42.6	63.7	69.4	59.1	53.7	66.6
Oct 5	60.0	69.0	56.1	59.0	54.5	48.7	60.4	59.1	75.8	54.7	60.2	59.3	65.2	54.5	60.1	51.4	61.1	51.3	58.8	69.8	56.2	50.9	56.1
Oct 6	63.3	57.7	57.0	47.9	59.2	47.4	53.8	59.5	73.5	52.7	55.4	54.0	67.8	59.6	48.9	47.9	61.1	48.8	58.9	64.0	55.7	48.7	52.3
Oct 7	58.1	68.5	56.6	53.5	53.4	57.4	56.6	46.6	64.4	57.1	42.3	48.9	65.5	51.9	56.1	53.2	57.8	52.7	53.9	60.8	67.1	54.0	56.6
Oct 8	55.5	64.7	44.0	46.5	57.2	48.1	52.1	39.4	67.4	67.8	49.1	52.4	66.2	47.8	53.5	57.8	49.8	51.0	50.0	62.2	59.5	60.1	49.5
Oct 9	54.2	55.4	53.0	47.1	54.5	52.1	62.2	35.7	67.0	72.0	53.1	68.0	73.3	50.3	55.3	49.0	46.1	55.9	52.5	62.3	55.1	54.7	51.7
Oct 10	53.8	43.7	63.8	49.8	57.2	49.9	66.7	33.7	53.6	57.4	50.0	64.5	59.7	51.5	59.9	48.2	55.5	54.1	58.7	47.6	54.6	47.9	59.5
Oct 11	46.0	46.7	61.6	48.8	54.5	62.5	61.5	40.7	56.6	58.9	44.5	70.3	52.0	54.5	59.9	49.5	65.0	53.8	48.2	48.8	49.1	54.1	65.1
Oct 12	34.5	49.3	53.3	57.6	55.6	66.1	65.9	48.7	48.8	50.7	43.1	68.8	60.7	58.1	65.8	48.3	57.0	62.9	46.8	53.7	51.5	52.8	54.4
Oct 13	39.3	48.8	59.2	56.9	65.6	54.3	71.0	47.0	47.8	51.8	56.3	59.1	67.5	48.7	65.2	56.1	48.9	59.6	44.0	49.6	46.1	49.5	60.4
Oct 14	44.5	52.3	56.3	52.9	67.2	62.5	64.0	43.5	48.1	43.1	51.0	61.2	73.5	53.7	54.7	64.3	44.6	60.4	44.9	50.5	46.4	51.0	60.1
Oct 15	49.6	49.2	55.8	51.2	49.1	62.6	58.8	40.7	47.7	48.0	47.4	46.5	67.0	57.0	48.5	66.0	43.5	58.6	44.7	48.7	59.5	44.1	57.7
Oct 16	48.1	46.1	53.4	51.5	54.9	61.1	53.3	45.3	56.5	53.9	52.6	34.4	62.8	50.3	48.2	66.5	48.6	50.1	56.3	45.5	61.0	49.3	49.0
Oct 17	57.7	43.7	54.5	63.0	41.2	57.4	54.3	55.8	58.9	53.8	42.6	24.7	56.2	45.9	45.8	65.6	59.5	49.3	54.5	48.1	64.8	47.2	45.9
Oct 18	53.5	53.1	50.2	57.6	39.1	52.1	50.5	55.4	44.8	48.7	51.4	25.0	50.7	54.2	40.3	60.4	56.1	48.0	53.1	46.1	69.0	53.6	57.5
Oct 19	55.4	61.6	41.4	43.9	50.6	60.2	49.8	52.7	44.3	43.8	56.0	22.5	40.0	60.4	37.9	64.5	52.0	45.3	56.2	49.7	62.2	48.0	65.1
Oct 20	53.9	57.9	45.0	48.2	55.1	58.8	47.2	44.2	43.4	45.6	52.4	28.6	40.0	52.8	36.7	53.8	62.2	43.6	58.9	42.1	56.6	51.9	57.0
Oct 21	53.3	57.4	53.3	47.4	44.4	63.1	57.3	35.2	37.8	50.0	55.4	30.9	29.9	41.8	43.6	47.4	65.9	41.7	54.9	46.3	61.3	69.1	47.5
Oct 22	55.0	59.8	60.6	47.6	48.7	60.2	58.1	37.0	39.9	46.4	56.6	31.8	31.5	43.6	51.5	52.6	64.3	34.8	54.4	42.6	51.7	64.6	46.9
Oct 23	49.4	46.8	52.4	34.1	48.4	58.6	58.5	29.8	39.3	52.3	52.8	39.8	21.5	46.2	50.8	46.9	62.4	43.7	41.8	31.7	48.1	61.5	50.8
Oct 24	44.5	46.0	47.9	44.2	40.3	53.7	50.1	32.5	41.3	58.6	50.2	45.4	30.0	52.1	55.8	41.9	52.6	35.5	36.7	40.8	50.4	67.7	43.2
Oct 25	40.8	46.0	40.4	46.6	44.5	53.0	52.0	44.5	43.1	67.3	46.8	42.9	37.0	57.8	61.0	53.1	52.4	44.2	43.2	40.4	51.9	65.6	43.0
Oct 26	39.6	43.9	33.0	49.8	38.0	43.8	46.2	42.4	40.1	63.5	35.4	40.4	42.6	67.2	64.0	62.1	50.5	44.9	42.4	51.8	38.3	70.2	44.0

YEAR->	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70
Oct 27	54.8	40.0	40.8	51.8	28.9	42.8	44.7	39.6	55.8	42.5	37.2	32.7	46.3	44.9	47.4	49.1	44.2	45.8	45.1	54.7	44.2	47.7	36.9	32.9
Oct 28	45.1	49.0	37.2	53.7	38.3	36.8	43.1	35.4	55.3	36.5	39.9	37.9	49.4	54.1	43.4	44.6	40.5	53.5	42.3	46.5	43.7	45.5	38.1	40.8
Oct 29	38.1	48.6	46.3	55.5	34.3	41.6	37.7	51.4	47.4	33.4	31.7	44.6	36.7	54.7	51.5	43.8	30.3	55.8	33.8	35.1	41.0	41.5	40.1	50.9
Oct 30	30.0	52.8	38.2	52.5	31.4	40.4	41.5	52.3	51.0	46.4	28.0	55.2	45.0	52.6	56.1	44.1	41.2	53.4	37.8	43.7	41.7	39.7	45.2	54.3
Oct 31	36.7	64.8	38.0	52.5	28.8	48.0	42.8	54.1	39.9	50.5	38.9	35.2	35.3	47.3	36.7	39.0	48.8	58.2	46.3	54.2	40.6	47.1	37.5	40.4
Nov 1	46.1	62.7	45.7	52.9	36.9	32.2	47.5	49.8	49.6	52.6	39.0	33.2	37.4	54.6	32.2	46.5	40.6	45.8	46.5	36.8	36.7	46.0	31.6	36.4
Nov 2	46.4	50.7	35.9	52.7	34.5	35.5	42.7	47.4	48.2	52.1	26.7	29.5	29.1	46.2	35.3	42.3	42.2	53.9	45.7	42.2	34.2	50.4	40.6	30.9
Nov 3	40.9	40.9	37.6	43.2	36.5	36.8	49.0	46.8	42.0	48.0	23.7	34.1	37.1	49.2	30.2	48.4	40.8	46.8	51.3	44.4	34.7	56.9	40.8	29.1
Nov 4	45.4	45.9	45.6	41.0	49.8	34.3	47.3	50.4	56.5	41.4	23.0	24.9	37.6	40.9	38.4	47.1	48.1	37.7	51.8	40.6	31.1	57.4	46.2	33.6
Nov 5	34.2	46.8	56.0	34.7	26.9	28.0	53.9	48.5	51.1	41.3	26.5	30.1	36.6	38.8	37.0	48.9	41.3	39.5	54.2	31.1	26.5	48.5	46.4	38.5
Nov 6	40.1	40.9	37.3	24.7	29.8	37.6	55.3	45.1	59.3	38.2	23.3	26.6	39.0	25.2	33.7	38.7	45.0	47.3	46.0	28.2	24.2	36.8	46.5	41.1
Nov 7	50.5	42.3	48.2	28.7	28.1	30.2	49.1	55.0	57.3	36.9	23.3	33.8	39.6	23.1	36.7	41.9	47.2	41.0	43.7	36.8	28.9	35.5	49.9	46.7
Nov 8	48.1	35.0	34.0	30.0	36.5	43.3	36.7	40.3	42.7	45.7	42.0	24.0	45.1	34.2	31.4	32.0	44.7	44.5	42.5	40.3	37.7	39.3	46.9	41.2
Nov 9	55.1	37.1	42.4	39.7	41.2	37.0	30.9	45.2	44.0	44.8	40.1	31.6	38.6	31.7	34.1	30.4	41.9	45.2	38.9	41.8	32.1	39.1	32.8	44.3
Nov 10	52.2	25.7	48.8	34.6	37.2	40.2	49.8	32.4	29.7	46.1	40.9	45.1	41.2	35.2	49.6	28.3	54.5	43.3	32.5	37.7	31.4	37.1	21.8	40.6
Nov 11	48.2	36.6	47.4	39.7	46.0	44.3	39.3	20.9	28.1	47.1	33.9	46.9	31.9	36.2	45.8	32.0	53.7	48.2	29.6	38.8	27.9	44.2	24.4	47.9
Nov 12	41.7	23.6	44.0	46.5	32.7	31.9	38.3	18.4	23.8	42.3	28.3	34.1	31.1	37.3	53.4	33.7	50.3	56.7	30.5	36.4	20.8	33.5	28.2	41.8
Nov 13	38.0	27.4	38.5	40.5	34.1	30.7	33.8	25.3	30.6	54.6	36.3	39.2	40.7	39.8	43.2	17.0	53.5	59.9	31.0	43.3	12.1	31.4	22.0	37.8
Nov 14	23.6	30.6	39.6	37.0	33.7	44.8	39.5	31.6	41.6	58.6	36.2	38.1	43.3	42.9	31.3	24.7	36.2	51.6	19.0	39.9	21.0	34.4	25.6	51.2
Nov 15	22.5	34.6	46.5	46.8	21.4	44.3	37.4	35.8	41.5	67.6	27.1	34.7	58.6	38.3	27.3	31.4	37.1	41.5	31.2	23.5	32.1	35.4	36.5	45.0
Nov 16	21.7	30.2	30.0	36.1	20.1	46.7	45.8	28.8	30.5	57.1	32.4	38.1	50.1	37.8	33.0	41.2	26.2	42.1	33.2	29.4	35.8	36.9	26.5	37.6
Nov 17	20.2	32.2	30.1	35.3	30.2	31.3	41.7	27.6	31.0	52.8	34.6	47.8	48.5	30.6	35.6	42.9	19.9	40.0	40.9	37.4	27.9	43.1	26.4	29.0
Nov 18	17.2	34.8	24.2	35.7	39.2	23.5	35.6	28.7	32.4	37.5	35.2	49.1	42.3	25.4	30.3	25.8	25.3	32.6	45.1	34.1	30.3	46.5	20.3	35.4
Nov 19	21.7	28.4	35.3	30.9	36.9	19.8	40.4	26.7	41.7	41.9	33.6	37.4	37.2	27.1	32.7	33.9	29.1	33.1	44.2	29.4	35.5	41.3	14.6	37.8
Nov 20	30.3	32.4	37.1	33.8	43.2	35.8	40.8	34.0	45.7	45.2	33.4	28.1	38.8	32.7	26.4	39.8	39.1	41.6	41.5	34.9	21.7	40.7	17.9	40.5
Nov 21	31.2	29.8	37.0	27.2	37.2	41.5	31.3	25.5	53.5	46.9	38.9	26.6	31.8	30.0	25.7	38.9	38.5	37.8	31.1	37.6	25.3	26.2	16.7	43.3
Nov 22	40.5	32.1	33.2	25.7	37.3	49.6	42.2	23.5	51.2	45.2	38.1	21.7	30.8	30.9	31.4	34.7	30.5	31.9	27.0	39.0	23.0	21.0	38.0	35.6
Nov 23	30.4	25.7	31.5	14.2	41.3	38.8	41.5	18.9	46.7	39.0	48.1	29.7	26.6	30.6	37.4	50.1	38.3	26.1	28.0	27.1	33.2	24.9	32.2	36.8
Nov 24	25.9	37.3	25.9	17.2	41.3	44.4	39.0	23.8	40.3	39.7	41.6	30.7	29.2	34.0	33.8	48.9	41.7	28.3	31.5	31.0	31.6	32.4	30.1	32.9
Nov 25	24.7	31.9	19.5	30.4	36.5	41.7	41.3	23.8	42.4	31.7	30.8	34.5	28.5	33.2	34.6	39.3	35.3	25.8	44.5	33.0	23.0	25.0	32.2	29.5
Nov 26	33.0	27.8	22.2	32.3	34.7	40.4	35.7	15.3	30.7	37.5	35.0	48.1	37.7	43.5	35.8	47.1	30.6	27.6	52.5	36.9	23.5	30.2	32.8	20.0
Nov 27	15.5	18.8	27.5	42.0	31.9	38.1	31.1	13.9	23.2	35.6	20.4	47.3	37.7	41.5	34.1	48.1	15.9	12.6	36.8	29.6	19.0	37.8	41.1	18.9
Nov 28	21.2	35.0	33.1	44.3	25.5	42.3	26.9	15.6	32.5	30.7	31.9	42.5	41.0	45.8	35.4	30.5	28.2	9.2	31.3	25.9	24.0	34.3	35.9	24.7
Nov 29	17.7	37.8	35.6	37.3	25.3	40.3	28.6	21.3	36.0	22.0	23.0	27.4	43.0	37.9	31.8	35.0	32.9	13.5	33.1	19.1	29.5	22.3	50.6	30.7
Nov 30	21.2	29.9	37.0	31.8	28.0	37.0	27.1	23.8	26.1	22.7	21.7	18.0	47.5	46.4	22.9	27.8	30.4	27.3	32.1	28.1	35.6	29.8	50.3	37.9
Dec 1	18.8	27.9	33.2	45.8	29.3	39.5	21.1	20.0	29.5	29.6	28.5	23.6	36.3	49.2	24.2	29.8	31.1	26.1	33.6	19.3	36.9	29.1	36.8	29.0
Dec 2	23.7	28.7	42.4	24.2	25.4	40.6	31.9	29.5	29.0	27.3	28.4	23.7	42.0	42.9	19.0	33.8	35.9	19.2	31.0	26.2	42.8	18.3	35.3	32.8
Dec 3	21.0	31.5	40.8	30.4	28.5	51.9	29.9	30.7	36.7	26.7	37.8	24.8	46.7	40.0	25.3	26.0	39.3	27.0	26.8	27.4	31.8	22.9	33.0	32.6
Dec 4	21.9	31.4	46.0	43.8	29.0	41.0	36.6	32.2	27.1	23.8	44.4	30.6	42.2	38.8	28.5	27.7	30.2	23.6	34.6	31.3	28.2	27.4	30.2	25.2
Dec 5	20.3	35.5	43.6	42.3	29.9	41.3	36.0	34.0	36.4	28.1	49.5	37.1	37.3	35.6	25.6	30.4	27.5	14.7	35.7	38.5	25.2	30.2	36.7	32.9
Dec 6	27.1	31.3	40.9	35.7	22.9	41.9	23.3	28.5	45.0	24.0	46.6	42.5	23.5	23.1	18.0	32.3	31.1	17.0	44.7	37.3	26.5	35.9	43.5	33.8
Dec 7	41.7	32.4	48.0	33.0	17.8	34.3	31.7	36.9	42.2	30.5	51.8	35.5	28.6	23.4	16.8	31.4	22.5	25.2	30.6	34.5	34.7	38.0	42.1	31.5
Dec 8	25.6	33.0	47.7	30.9	21.8	34.2	19.2	38.2	44.0	22.3	43.0	35.9	24.6	28.1	15.3	32.8	34.7	25.6	27.5	22.1	25.6	49.6	33.1	34.6
Dec 9	37.6	35.4	40.8	28.1	23.8	40.7	16.9	26.9	38.7	23.9	47.6	31.2	38.1	36.4	19.4	31.5	27.0	24.5	22.7	17.7	23.8	42.7	25.2	28.6
Dec 10	36.9	33.0	29.8	17.0	23.0	36.9	19.1	17.2	26.9	32.8	35.7	24.7	41.7	30.9	16.0	19.9	32.0	17.5	32.3	15.0	29.8	46.8	28.9	31.1
Dec 11	36.9	41.8	30.4	33.1	31.5	41.0	31.8	26.6	31.5	33.3	36.8	22.5	31.2	33.2	7.8	23.0	28.5	9.8	44.7	27.8	27.4	45.9	19.8	28.6
Dec 12	41.1	48.6	32.1	37.8	36.4	35.1	32.8	24.1	28.7	28.7	30.5	15.7	25.9	29.9	10.5	20.5	23.6	21.4	39.8	28.5	34.2	42.1	27.5	32.5
Dec 13	38.8	43.6	29.9	29.1	38.8	20.3	33.9	15.0	30.6	27.6	29.8	11.4	23.8	21.8	22.9	17.0	18.7	23.0	23.3	19.5	26.7	30.2	33.7	36.0
Dec 14	33.4	30.0	26.8	30.0	38.4	24.4	42.4	18.6	24.1	27.6	24.4	25.2	20.2	19.4	24.7	28.9	17.4	25.7	14.9	22.6	29.2	33.0	39.4	39.4
Dec 15	37.9	30.2	32.5	29.1	29.8	20.2	37.1	12.2	26.7	24.4	15.3	37.2	24.9	28.9	32.6	34.2	19.8	28.2	20.1	32.2	27.5	20.1	40.4	38.8
Dec 16	35.0	29.9	26.2	45.0	42.1	29.9	27.8	18.2	26.1	33.6	21.3	34.3	19.9	30.5	36.6	18.7	29.5	25.5	20.6	40.0	26.9	20.2	37.2	35.8
Dec 17	26.2	35.9	34.8	36.7	37.0	22.0	33.1	24.1	21.7	40.8	20.5	27.5	21.2	28.2	24.1	27.4	32.8	28.0	13.4	22.8	34.6	26.3	31.9	27.3
Dec 18	33.5	30.7	25.7	34.8	40.2	18.9	33.3	26.4	24.8	41.8	30.6	33.1	27.5	28.0	28.0	23.9	31.9	27.6	20.7	29.3	40.4	19.1	40.0	18.7
Dec 19	33.8	39.0	30.7	27.5	39.7	20.0	35.8	31.1	16.1	45.2	25.8	31.6	41.3	35.3	18.3	34.9	28.7	21.8	22.9	23.8	30.8	24.3	31.8	25.6
Dec 20	34.4	32.3	40.5	36.3	36.2	13.6	30.3	39.1	22.0	36.0	25.1	33.4	34.2	30.2	21.2	36.7	34.2	19.4	21.7	19.3	32.7	27.1	29.4	24.2
Dec 21	29.4	39.6	52.5	29.6	29.3	5.8	26.6	36.9	16.6	21.6	26.4	43.7	29.6	38.6	21.8	38.9	34.6	14.8	19.1	24.8	25.5	21.5	25.9	24.4
Dec 22	29.4	30.7	41.1	28.9	32.7	16.7	21.2	32.6	16.0	15.0	17.3	34.4	33.2	33.0	19.9	36.2	33.3	26.5	22.4	30.5	25.1	25.9	21.7	20.6
Dec 23	41.3	35.7	38.8	25.4	40.7	13.5	20.1	34.2	18.3	27.5	16.0	29.4	27.4	43.7	20.5	33.2	36.6	28.8	25.9	22.8	19.7	31.0	28.0	18.6
Dec 24	38.4	25.9	37.2	12.1	29.2	19.5	21.0	22.4	30.9	31.7	15.1	27.0	25.6	38.2	28.4	38.3	35.2	21.5	37.2	24.8	11.2	25.2	20.1	25.1
Dec 25	34.6	33.2	28.8	22.7	25.1	25.5	25.2	21.9	25.6	21.7	15.7	29.5	13.4	35.5	37.7	33.9	29.9	17.5	30.2	32.0	11.4	21.3	26.4	20.8
Dec 26	22.0	28.8	25.1	28.7	16.1	22.9	25.0	18.8	24.4	21.7	24.8	24.4	26.3	37.3	36.8	24.9	34.4	21.1	28.9	37.4	15.8	17.5	20.5	20.1
Dec 27	25.9	31.0	32.6	29.2	27.9	21.6	19.2	18.3	35.1	19.3	35.3	23.4	24.3	34.0	32.5	26.8	32.7	21.2	35.3	36.2	12.5	14.8	29.8	29.6
Dec 28	29.0	23.4	29.6	20.1	22.7	24.4	20.0	14.0	34.3	19.3	43.1	27.5	21.0	32.5	41.3	29.5	28.3	20.3	31.1	44.2	13.5	13.5	15.2	32.6
Dec 29	28.0	24.2	33.5	18.5	29.0	26.7	26.0	10.1	26.0	20.0	43.0	31.0	24.5	23.4	28.8	35.1	29.1	18.1	24.1	35.1	18.6	15.2	14.9	28.9
Dec 30	26.0	15.1	37.0	14.1	32.2	33.2	26.4	18.3	28.0	22.3	32.1	30.2	18.2	16.6	36.9	45.2	24.3	32.8	20.7	42.0	20.3	25.1	27.3	31.0
Dec 31	23.3	13.8	13.8	13.8	13.8	21.7	21.7	21.7	21.7	22.6	22.6	22.6	22.6	12.6	12.6	12.6	12.6	27.2	27.2	27.2	27.2	19.9	19.9	19.9
Mean	51.6	52.0	51.6	52.9	51.5	52.3	52.1	50.8	50.4	52.9	52.5	50.4	51.3	52.5	52.1	51.2	52.4	50.9	51.8	51.3	50.6	51.7	51.7	51.3
Min	10.7	13.8	9.5	12.1	10.2	5.8	16.9	10.1	14.4	15.0	15.1	11.4	13.4	12.6	7.8	12.6	12.2	9.2	13.4	8.6	10.3	11.1	14.6	14.8
Max	85.5	85.5	86.2	88.2	90.3	87.1	85.1	87.9	89.6	90.1	90.5	91.6	91.2	87.1	86.8	87.1	86.6	88.3	87.5	87.7	88.1	87.2	86.7	93.1

YEAR->	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93
Oct 27	37.0	57.5	40.0	38.0	44.1	44.0	54.5	47.0	33.1	44.3	39.7	46.7	35.4	53.7	54.1	67.3	43.7	53.0	40.5	55.0	46.3	65.9	54.5
Oct 28	32.2	59.0	32.6	36.2	43.0	58.9	54.3	55.6	42.7	47.6	37.2	39.4	26.1	46.2	48.7	57.7	39.1	47.3	54.4	45.1	35.3	52.7	58.9
Oct 29	44.2	58.0	38.2	28.9	40.4	48.9	45.5	45.2	45.9	39.1	37.3	50.8	33.9	54.2	62.7	53.8	45.6	43.8	48.9	43.7	40.1	52.2	62.3
Oct 30	48.6	63.5	39.0	27.8	50.8	52.2	44.3	34.3	43.9	53.4	39.3	58.5	39.2	51.3	56.4	51.4	43.8	57.2	42.8	41.7	49.9	62.6	68.2
Oct 31	58.6	53.7	38.8	28.9	39.2	54.6	54.8	29.8	40.0	56.2	41.8	58.2	31.7	35.2	60.5	48.7	27.7	49.6	46.8	38.0	50.7	54.3	56.6
Nov 1	47.4	57.3	40.2	39.9	35.2	58.2	60.2	41.9	37.5	50.3	48.2	65.3	39.5	41.4	51.2	44.3	23.2	42.9	37.0	42.7	44.8	53.1	56.0
Nov 2	41.5	52.7	43.8	31.5	24.7	54.2	55.6	39.4	32.7	38.3	43.3	44.1	34.9	31.7	50.2	28.8	35.3	48.2	26.5	47.3	54.6	45.9	61.8
Nov 3	49.3	37.6	45.2	24.3	27.7	37.7	55.8	36.3	41.2	38.9	38.9	47.5	39.6	33.0	45.5	28.6	27.4	49.0	41.5	43.6	54.2	34.4	54.6
Nov 4	51.5	37.3	42.0	25.6	27.9	45.0	54.6	28.8	41.3	38.3	36.8	47.1	19.3	42.8	32.9	26.6	38.6	40.3	44.8	41.2	42.7	41.2	47.9
Nov 5	45.3	42.5	40.5	36.6	27.3	56.9	44.3	37.6	31.6	30.9	34.4	45.8	26.8	42.6	43.6	28.5	42.9	33.5	39.6	29.6	35.8	46.8	32.3
Nov 6	44.0	54.8	54.4	42.5	38.2	56.1	41.2	31.9	33.2	29.9	37.9	41.9	30.4	41.1	43.3	19.2	38.7	32.1	41.7	36.9	38.4	44.0	27.8
Nov 7	41.5	36.7	50.6	33.8	39.3	49.0	40.6	33.2	44.2	41.1	43.1	30.8	36.2	47.6	31.3	24.3	35.5	31.3	29.8	34.2	38.4	46.7	30.2
Nov 8	33.7	37.8	49.6	44.3	38.6	51.8	29.0	37.6	41.6	40.0	35.0	27.3	26.4	42.3	31.2	18.8	29.8	45.0	22.9	36.5	45.2	45.5	44.7
Nov 9	27.8	45.0	48.8	41.6	43.6	39.6	23.8	37.8	39.5	32.1	37.0	31.3	23.2	40.3	31.8	31.5	38.7	37.8	40.9	26.9	49.9	35.4	37.7
Nov 10	24.0	44.0	45.5	37.5	43.8	25.3	17.0	36.1	24.2	40.9	34.8	34.1	27.7	38.4	43.2	40.5	32.3	41.9	31.9	33.9	48.8	35.9	28.3
Nov 11	20.5	47.0	40.4	42.9	46.0	35.8	28.1	31.8	18.6	40.1	30.7	31.8	35.9	45.5	39.5	39.1	37.3	38.4	32.3	34.7	51.7	41.6	34.6
Nov 12	27.2	52.2	43.1	35.3	48.1	41.5	27.1	40.5	18.7	39.2	23.7	45.8	41.4	38.6	27.2	34.8	35.2	40.9	27.9	38.8	47.7	56.8	27.6
Nov 13	31.9	54.0	54.9	46.6	47.8	35.2	24.4	48.9	23.1	33.7	35.5	33.5	29.9	36.5	27.0	34.6	36.8	40.2	36.4	37.1	49.1	51.7	27.7
Nov 14	36.5	33.9	50.3	42.5	46.5	31.0	31.8	53.7	26.4	35.1	38.7	44.3	26.2	34.8	15.8	34.7	36.6	38.0	42.4	40.0	57.8	40.8	45.1
Nov 15	44.4	21.7	36.3	26.9	43.0	25.9	28.2	42.8	35.4	32.2	44.2	47.9	38.7	21.2	19.7	27.9	25.2	34.3	33.4	22.5	44.8	44.2	43.1
Nov 16	36.3	19.9	44.0	39.1	35.8	33.8	38.3	38.3	33.8	32.8	45.6	47.8	36.1	21.1	33.7	44.0	28.4	27.5	34.0	24.3	42.8	38.5	45.9
Nov 17	30.4	33.2	40.0	45.7	30.9	30.2	24.8	35.0	35.5	19.6	50.0	41.1	26.6	32.2	37.5	42.7	42.5	30.2	28.1	26.4	40.5	45.6	37.2
Nov 18	40.5	30.3	37.3	55.5	34.4	19.6	29.3	33.6	35.8	17.8	50.5	49.3	29.2	37.4	33.7	44.6	40.3	40.3	31.2	19.9	44.4	45.3	32.4
Nov 19	33.5	37.7	34.8	53.9	28.1	23.0	19.3	33.9	43.5	21.2	47.7	46.3	29.6	25.2	29.8	39.0	36.0	32.4	39.9	21.5	46.1	40.7	33.6
Nov 20	40.7	41.7	29.5	51.0	20.6	27.7	24.5	24.3	46.7	31.9	51.7	30.1	17.7	35.4	23.0	41.9	39.0	34.2	45.0	15.7	49.8	41.2	40.0
Nov 21	37.0	37.0	40.8	41.4	26.0	41.5	28.3	23.7	40.7	29.1	52.1	36.8	21.8	46.1	27.2	43.9	46.8	38.1	41.6	23.2	42.6	31.7	35.4
Nov 22	36.1	29.6	44.0	38.1	35.7	38.5	23.8	30.0	37.7	23.5	55.7	51.9	28.6	58.5	41.7	40.0	43.0	41.2	48.4	30.8	48.2	30.2	40.0
Nov 23	38.7	29.1	38.5	39.9	40.6	35.1	29.7	34.7	39.9	23.8	33.2	50.0	27.1	59.7	34.1	38.6	29.9	42.8	58.1	27.2	55.2	31.3	37.4
Nov 24	27.8	29.6	47.3	39.8	33.5	36.8	28.3	37.1	38.7	18.1	40.4	45.6	33.2	64.8	32.3	42.3	28.2	45.1	49.8	22.8	37.4	31.5	36.8
Nov 25	40.4	20.0	41.3	45.5	23.4	45.4	25.1	31.2	30.7	19.8	26.3	47.2	34.0	48.5	29.7	32.1	30.9	40.7	46.5	27.4	45.6	30.1	31.0
Nov 26	35.0	25.1	32.8	37.2	36.2	34.7	13.6	26.2	28.1	35.2	28.8	41.6	37.1	49.8	34.5	29.0	33.8	35.7	36.8	33.8	40.8	28.0	32.0
Nov 27	38.4	28.3	31.9	41.3	34.1	38.6	30.3	27.3	26.5	35.2	27.1	48.1	38.2	35.7	35.2	24.5	24.4	36.0	27.0	30.9	39.3	20.7	38.8
Nov 28	37.0	28.5	33.0	27.4	19.3	35.9	31.6	39.9	21.5	31.7	35.6	37.7	33.6	29.9	40.1	16.3	28.5	29.5	27.7	35.6	35.2	18.3	24.3
Nov 29	30.8	22.9	31.5	39.7	18.2	31.5	34.9	42.1	27.7	30.7	27.8	28.5	31.7	35.6	45.1	20.6	16.1	22.2	27.4	45.7	37.4	21.3	23.2
Nov 30	26.2	35.8	42.1	49.0	27.7	28.2	38.9	38.7	24.1	23.1	31.6	26.8	41.3	40.2	42.9	13.4	4.8	27.9	39.3	47.3	35.3	20.0	12.9
Dec 1	26.8	39.1	40.5	37.1	25.4	33.7	47.3	31.6	23.4	40.0	38.2	25.8	40.9	35.4	37.1	8.6	17.5	27.6	49.2	37.0	34.7	19.8	16.5
Dec 2	22.2	31.1	33.7	32.9	27.1	34.6	46.9	33.5	17.1	48.9	43.5	36.7	42.3	34.8	29.4	13.7	18.6	29.0	40.9	37.5	34.7	34.7	16.0
Dec 3	27.7	34.5	24.4	44.0	21.8	31.1	47.9	35.3	17.8	27.9	40.5	30.3	40.6	32.5	44.1	13.3	18.6	25.0	38.0	39.7	32.5	27.0	21.7
Dec 4	17.0	35.8	33.0	33.8	26.3	28.2	46.6	36.2	27.9	22.5	24.6	32.9	39.2	35.2	40.5	19.0	27.7	22.1	28.9	30.6	34.2	29.5	19.7
Dec 5	9.9	31.2	28.9	28.3	29.0	40.3	41.1	30.8	22.2	22.0	21.2	33.8	48.2	38.0	41.6	19.4	24.6	21.2	35.8	37.6	32.9	17.0	33.8
Dec 6	16.0	34.4	25.1	29.3	21.6	49.9	35.5	31.0	30.1	24.4	29.8	41.3	36.8	43.5	39.9	34.3	27.5	26.5	34.7	44.3	30.3	25.9	28.2
Dec 7	25.3	27.1	27.4	28.4	26.4	52.1	38.6	27.7	28.6	34.8	22.1	39.1	36.1	39.1	29.1	42.0	28.1	22.0	24.8	45.8	40.0	32.0	27.8
Dec 8	30.7	21.9	28.0	30.2	33.7	36.4	39.2	34.9	28.6	36.4	22.7	35.1	33.6	45.3	34.2	43.7	27.2	23.0	20.3	47.7	41.1	32.3	30.3
Dec 9	30.9	15.8	32.8	26.9	19.4	42.9	39.3	35.6	17.1	38.0	28.7	40.1	28.9	39.5	31.9	41.4	30.5	29.4	26.4	52.0	40.1	31.2	22.4
Dec 10	21.3	20.3	32.3	14.5	28.9	37.8	33.1	23.0	17.6	26.0	17.8	27.4	25.1	34.4	32.0	32.2	25.7	29.0	20.6	52.9	36.1	31.8	29.6
Dec 11	29.7	19.8	28.6	23.9	34.1	31.1	24.1	21.6	22.7	16.2	32.0	21.6	33.3	22.5	31.2	19.6	27.6	23.1	16.5	46.7	32.4	28.2	33.1
Dec 12	27.0	26.9	26.4	22.9	38.0	29.4	23.0	22.5	28.5	13.1	24.8	21.9	42.8	28.7	27.1	18.0	20.6	22.9	21.8	46.7	38.6	24.8	35.6
Dec 13	33.6	26.8	28.6	26.8	33.5	28.6	26.8	35.7	30.0	21.6	33.6	29.4	37.0	43.0	23.5	26.1	19.0	32.0	21.4	29.9	34.9	24.9	31.4
Dec 14	42.0	35.4	18.2	22.6	42.1	27.1	31.0	44.4	30.0	34.1	23.4	33.8	29.8	46.2	17.8	24.7	21.5	34.8	24.0	30.3	26.1	27.4	31.7
Dec 15	33.0	23.9	31.3	27.5	33.2	19.3	17.0	39.2	33.7	34.4	25.6	37.4	27.4	31.1	25.0	30.9	28.9	34.7	20.8	25.1	17.5	22.3	31.1
Dec 16	24.0	28.4	27.4	23.5	38.2	30.1	21.3	28.1	29.0	34.6	12.2	37.6	26.9	35.7	22.6	32.1	18.3	30.9	40.0	21.4	25.2	17.8	22.6
Dec 17	32.4	33.5	29.6	31.2	24.9	22.8	25.4	34.2	22.8	29.6	25.8	22.2	27.9	42.8	20.1	27.8	22.0	42.3	47.5	28.0	29.6	20.3	20.6
Dec 18	27.4	34.8	38.5	33.6	27.7	31.8	23.2	21.1	33.1	23.2	30.0	23.4	18.0	34.6	30.0	23.9	22.7	35.1	37.6	26.0	28.8	28.1	33.3
Dec 19	34.5	25.1	37.0	29.4	35.2	21.6	22.8	28.3	35.5	27.2	22.8	26.5	21.7	27.9	23.8	22.2	32.3	23.5	38.3	18.6	44.7	20.6	30.5
Dec 20	38.4	29.9	30.4	26.2	27.0	29.6	22.3	31.8	38.9	26.9	22.4	27.9	15.6	38.5	26.5	16.6	33.0	22.6	29.5	25.7	30.9	31.9	26.1
Dec 21	35.0	22.0	29.5	25.2	31.1	32.5	31.7	27.6	34.1	28.2	31.8	38.8	13.7	32.4	25.7	21.5	40.0	31.4	39.6	21.4	22.6	19.8	22.4
Dec 22	22.6	32.6	30.5	24.9	34.4	31.2	34.5	24.5	40.3	24.5	24.3	35.3	28.9	27.5	34.6	18.2	35.5	26.5	28.2	32.2	13.4	19.8	24.1
Dec 23	29.6	19.6	34.9	31.1	29.6	28.6	39.8	17.5	46.5	22.5	14.9	25.8	40.3	33.1	41.1	22.0	34.0	21.9	34.6	28.1	22.8	18.9	32.5
Dec 24	24.8	24.1	28.7	29.5	27.6	27.2	45.4	31.5	41.4	25.6	7.9	22.2	31.8	25.0	35.9	27.9	40.3	24.0	35.6	30.9	31.2	26.6	23.9
Dec 25	28.9	31.4	22.6	27.7	16.7	20.6	30.0	18.5	38.6	19.9	15.5	13.8	25.1	28.7	22.3	34.5	22.8	31.7	41.6	30.2	31.6	18.2	25.9
Dec 26	33.9	25.9	22.2	30.4	25.4	18.8	15.4	17.0	28.4	20.6	9.1	20.1	22.3	35.9	21.0	31.5	27.8	27.6	37.9	24.8	42.2	25.0	33.5
Dec 27	17.4	30.4	32.3	37.0	25.7	15.7	19.1	26.3	22.9	17.8	6.8	16.9	26.7	38.7	19.8	34.9	16.6	24.9	33.8	24.7	39.8	22.9	30.1
Dec 28	16.1	25.3	32.6	25.2	18.0	5.7	22.2	23.2	29.7	19.6	8.2	18.6	32.8	37.5	29.2	26.7	11.9	22.3	31.3	23.6	40.4	25.7	26.6
Dec 29	19.8	23.2	31.4	30.6	18.8	21.2	25.3	31.7	38.7	13.4	7.7	25.3	39.7	21.7	30.6	20.9	7.9	15.9	36.5	14.6	26.4	29.7	21.6
Dec 30	22.1	35.6	28.6	32.9	19.9	22.8	26.6	32.1	35.1	8.0	20.9	19.4	41.3	19.7	24.9	22.2	10.7	16.0	33.4	18.6	20.2	34.7	17.9
Dec 31	19.9	20.2	20.2	20.2	20.2	37.1	37.1	37.1	37.1	16.3	16.3	16.3	16.3	21.0	21.0	21.0	21.0	25.9	25.9	25.9	25.9	36.2	36.2
Mean	51.0	53.0	51.5	51.3	51.6	52.9	53.3	52.8	51.7	51.9	51.4	51.5	51.2	53.4	50.8	51.6	51.4	51.5	53.4	52.7	53.1	52.3	51.4
Min	9.9	11.8	13.4	13.8	16.7	5.7	13.6	16.5	16.2	8.0	6.8	9.5	13.7	17.0	15.1	8.6	4.8	15.4	16.5	14.6	13.3	13.2	12.9
Max	86.9	89.4	87.7	85.7	85.6	86.8	92.1	90.1	85.5	88.2	85.9	90.8	86.1	86.0	89.1	87.4	90.0	87.0	90.1	85.3	89.1	85.5	86.5

YEAR->	94	95	96	97	98	99	100	T_{avg}	T_{min}	T_{max}
Jan 1	21.9	35.1	18.4	31.0	48.6	36.3	34.4	31.663	15.8	51.6
Jan 2	11.1	33.8	26.4	24.5	50.5	39.3	28.5	31.158	11.1	50.5
Jan 3	25.3	24.2	32.6	32.7	40.3	34.5	23.1	31.682	12.9	53.4
Jan 4	26.1	15.6	27.6	29.8	41.2	44.5	24.4	31.677	12.9	47.1
Jan 5	36.2	12.0	36.8	32.0	38.1	49.3	20.2	31.187	12.0	51.8
Jan 6	27.7	9.1	38.4	38.5	35.9	54.7	23.5	31.424	9.1	54.7
Jan 7	37.5	22.4	32.6	32.6	39.4	50.4	23.8	29.980	8.5	50.4
Jan 8	31.7	29.7	34.6	31.8	29.0	53.1	18.8	29.868	15.7	53.1
Jan 9	29.3	37.7	26.3	29.8	36.0	48.2	23.5	29.906	14.9	48.2
Jan 10	29.8	33.2	31.5	32.3	30.8	46.2	24.6	29.961	9.5	47.6
Jan 11	26.0	41.5	31.3	34.6	27.6	41.0	14.2	30.147	10.1	50.6
Jan 12	26.4	36.2	30.9	30.3	22.6	33.3	20.3	30.641	15.1	46.2
Jan 13	24.5	20.9	32.7	31.9	27.0	29.0	10.9	29.509	10.9	48.1
Jan 14	27.0	23.4	28.8	27.6	33.0	34.0	15.6	30.052	12.7	46.8
Jan 15	30.4	27.3	31.7	35.1	38.4	31.7	13.8	30.456	13.8	45.8
Jan 16	31.3	35.1	25.3	28.8	27.0	41.2	15.9	29.982	11.7	46.2
Jan 17	36.8	31.2	22.8	25.9	25.0	33.5	12.9	30.754	12.9	52.9
Jan 18	37.7	18.3	19.9	29.1	30.5	39.6	18.1	30.395	10.4	48
Jan 19	29.9	28.2	14.6	19.6	29.4	39.8	23.0	29.450	14.6	48
Jan 20	36.9	30.7	27.3	19.6	31.7	47.5	22.2	30.222	11.5	47.5
Jan 21	45.1	29.8	27.3	24.5	35.0	45.5	14.9	29.713	10.2	52.8
Jan 22	44.4	37.9	26.7	28.7	39.2	40.7	20.6	31.188	11.4	46.9
Jan 23	41.6	35.4	26.2	26.6	30.9	27.3	16.0	31.152	16.0	49.2
Jan 24	34.3	28.3	28.8	29.6	35.7	19.1	27.0	30.403	12.0	48.7
Jan 25	34.3	32.0	24.9	32.9	23.0	24.4	34.5	30.791	10.9	51.2
Jan 26	27.3	28.6	20.1	35.9	25.0	21.9	32.9	30.889	13.4	48.8
Jan 27	19.2	35.6	33.4	31.8	30.9	9.6	25.3	30.390	9.6	48.1
Jan 28	27.1	46.1	26.7	28.8	31.1	13.1	30.0	30.453	11.0	55.5
Jan 29	30.8	45.7	17.4	26.3	23.9	14.4	18.5	30.327	9.2	47
Jan 30	22.6	35.6	23.5	25.0	34.3	8.9	19.2	28.867	8.9	51.8
Jan 31	22.6	43.2	30.5	33.3	36.1	9.2	21.4	29.842	9.2	55.9
Feb 1	34.7	35.1	17.1	33.6	33.9	20.9	30.2	28.991	13.0	45.7
Feb 2	27.0	31.8	18.9	35.8	26.4	22.4	30.9	28.672	14.1	44.6
Feb 3	14.6	39.5	12.0	47.0	28.0	13.7	32.2	29.311	12.0	47.2
Feb 4	22.8	43.0	25.9	39.7	33.2	24.6	20.7	29.824	6.7	44.3
Feb 5	34.6	38.8	29.9	32.9	17.8	26.3	27.8	29.643	11.8	43.9
Feb 6	40.0	24.9	28.8	39.6	21.6	19.6	40.6	30.395	8.6	45.9
Feb 7	38.2	20.9	17.6	30.7	22.4	28.2	28.2	29.940	12.4	53.5
Feb 8	29.4	23.3	21.8	30.6	27.5	34.4	27.4	29.902	11.7	49.5
Feb 9	25.2	18.6	29.5	29.4	22.2	35.5	28.7	29.385	13.4	49.2
Feb 10	31.0	25.7	37.3	29.8	19.4	31.4	24.0	30.554	14.5	51
Feb 11	38.6	31.7	31.9	39.5	29.5	39.5	23.1	31.722	10.8	57.6
Feb 12	38.0	29.3	28.3	30.3	27.8	42.7	28.0	31.244	14.7	60.6
Feb 13	40.2	37.4	31.0	31.7	41.2	47.0	28.1	31.911	11.9	54.9
Feb 14	39.5	41.9	35.8	32.1	45.3	40.5	31.1	32.403	15.6	54.9
Feb 15	49.2	45.2	25.5	26.6	38.0	43.9	28.8	32.333	11.1	54.3
Feb 16	31.8	31.4	18.3	42.5	36.2	49.0	40.6	32.357	8.6	49
Feb 17	39.9	48.9	37.6	38.8	32.4	41.8	38.8	32.781	14.9	51.1
Feb 18	36.6	46.8	20.8	45.7	35.0	36.3	25.6	33.019	18.7	53.5
Feb 19	37.2	45.8	24.5	41.9	37.0	33.1	26.6	32.422	13.6	55
Feb 20	44.0	41.2	27.3	30.1	41.2	40.9	31.1	32.607	15.8	46.8
Feb 21	29.4	24.4	25.4	37.3	31.4	42.4	39.4	31.753	17.4	48
Feb 22	29.9	25.0	29.4	27.2	32.0	41.3	44.8	32.654	13.5	52.5
Feb 23	40.2	32.7	18.9	20.2	43.9	37.4	45.1	32.837	6.7	53.4
Feb 24	30.6	35.9	19.9	22.5	39.3	35.0	48.3	33.571	14.1	54
Feb 25	31.3	39.5	16.9	28.4	45.2	32.1	39.2	33.487	11.8	50.7
Feb 26	35.7	37.3	24.7	32.1	42.6	34.9	37.5	35.529	11.6	52.6
Feb 27	25.1	52.3	37.4	37.0	47.7	37.0	26.9	35.700	19.5	60.9
Feb 28	39.0	49.6	40.5	33.8	51.3	35.6	38.7	36.532	19.6	55.8
Feb 29	49.6	45.4	36.4	32.3	48.9	38.8	37.5	38.600	16.6	56.8
Mar 1	39.6	49.3	46.5	32.2	44.7	39.2	37.7	38.192	20.1	57.3
Mar 2	32.3	43.2	44.8	32.6	40.8	38.0	44.3	38.838	20.5	59.4
Mar 3	34.1	36.2	30.9	44.4	38.3	46.8	52.1	39.342	16.5	59.3
Mar 4	31.8	55.9	40.3	48.3	35.0	28.3	38.1	38.873	21.4	59.7
Mar 5	34.5	56.1	43.4	46.3	43.7	32.8	42.6	38.678	24.1	57.9
Mar 6	30.6	46.3	46.4	37.4	42.2	41.1	49.0	39.482	22.4	58.7
Mar 7	32.3	40.5	41.3	30.2	36.2	32.7	42.3	39.282	15.1	59.3
Mar 8	39.2	32.6	32.2	36.4	31.1	29.4	48.8	39.035	15.2	59.5
Mar 9	50.5	32.0	44.3	26.6	31.9	31.9	57.0	38.671	17.7	63.3
Mar 10	48.6	40.0	43.3	24.3	38.8	32.1	57.9	38.755	20.8	66.3
Mar 11	55.6	33.5	32.8	29.6	57.5	43.1	53.9	39.260	18.3	68.9
Mar 12	43.7	41.3	33.7	32.2	38.5	45.4	47.1	39.752	10.5	59.6
Mar 13	54.5	36.7	33.9	40.6	37.8	43.1	34.2	40.819	18.3	61.3
Mar 14	43.7	47.6	45.8	41.7	28.9	45.3	39.9	40.978	19.5	57.9
Mar 15	51.5	44.6	40.4	38.7	30.6	41.3	45.1	40.555	18.6	61.8

YEAR->	94	95	96	97	98	99	100	T_{avg}	T_{min}	T_{max}
Mar 16	30.6	42.7	43.0	47.2	34.9	37.4	44.2	41.655	23.8	64.6
Mar 17	41.8	38.5	43.4	53.8	35.5	52.7	46.3	42.618	24.1	59.3
Mar 18	37.9	49.7	44.1	50.0	33.7	41.9	41.1	43.436	25.3	69.9
Mar 19	41.2	55.3	54.1	47.7	40.9	42.4	40.1	44.923	21.9	69.2
Mar 20	39.0	47.2	59.9	47.1	53.3	48.1	46.3	43.671	26.7	66.9
Mar 21	35.5	44.6	56.2	36.2	39.5	46.1	52.8	43.405	22.2	64
Mar 22	33.3	43.3	49.8	53.7	38.0	47.9	47.2	44.457	29.1	66
Mar 23	37.6	40.0	44.2	59.6	44.4	39.2	51.9	45.189	28.9	60.2
Mar 24	45.4	40.3	49.2	60.8	61.1	44.1	49.6	45.518	26.7	63.1
Mar 25	43.8	40.9	44.1	65.2	49.4	50.3	56.7	46.190	23.2	68.9
Mar 26	54.3	43.9	51.7	50.3	44.5	45.1	51.5	46.360	22.1	67.2
Mar 27	60.0	36.0	60.2	51.9	45.8	54.3	54.9	46.109	31.9	68.7
Mar 28	59.8	46.8	45.1	52.0	47.0	52.5	43.1	46.627	27.4	71.7
Mar 29	56.8	43.9	59.5	47.1	38.7	41.0	32.8	47.322	29.8	70.9
Mar 30	54.7	61.1	47.9	49.4	41.2	39.6	42.4	47.314	27.6	69.5
Mar 31	57.2	56.7	44.7	57.9	32.6	41.7	38.0	45.030	24.2	66.8
Apr 1	45.6	47.7	47.0	56.4	33.7	46.5	27.3	43.848	26.1	61.3
Apr 2	60.6	48.3	45.8	67.0	34.4	51.0	32.5	45.680	24.0	67.3
Apr 3	44.3	51.5	45.2	46.4	44.4	58.5	33.6	45.636	25.4	67.8
Apr 4	33.2	55.0	40.2	58.2	39.8	50.3	37.6	45.913	25.9	65
Apr 5	40.3	60.0	38.4	44.1	46.4	33.2	48.8	46.111	28.3	70.8
Apr 6	36.5	56.5	36.2	46.8	43.9	36.2	41.2	46.366	28.4	68.7
Apr 7	42.4	41.4	44.1	49.1	36.2	29.5	49.8	45.732	27.3	64.7
Apr 8	44.6	56.9	41.7	46.8	45.6	37.6	53.1	46.204	26.1	64.6
Apr 9	48.3	50.0	41.6	51.4	41.6	42.5	39.5	47.139	24.9	65.4
Apr 10	52.6	54.2	42.4	46.7	41.5	41.9	48.6	48.038	31.9	66
Apr 11	46.0	54.1	41.7	67.9	51.2	41.1	51.5	48.257	28.1	68.9
Apr 12	42.9	48.4	31.2	69.0	50.3	49.8	53.2	48.512	29.5	69
Apr 13	42.3	56.3	26.3	68.8	48.7	56.4	56.8	49.170	24.9	77.2
Apr 14	37.0	56.5	37.4	68.6	53.6	52.2	47.9	50.591	31.7	82.1
Apr 15	40.0	49.7	38.3	61.4	50.7	40.5	49.6	51.575	34.8	74.3
Apr 16	39.1	45.9	41.5	61.3	62.6	42.3	53.4	51.466	35.4	80.4
Apr 17	55.2	48.5	49.0	51.0	52.4	38.4	42.6	51.361	35.9	79.8
Apr 18	54.8	46.7	45.0	60.8	47.3	42.2	39.9	51.961	31.1	79.9
Apr 19	54.3	49.5	46.7	61.2	49.3	51.3	46.1	52.068	32.2	72.1
Apr 20	49.7	57.9	46.6	59.6	50.2	41.6	53.2	53.119	32.6	70.6
Apr 21	45.9	46.6	38.0	63.3	54.8	34.6	53.5	52.947	34.6	71.7
Apr 22	46.5	52.1	45.7	64.7	53.1	48.6	42.2	52.400	32.7	68.4
Apr 23	43.3	50.3	52.3	68.1	62.7	55.3	34.0	53.099	34.0	73.2
Apr 24	41.4	50.1	46.9	62.9	57.1	58.1	31.2	52.216	31.2	70.9
Apr 25	46.2	52.2	37.7	55.1	54.1	55.3	42.9	52.759	33.7	73.1
Apr 26	46.7	50.0	49.6	49.8	56.3	54.1	52.9	53.659	35.5	81.4
Apr 27	47.4	56.0	52.3	48.2	41.8	50.8	50.8	53.856	37.7	75.5
Apr 28	45.5	58.2	60.6	60.2	49.0	42.1	46.6	53.526	31.2	73.8
Apr 29	49.8	58.7	55.4	57.6	61.9	50.2	56.8	55.184	38.0	72.4
Apr 30	46.7	60.5	51.5	65.6	61.4	45.9	59.9	54.171	39.0	71.2
May 1	48.6	61.4	60.5	69.4	58.9	43.4	55.5	54.649	36.5	69.4
May 2	52.3	52.4	59.5	65.1	49.1	53.5	58.6	54.974	27.0	73.1
May 3	47.9	55.6	65.0	59.9	42.9	61.1	51.0	55.082	38.8	70.6
May 4	67.1	53.0	60.2	57.2	47.4	65.8	63.2	55.983	36.7	75.2
May 5	63.4	60.3	73.7	55.4	58.4	55.5	59.1	56.357	37.5	73.7
May 6	50.4	62.4	66.9	59.0	58.5	47.4	62.8	56.991	43.0	81.7
May 7	68.7	48.5	63.0	62.6	58.0	46.5	60.7	58.030	39.0	80.4
May 8	61.8	52.5	58.4	58.0	43.7	55.5	68.7	57.338	36.2	79.4
May 9	50.3	57.4	59.0	52.9	46.7	53.3	54.8	57.969	41.4	78.6
May 10	50.5	62.7	54.7	51.4	64.9	59.2	46.6	57.738	39.8	79.8
May 11	47.6	60.2	57.1	55.1	67.5	60.9	47.7	57.930	34.6	80.2
May 12	39.9	63.7	58.2	53.2	58.9	48.5	52.5	58.102	39.9	77.2
May 13	53.3	56.0	60.7	51.4	69.2	50.6	52.1	59.418	38.6	80
May 14	55.8	50.9	49.7	51.5	68.6	52.2	58.2	58.665	38.3	72.6
May 15	58.5	48.9	51.7	56.0	68.4	67.0	61.4	59.936	41.2	81.5
May 16	62.7	56.2	55.9	57.3	62.4	56.8	53.8	59.463	40.6	77.7
May 17	59.3	54.7	63.2	58.9	60.0	59.3	66.2	60.184	45.4	75.6
May 18	56.1	59.9	70.5	48.5	66.4	60.2	59.6	61.343	47.9	78.2
May 19	55.1	56.5	72.6	50.8	58.3	58.2	58.8	61.180	46.4	74.7
May 20	61.3	48.6	66.5	60.5	70.0	62.7	62.1	61.483	46.6	79.4
May 21	61.0	51.3	65.6	60.2	61.5	59.9	61.3	62.308	48.2	76.5
May 22	56.6	52.1	58.7	67.0	58.7	71.3	65.5	63.006	45.6	80.4
May 23	60.1	60.5	56.6	71.8	62.7	59.5	66.6	62.783	50.3	82.6
May 24	64.9	61.6	57.9	66.4	59.0	54.6	65.6	63.165	49.1	79.2
May 25	64.1	63.0	62.5	64.3	64.4	56.2	60.3	63.606	47.2	80.8
May 26	66.3	66.0	61.0	62.1	62.6	64.2	64.2	63.930	49.8	78.6
May 27	64.2	74.7	68.2	67.7	64.0	63.5	55.8	65.080	47.4	81.2
May 28	69.6	69.2	67.3	58.0	69.4	66.3	54.6	64.778	47.6	80
May 29	60.5	69.0	60.4	62.4	68.2	70.1	56.7	65.658	50.1	80.2

YEAR->	94	95	96	97	98	99	100	T_{avg}	T_{min}	T_{max}
May 30	63.1	70.1	60.3	59.1	60.2	84.4	56.5	66.203	52.7	84.4
May 31	71.1	65.6	65.1	64.3	63.1	74.9	60.7	65.685	52.1	76.2
Jun 1	75.3	64.8	62.5	64.1	65.6	71.7	64.9	66.554	51.0	83.2
Jun 2	77.4	57.6	61.6	60.4	65.2	82.3	58.8	66.560	49.5	82.3
Jun 3	79.5	55.0	65.6	61.3	63.8	82.8	63.1	66.961	49.6	82.8
Jun 4	81.3	51.6	65.9	70.7	66.1	73.4	66.4	67.479	51.6	81.3
Jun 5	80.6	58.7	63.7	69.7	66.0	78.7	69.6	66.976	52.5	80.6
Jun 6	79.9	57.6	60.1	71.7	77.5	75.4	73.9	67.900	54.2	81.3
Jun 7	73.4	58.8	53.9	70.9	75.0	77.0	70.2	67.668	53.9	80.6
Jun 8	71.4	65.4	50.7	71.8	69.3	71.6	69.6	68.173	50.7	81.8
Jun 9	71.1	67.5	53.9	64.7	64.5	68.0	72.6	68.409	53.9	82.4
Jun 10	66.6	59.1	59.0	60.1	66.6	73.7	74.3	68.631	54.5	82.6
Jun 11	68.3	69.7	64.3	61.0	71.2	67.5	67.0	68.210	51.3	81.4
Jun 12	65.6	67.8	72.7	65.7	66.2	73.0	63.8	68.355	49.9	80.6
Jun 13	67.5	71.5	71.2	67.9	72.8	66.4	70.7	68.694	53.2	80.9
Jun 14	72.9	68.7	64.0	71.8	77.2	70.0	69.9	69.813	58.2	83.1
Jun 15	71.0	73.9	69.5	76.4	74.5	70.8	76.5	69.929	54.3	81.4
Jun 16	76.0	69.4	68.2	71.5	70.3	72.2	77.1	70.310	57.5	79.9
Jun 17	69.7	75.6	73.6	70.2	70.7	69.6	71.7	70.850	55.5	80.8
Jun 18	75.6	72.9	71.9	72.1	71.2	71.9	76.2	71.280	57.2	84.5
Jun 19	73.8	66.6	66.0	66.0	73.6	78.1	69.3	71.003	58.2	83
Jun 20	73.1	66.8	70.0	66.2	69.4	66.4	66.2	70.413	56.7	81.6
Jun 21	67.8	68.8	66.5	67.7	61.0	66.8	70.2	70.512	55.5	84.6
Jun 22	69.0	70.7	75.5	68.2	59.8	68.6	67.3	71.103	57.2	84.2
Jun 23	76.7	69.5	71.0	66.7	65.6	70.4	73.5	70.964	57.1	80.9
Jun 24	74.0	72.1	74.2	70.0	69.9	72.2	69.9	71.347	56.8	82.3
Jun 25	72.9	64.2	66.5	63.6	73.8	74.4	75.4	71.603	60.2	83.2
Jun 26	69.5	66.4	71.7	66.9	71.5	76.7	74.4	71.793	59.8	84.6
Jun 27	72.2	70.3	70.0	69.2	71.1	73.7	73.7	72.156	59.6	80.7
Jun 28	76.1	66.2	70.8	70.0	67.8	75.8	75.5	72.299	56.7	80.2
Jun 29	78.6	68.2	70.6	72.4	71.9	77.1	74.3	72.912	59.9	84
Jun 30	76.1	69.3	74.7	71.8	67.7	81.8	75.3	75.974	65.0	87.6
Jul 1	89.1	71.7	76.3	74.7	75.5	79.8	80.2	78.251	67.4	94
Jul 2	80.9	70.9	75.0	69.2	71.9	85.3	78.3	78.321	66.0	91.5
Jul 3	78.4	72.0	75.9	67.9	71.6	79.8	76.0	78.233	64.8	93.1
Jul 4	78.5	73.4	79.7	66.0	75.4	77.0	79.7	78.786	65.8	85.9
Jul 5	83.1	71.2	82.0	69.2	81.1	78.5	82.1	78.863	69.2	88.9
Jul 6	85.5	77.5	87.7	73.6	83.0	77.9	74.9	78.897	70.1	90
Jul 7	83.0	73.6	85.2	75.7	81.2	79.1	77.7	78.856	66.9	90.5
Jul 8	78.5	81.2	81.8	77.7	79.2	79.1	72.1	78.808	67.3	88.1
Jul 9	84.2	83.3	82.9	77.3	79.9	82.1	74.9	78.659	63.4	89.1
Jul 10	79.6	83.1	82.2	81.4	79.9	81.9	73.8	78.633	69.3	90
Jul 11	77.3	80.1	77.5	80.6	77.4	82.3	78.4	78.815	69.1	86.8
Jul 12	75.7	79.3	77.0	86.4	77.2	82.6	75.9	79.478	71.0	89
Jul 13	78.3	82.9	74.2	84.8	80.1	82.1	78.8	79.559	71.3	88.2
Jul 14	72.4	74.2	74.7	78.3	80.8	77.6	80.9	79.169	68.8	89.3
Jul 15	68.4	76.9	72.4	74.9	78.9	76.2	77.8	78.726	68.4	87
Jul 16	77.5	78.8	82.8	75.6	77.4	73.0	80.1	78.256	70.3	87.1
Jul 17	78.8	79.5	81.9	75.1	77.4	77.4	76.3	78.644	70.0	87.1
Jul 18	80.4	77.3	76.7	77.7	76.3	78.1	81.0	79.347	69.7	88.8
Jul 19	78.3	82.5	81.9	81.9	79.2	79.8	80.5	79.476	69.7	91.6
Jul 20	72.8	75.3	81.6	83.8	81.6	82.8	83.5	79.583	69.9	88.5
Jul 21	74.6	75.8	78.5	83.3	77.6	85.8	87.3	79.842	66.8	88.1
Jul 22	76.6	76.9	72.9	84.4	83.3	77.1	84.6	79.426	69.5	86.8
Jul 23	83.3	80.1	73.1	85.0	72.4	78.9	79.9	79.409	69.9	88.1
Jul 24	83.2	76.0	77.9	81.9	75.5	74.4	77.1	79.160	69.3	87.4
Jul 25	84.7	79.2	84.8	86.5	72.4	75.6	74.6	79.358	67.8	89.9
Jul 26	89.3	75.9	84.8	89.3	69.4	71.5	77.2	78.610	65.4	89.3
Jul 27	86.3	76.9	82.7	81.8	73.8	66.3	76.0	78.027	65.1	91.3
Jul 28	82.4	76.8	81.7	81.1	73.0	73.6	70.3	77.636	65.0	88.9
Jul 29	81.3	77.0	80.6	80.2	76.1	72.3	65.7	77.820	65.7	89.5
Jul 30	86.3	78.7	84.0	83.3	81.4	73.9	64.9	78.457	64.9	90.1
Jul 31	85.0	83.2	76.7	85.8	77.0	73.9	73.1	79.417	70.2	90.1
Aug 1	84.7	80.6	81.3	87.0	85.2	77.4	77.2	80.094	69.5	90
Aug 2	87.6	83.3	85.7	82.8	81.9	83.0	77.9	79.671	69.9	90.1
Aug 3	80.5	82.0	85.2	77.3	77.5	83.0	74.8	79.488	70.8	89.2
Aug 4	83.6	79.1	82.5	82.5	83.8	91.1	82.9	79.887	64.7	91.7
Aug 5	82.7	78.3	83.5	81.5	84.2	90.2	80.0	79.412	64.4	90.2
Aug 6	83.2	74.6	83.2	85.1	84.8	87.5	81.4	78.905	67.3	90.8
Aug 7	82.3	77.9	77.7	83.7	74.6	86.4	76.4	78.627	63.6	88.5
Aug 8	80.0	77.8	79.8	78.2	77.4	88.0	77.7	78.442	66.1	90.3
Aug 9	84.4	75.9	77.7	79.0	78.0	84.8	81.3	78.614	64.4	87.9
Aug 10	81.6	77.8	79.9	76.0	80.8	83.2	86.1	78.132	67.4	90.1
Aug 11	77.6	81.2	74.3	75.3	83.0	82.9	91.6	77.745	64.3	91.6
Aug 12	78.4	76.2	82.7	75.0	75.7	84.6	85.1	77.086	63.9	92.5

YEAR->	94	95	96	97	98	99	100	T_{avg}	T_{min}	T_{max}
Aug 13	71.5	79.4	80.3	75.4	71.6	83.0	79.3	76.670	66.8	86.2
Aug 14	75.6	77.7	82.5	83.6	75.4	80.6	81.6	76.651	63.7	92.1
Aug 15	79.5	80.8	83.0	82.5	77.4	88.0	75.8	76.966	65.1	91.6
Aug 16	85.4	75.4	84.5	73.7	78.8	75.4	72.6	76.500	65.3	91
Aug 17	82.4	70.1	78.2	74.3	79.5	75.7	77.2	76.230	65.3	89.5
Aug 18	77.8	70.5	80.3	74.3	74.3	83.5	83.3	76.287	61.4	88.3
Aug 19	78.5	76.5	79.4	73.5	75.8	75.3	79.9	76.556	64.0	85.8
Aug 20	82.6	74.4	80.2	68.3	72.5	71.6	80.5	76.715	60.9	86.6
Aug 21	81.2	74.2	77.9	77.5	76.6	75.8	74.8	76.439	64.2	88.5
Aug 22	78.8	69.8	78.9	83.6	74.1	75.6	73.7	76.473	63.7	84.8
Aug 23	76.6	71.0	71.8	84.0	74.5	77.9	77.5	75.746	63.2	86.2
Aug 24	72.9	67.0	75.7	86.6	76.8	81.9	76.4	75.747	64.9	86.6
Aug 25	77.4	66.3	70.9	81.4	79.7	76.0	79.1	75.095	60.7	86.3
Aug 26	77.7	69.1	72.1	75.6	79.2	80.3	78.9	74.820	61.2	85.6
Aug 27	73.7	68.1	71.0	84.0	77.0	78.7	74.1	74.468	61.8	85
Aug 28	73.3	68.3	74.2	81.9	79.3	76.3	69.5	73.485	56.1	89.1
Aug 29	76.3	73.0	75.1	72.8	79.5	71.7	68.8	73.239	56.9	86.8
Aug 30	76.5	72.2	77.4	71.5	71.2	75.3	75.0	73.190	58.6	86
Aug 31	74.0	74.6	73.5	60.4	70.8	74.7	67.1	69.864	53.8	83.5
Sep 1	66.7	74.0	70.3	60.5	67.0	66.8	63.1	68.678	57.6	84.7
Sep 2	62.9	74.5	71.1	64.4	65.1	66.2	59.1	68.723	52.0	84.7
Sep 3	59.2	78.5	71.1	62.8	65.3	62.1	63.5	68.381	52.4	83.1
Sep 4	55.8	77.1	70.8	73.8	65.8	66.7	65.3	68.323	54.8	86.3
Sep 5	66.1	73.0	68.8	75.6	62.9	63.7	71.4	68.405	52.1	85.5
Sep 6	59.2	72.5	76.0	61.0	62.6	69.7	76.2	68.491	48.4	84.3
Sep 7	68.5	66.4	73.5	79.0	61.0	75.1	70.2	67.684	50.7	83
Sep 8	67.2	60.5	68.6	67.1	53.6	65.3	71.0	66.992	50.0	85.9
Sep 9	59.4	60.7	72.5	65.9	51.4	62.1	61.6	66.518	50.0	84
Sep 10	71.3	68.6	75.4	63.4	54.2	69.2	67.8	66.605	50.8	83.4
Sep 11	67.9	65.2	72.0	61.9	60.6	71.2	64.4	66.764	48.6	80.6
Sep 12	64.1	65.7	69.8	64.0	68.5	69.5	65.2	66.771	50.6	81.8
Sep 13	52.0	74.8	79.2	61.0	58.3	74.1	66.2	66.054	52.0	84.3
Sep 14	44.7	68.7	66.6	65.0	61.3	69.6	64.2	65.606	44.7	81.7
Sep 15	43.8	65.4	68.4	71.3	68.5	64.8	64.8	66.351	43.8	82
Sep 16	56.9	64.6	67.0	74.6	71.9	66.0	69.3	66.223	52.3	80.4
Sep 17	71.8	63.5	77.3	70.1	69.5	60.5	68.1	66.449	48.0	82.7
Sep 18	64.7	54.3	66.5	70.4	73.9	58.7	76.3	64.664	44.1	85.8
Sep 19	52.9	63.0	67.1	67.3	72.0	60.0	72.3	64.134	49.2	81.5
Sep 20	51.6	68.5	61.1	66.7	65.2	71.7	69.1	63.646	48.7	76.5
Sep 21	57.2	63.8	60.8	64.0	66.4	69.0	66.2	63.493	47.9	78.5
Sep 22	54.2	61.6	66.1	64.6	64.0	62.4	79.3	63.416	47.4	79.4
Sep 23	57.8	59.9	54.8	69.4	59.6	62.5	73.1	62.562	48.8	79.5
Sep 24	57.5	63.3	58.5	73.5	52.7	60.5	73.8	62.636	46.5	77.5
Sep 25	52.0	63.4	68.7	64.2	52.9	67.0	79.0	62.845	49.8	79.1
Sep 26	55.0	72.1	67.4	63.1	54.6	73.0	81.5	63.230	46.6	81.8
Sep 27	51.2	70.2	68.5	55.7	51.2	71.6	67.0	61.782	41.7	86.5
Sep 28	61.0	70.4	61.7	53.0	48.0	69.0	64.4	61.315	40.0	80.1
Sep 29	55.1	73.6	56.6	58.9	37.8	65.6	59.4	60.178	37.8	76.2
Sep 30	54.5	64.4	55.4	51.8	43.1	56.3	55.0	57.876	40.8	80.6
Oct 1	66.9	69.8	63.1	51.1	48.3	57.5	52.2	56.544	37.7	76.6
Oct 2	72.0	59.8	52.5	54.4	49.2	50.5	52.9	55.287	34.1	76.1
Oct 3	60.5	60.9	40.8	61.0	52.1	61.9	52.2	55.420	40.5	73.6
Oct 4	72.3	60.4	43.7	63.3	50.3	63.3	51.9	56.159	33.9	72.3
Oct 5	66.8	54.0	40.6	63.8	48.2	54.0	53.5	55.659	35.6	75.8
Oct 6	66.2	55.7	47.0	77.0	53.1	49.5	45.8	54.083	33.1	77
Oct 7	70.7	62.3	55.3	59.5	49.4	64.7	54.6	54.673	34.3	75.3
Oct 8	73.5	56.5	56.1	55.8	54.9	59.6	58.6	54.297	37.2	73.5
Oct 9	67.3	53.4	56.1	50.6	57.4	47.2	49.1	53.904	35.7	73.3
Oct 10	65.7	55.6	58.5	53.5	51.4	51.6	40.0	53.068	31.9	73.2
Oct 11	59.7	52.8	52.8	56.5	49.9	55.8	41.3	52.414	32.1	70.3
Oct 12	57.8	61.8	50.9	54.5	45.0	56.2	54.6	52.810	28.4	78.3
Oct 13	60.4	57.1	62.1	47.4	45.9	46.8	54.3	52.991	34.6	78.3
Oct 14	52.7	43.8	51.2	57.0	51.5	41.2	61.5	52.623	33.5	73.5
Oct 15	53.8	54.0	57.8	55.8	50.9	50.5	58.5	51.352	32.1	68
Oct 16	49.2	64.9	58.8	49.8	50.5	59.9	44.9	51.493	33.2	66.5
Oct 17	46.5	61.4	60.5	59.1	50.6	61.4	50.9	50.979	24.7	67.9
Oct 18	46.9	46.6	62.0	58.1	51.5	58.8	51.5	50.501	25.0	70.3
Oct 19	37.4	42.7	59.6	59.6	39.0	63.3	53.0	49.724	22.5	78.4
Oct 20	41.8	39.6	44.6	56.3	42.2	42.8	54.7	47.973	25.2	74.2
Oct 21	34.6	45.6	49.4	57.5	46.0	45.8	54.2	48.097	24.0	73.7
Oct 22	43.6	36.4	50.3	54.9	38.7	45.9	44.6	47.154	19.7	75.9
Oct 23	50.4	48.3	52.8	49.6	47.4	45.4	54.7	46.395	21.5	62.4
Oct 24	51.4	53.1	49.1	55.1	52.2	43.5	59.7	47.003	30.0	67.7
Oct 25	49.3	46.9	46.2	47.2	46.6	37.1	55.2	46.857	23.7	70.5
Oct 26	52.8	38.7	52.0	57.8	35.4	35.8	63.7	45.712	25.9	75.4

YEAR->	94	95	96	97	98	99	100	T_{avg}	T_{min}	T_{max}
Oct 27	56.5	50.6	52.5	54.9	38.3	37.0	49.5	45.734	27.8	67.3
Oct 28	51.1	51.4	57.7	51.9	43.2	44.2	58.1	45.606	25.5	63.6
Oct 29	63.3	50.4	53.3	57.5	39.6	49.1	63.5	45.739	28.8	63.5
Oct 30	58.8	50.9	59.5	44.6	43.2	52.7	51.5	46.365	27.8	68.4
Oct 31	51.9	51.4	56.9	23.5	48.6	36.3	58.8	44.180	23.5	64.8
Nov 1	48.9	34.7	58.7	20.3	36.0	42.5	59.8	43.163	20.3	65.3
Nov 2	45.7	34.1	67.3	27.8	35.6	44.2	54.5	41.415	24.3	67.3
Nov 3	44.2	44.3	58.4	23.6	29.2	38.8	45.7	41.088	17.0	65.6
Nov 4	48.4	51.5	57.1	40.6	36.5	38.5	58.4	41.336	12.6	62.3
Nov 5	53.5	43.5	62.5	37.6	47.3	33.4	49.0	39.957	13.0	62.5
Nov 6	57.0	37.1	57.5	39.3	37.1	36.4	41.9	40.008	19.2	61.9
Nov 7	57.3	43.1	48.8	48.0	46.2	41.3	29.5	40.409	23.1	57.3
Nov 8	54.5	44.8	35.7	44.0	47.7	39.5	30.1	38.978	18.8	64
Nov 9	40.2	50.4	30.2	41.9	53.1	37.8	34.8	39.000	16.8	61
Nov 10	45.6	40.5	23.4	50.9	55.6	41.2	44.9	38.386	17.0	58.6
Nov 11	34.0	49.1	17.6	46.8	42.7	53.6	37.2	37.896	17.6	55.9
Nov 12	40.5	42.6	17.8	54.9	40.6	58.2	27.7	37.709	17.8	58.2
Nov 13	40.4	35.9	18.8	44.5	37.7	42.3	33.6	37.471	12.1	59.9
Nov 14	44.4	26.5	30.1	55.8	40.5	36.8	25.7	37.876	15.8	58.6
Nov 15	53.4	22.3	32.3	50.4	41.6	47.3	29.3	36.033	18.2	67.6
Nov 16	44.3	31.1	25.4	58.1	40.0	43.9	25.9	35.675	17.4	65.7
Nov 17	39.3	28.2	33.0	51.6	32.8	38.9	24.1	35.382	18.0	63.2
Nov 18	55.5	32.1	38.6	41.5	28.7	42.2	27.5	35.095	17.2	56
Nov 19	44.2	39.4	40.5	51.9	46.2	40.2	31.5	35.186	14.6	62.4
Nov 20	37.3	32.6	43.1	35.3	43.1	52.9	27.0	36.006	15.7	53.7
Nov 21	38.3	27.8	43.7	41.1	38.6	44.1	27.4	36.125	14.3	53.5
Nov 22	40.3	31.4	44.7	38.9	52.9	39.5	28.8	36.240	12.3	58.5
Nov 23	40.3	37.0	46.8	28.9	57.5	34.4	29.8	35.787	14.2	59.7
Nov 24	43.7	29.6	47.1	25.8	36.4	29.9	24.9	35.297	11.6	64.8
Nov 25	38.7	34.5	32.6	28.7	46.2	27.5	22.9	33.770	12.6	52.9
Nov 26	39.6	41.0	27.5	37.0	39.4	26.0	20.4	33.348	13.6	53.1
Nov 27	41.4	39.2	31.8	27.2	39.9	27.0	17.6	32.389	7.1	51.3
Nov 28	37.8	35.6	36.4	28.6	41.4	29.3	22.6	31.590	9.2	51.6
Nov 29	39.9	37.7	34.1	25.6	41.6	34.8	24.1	31.091	13.5	54.1
Nov 30	44.3	44.8	29.1	35.4	42.8	25.9	24.8	32.247	4.8	51.5
Dec 1	41.5	42.1	30.5	34.3	35.7	26.9	25.1	31.698	8.6	50.6
Dec 2	40.6	29.2	28.1	48.1	21.1	13.5	27.6	31.425	13.5	54.8
Dec 3	42.5	18.9	28.2	34.7	25.1	16.1	25.4	31.054	13.3	56.4
Dec 4	41.2	25.7	25.9	31.3	21.1	21.0	28.2	30.590	10.5	52.8
Dec 5	33.6	19.9	29.9	36.7	18.1	22.4	21.0	30.462	8.3	50.9
Dec 6	37.9	19.6	23.6	37.6	15.8	23.1	21.3	30.544	9.0	51.4
Dec 7	39.5	16.3	24.1	27.0	20.1	25.2	18.3	30.788	13.7	52.1
Dec 8	34.1	21.5	23.1	23.7	18.8	24.7	25.9	30.472	13.1	49.6
Dec 9	38.1	29.0	25.8	29.2	18.9	35.9	36.2	30.046	11.9	52
Dec 10	37.9	34.4	35.6	24.1	21.8	41.5	38.8	28.297	14.1	52.9
Dec 11	35.1	27.9	29.6	24.7	21.0	38.4	28.3	28.324	7.8	46.7
Dec 12	29.4	26.8	27.2	31.8	27.4	25.6	24.6	28.295	10.5	48.6
Dec 13	39.5	27.7	28.0	25.6	26.3	17.1	24.3	27.733	9.0	44.4
Dec 14	31.3	29.5	21.9	23.4	18.3	9.7	34.1	28.788	9.7	48.6
Dec 15	34.5	20.4	18.1	23.2	27.6	14.1	26.6	28.471	12.2	49.2
Dec 16	37.5	24.3	21.1	25.9	22.7	21.5	31.8	28.268	9.3	46.1
Dec 17	32.6	29.9	32.5	19.0	20.7	19.3	23.3	27.488	9.7	49.6
Dec 18	35.7	32.8	42.3	18.2	29.9	18.7	22.9	27.959	13.2	48.7
Dec 19	30.8	37.5	45.3	27.5	30.9	20.7	37.3	28.559	3.7	46.3
Dec 20	34.5	39.2	38.7	22.8	33.4	16.9	31.5	29.249	8.3	47.2
Dec 21	25.6	30.9	26.6	29.4	33.3	16.5	39.5	28.216	5.8	52.5
Dec 22	31.0	27.7	35.1	29.7	28.9	20.4	31.3	28.416	13.4	43
Dec 23	33.3	38.5	22.5	15.6	22.2	31.2	40.3	28.483	12.7	46.5
Dec 24	26.9	39.4	26.7	28.7	16.7	31.2	24.9	27.516	6.0	45.4
Dec 25	18.1	34.3	16.0	34.6	15.2	45.7	26.4	26.654	11.4	45.7
Dec 26	25.7	36.4	26.6	35.0	15.9	40.0	30.8	26.539	5.4	42.2
Dec 27	19.1	28.7	33.2	34.2	20.0	31.6	33.3	26.447	6.8	49
Dec 28	27.3	28.7	31.9	43.6	21.2	27.8	33.9	25.858	5.7	44.4
Dec 29	30.4	21.9	32.2	49.4	19.4	25.9	39.0	25.731	7.7	49.4
Dec 30	25.5	18.5	39.2	46.9	24.3	23.3	30.2	26.481	8.0	46.9
Dec 31	36.2	36.2	29.4	29.4	29.4	29.4	30.0	24.590	12.6	37.1

Mean	53.3	52.3	51.7	53.5	51.3	52.5	51.3
Min	11.1	9.1	12.0	15.6	15.2	8.9	10.9
Max	89.3	83.3	87.7	89.3	85.2	91.1	91.6

Average daily temp.	51.88
Min daily temperature:	3.70
Max daily temperature:	94.0

TABLE 16. SITE-WIDE HYDRAULIC CONDUCTIVITY TEST RESULTS

Well/Test	Cell	Test Unit	Static Water Level (ft.btc)	Total Depth (ft)	Hydraulic Conductivity (ft/day)	Hydraulic Conductivity (cm/sec)	Well Hydraulic Conductivity (cm/sec)	Log Hydraulic Conductivity (log[cm/sec])	Well Hydraulic Conductivity (log[cm/sec])
PZ-1#1		Unit 2 Clay	14.75	30.4	3.49	1.23E-03		-2.910	
PZ-1#2		Unit 2 Clay	14.75	30.4	3.56	1.26E-03	1.24E-03	-2.901	-2.905
DH-31B1	MW	Unit 2 Clay	31.69	34.18	2.359	8.32E-04		-3.080	
DH-31B2	MW	Unit 2 Clay	31.69	34.18	2.661	9.39E-04		-3.027	
DH-31B3	MW	Unit 2 Clay	31.69	34.18	2.428	8.56E-04	8.76E-04	-3.067	-3.058
DH-32A1	LARW	Unit 2 Clay	28.63	33.26	0.030	1.08E-05		-4.968	
DH-32A2	LARW	Unit 2 Clay	28.63	33.26	0.033	1.17E-05	1.12E-05	-4.931	-4.949
DH-33A1	MW	Unit 2 Clay	31.03	33.83	0.006	2.23E-06	2.23E-06	-5.652	-5.652
DH-59A1	11.e(2)	Unit 3 Sand	20.99		0.186	6.55E-05		-4.184	
DH-59A2	11.e(2)	Unit 3 Sand	20.99		0.688	2.43E-04		-3.615	
DH-59A3	11.e(2)	Unit 3 Sand	20.99		0.861	3.04E-04	2.04E-04	-3.517	-3.772
DH-62A1	11.e(2)	Unit 3 Sand	21.37		2.938	1.04E-03		-2.985	
DH-62A3	11.e(2)	Unit 3 Sand	21.37		2.938	1.04E-03		-2.985	
DH-62B2	11.e(2)	Unit 3 Sand	21.37		2.868	1.01E-03	1.03E-03	-2.995	-2.988
GW-16R-A1	LARW	Unit 2 Clay	31.81	36.94	1.754	6.19E-04		-3.208	
GW-16R-B1	LARW	Unit 2 Clay	31.81	36.94	1.979	6.98E-04		-3.156	
GW-16R-B2	LARW	Unit 2 Clay	31.81	36.94	1.028	3.63E-04	5.60E-04	-3.440	-3.268
GW-17AA1	VITRO	Unit 2 Clay	27.95	34.61	2.074	7.32E-04		-3.136	
GW-17AB1	VITRO	Unit 2 Clay	27.95	34.61	2.497	8.81E-04		-3.055	
GW-17AB2	VITRO	Unit 2 Clay	27.95	34.61	2.393	8.44E-04	8.19E-04	-3.074	-3.088
GW-19AA1	11.e(2)	Unit 3 Sand	20.4	29.44	0.221	7.80E-05		-4.108	
GW-19AB1	11.e(2)	Unit 3 Sand	20.4	29.44	0.178	6.28E-05		-4.202	
GW-19AB2	11.e(2)	Unit 3 Sand	20.4	29.44	0.253	8.93E-05	7.67E-05	-4.049	-4.120
GW-20-A1	LARW	Unit 2 Clay	25.92	36.05	5.011	1.77E-03		-2.753	
GW-20-A2	LARW	Unit 2 Clay	25.92	36.05	5.495	1.94E-03		-2.713	
GW-20-A3	LARW	Unit 2 Clay	25.92	36.05	6.661	2.35E-03	2.02E-03	-2.629	-2.698
GW-21A1	VITRO	Unit 2 Clay	35.51	44.26	5.149	1.82E-03		-2.741	
GW-21A2	VITRO	Unit 2 Clay	35.51	44.26	4.251	1.50E-03		-2.824	
GW-21A3	VITRO	Unit 2 Clay	35.51	44.26	5.365	1.89E-03	1.74E-03	-2.723	-2.763
GW-22-A1	LARW	Unit 2 Clay	27.64	33.3	2.445	8.63E-04		-3.064	
GW-22-A2	LARW	Unit 2 Clay	27.64	33.3	2.203	7.77E-04		-3.109	
GW-22-A3	LARW	Unit 2 Clay	27.64	33.3	2.108	7.44E-04	7.95E-04	-3.129	-3.101
GW-23-A3	LARW	Unit 2 Clay	26.66	33.28	1.469	5.18E-04		-3.286	
GW-23-B1	LARW	Unit 2 Clay	26.66	33.28	1.693	5.97E-04	5.58E-04	-3.224	-3.255
GW-24-A1	LARW	Unit 2 Clay	26.32	33.18	0.605	2.13E-04		-3.671	
GW-24-B1	LARW	Unit 2 Clay	26.32	33.18	0.775	2.73E-04		-3.563	
GW-24-B2	LARW	Unit 2 Clay	26.32	33.18	0.719	2.54E-04	2.47E-04	-3.596	-3.610
GW-25-B1	11.e(2)	Unit 3 Sand	25.65	35	2.316	8.17E-04		-3.088	
GW-25-B2	11.e(2)	Unit 3 Sand	25.65	35	3.326	1.17E-03		-2.931	
GW-25-B3	11.e(2)	Unit 3 Sand	25.65	35	3.568	1.26E-03		-2.900	
GW-25-B4	11.e(2)	Unit 3 Sand	25.65	35	2.557	9.02E-04		-3.045	
GW-25-B5	11.e(2)	Unit 3 Sand	25.65	35	3.154	1.11E-03	1.05E-03	-2.954	-2.983
GW-26-A1	11.e(2)	Unit 3 Sand	24.83	31	0.950	3.35E-04		-3.475	
GW-26-A2	11.e(2)	Unit 3 Sand	24.83	31	0.924	3.26E-04	3.31E-04	-3.487	-3.481
GW-27A1	11.e(2)	Unit 3 Sand	23.35	32	0.125	4.42E-05		-4.355	
GW-27B1	11.e(2)	Unit 3 Sand	23.35	32	0.074	2.60E-05		-4.585	
GW-27B2	11.e(2)	Unit 3 Sand	23.35	32	0.098	3.44E-05	3.49E-05	-4.463	-4.467
GW-28A1	11.e(2)	Unit 3 Sand	21.35	31.41	0.684	2.41E-04		-3.617	
GW-28B1	11.e(2)	Unit 3 Sand	21.35	31.41	0.569	2.01E-04		-3.697	
GW-28B2	11.e(2)	Unit 3 Sand	21.35	31.41	0.431	1.52E-04	1.98E-04	-3.818	-3.711
GW-29A1	LARW	Unit 2 Clay	25.83		2.436	8.60E-04		-3.066	
GW-29A2	LARW	Unit 2 Clay	25.83		0.582	2.05E-04		-3.687	
GW-29A3	LARW	Unit 2 Clay	25.83		1.331	4.69E-04	5.11E-04	-3.328	-3.361
GW-36A1	11.e(2)	Unit 3 Sand	20.81	31.64	1.875	6.61E-04		-3.180	
GW-36A2	11.e(2)	Unit 3 Sand	20.81	31.64	1.728	6.10E-04		-3.215	
GW-36A3	11.e(2)	Unit 3 Sand	20.81	31.64	1.840	6.49E-04	6.40E-04	-3.188	-3.194
GW-37A1	11.e(2)	Unit 3 Sand	19.37	31.74	0.976	3.44E-04		-3.463	
GW-37B1	11.e(2)	Unit 3 Sand	19.37	31.74	1.020	3.60E-04		-3.444	
GW-37B2	11.e(2)	Unit 3 Sand	19.37	31.74	1.071	3.78E-04	3.61E-04	-3.423	-3.443
GW-38A1	11.e(2)	Unit 3 Sand	21.99	32.14	1.788	6.31E-04		-3.200	
GW-38B1	11.e(2)	Unit 3 Sand	21.99	32.14	1.572	5.55E-04		-3.256	
GW-38B2	11.e(2)	Unit 3 Sand	21.99	32.14	1.572	5.55E-04	5.80E-04	-3.256	-3.237
GW-41A1	MW	Unit 2 Clay	30.15	37.48	1.391	4.91E-04		-3.309	
GW-41B1	MW	Unit 2 Clay	30.15	37.48	2.048	7.22E-04		-3.141	
GW-41B2	MW	Unit 2 Clay	30.15	37.48	1.979	6.98E-04	6.37E-04	-3.156	-3.202
GW-42A1	MW	Unit 2 Clay	29.96	37.06	2.195	7.74E-04		-3.111	
GW-42B1	MW	Unit 2 Clay	29.96	37.06	2.713	9.57E-04		-3.019	
GW-42B2	MW	Unit 2 Clay	29.96	37.06	2.246	7.92E-04	8.41E-04	-3.101	-3.077
GW-43A1	MW	Unit 2 Clay	31.22	37.68	2.056	7.25E-04		-3.139	
GW-43B2	MW	Unit 2 Clay	31.22	37.68	3.231	1.14E-03		-2.943	
GW-43B3	MW	Unit 2 Clay	31.22		2.843	1.00E-03	9.56E-04	-2.999	-3.027
GW-44A1	MW	Unit 2 Clay	29.67	36.82	1.400	4.94E-04		-3.306	
GW-44B1	MW	Unit 2 Clay	29.67	36.82	2.359	8.32E-04		-3.080	
GW-44B2	MW	Unit 2 Clay	29.67	36.82	2.229	7.86E-04	7.04E-04	-3.104	-3.164
GW-45A1	MW	Unit 2 Clay	29.87	36.85	0.459	1.62E-04		-3.791	
GW-45B1	MW	Unit 2 Clay	29.87	36.85	0.682	2.40E-04		-3.619	
GW-45B2	MW	Unit 2 Clay	29.87	36.85	0.687	2.42E-04	2.15E-04	-3.616	-3.675
GW-46A1	MW	Unit 2 Clay	29.85	37.31	0.296	1.05E-04		-3.981	
GW-46B1	MW	Unit 2 Clay	29.85	37.31	0.300	1.06E-04		-3.976	
GW-46B2	MW	Unit 2 Clay	29.85	37.31	0.330	1.16E-04	1.09E-04	-3.934	-3.963
GW-56R-A1	LARW	Unit 2 Clay	29.71	36.5	6.843	2.41E-03		-2.617	
GW-56R-A2	LARW	Unit 2 Clay	29.71	36.5	2.635	9.30E-04		-3.032	
GW-56R-A3	LARW	Unit 2 Clay	29.71	36.5	4.225	1.49E-03		-2.827	
GW-56R-A4	LARW	Unit 2 Clay	29.71	36.5	7.422	2.62E-03	1.86E-03	-2.582	-2.764

TABLE 16. SITE-WIDE HYDRAULIC CONDUCTIVITY TEST RESULTS

Well/Test	Cell	Test Unit	Static Water Level (ft.btc)	Total Depth (ft)	Hydraulic Conductivity (ft/day)	Hydraulic Conductivity (cm/sec)	Well Hydraulic Conductivity (cm/sec)	Log Hydraulic Conductivity (log[cm/sec])	Well Hydraulic Conductivity (log[cm/sec])
GW-57A1	11.e(2)	Unit 3 Sand	22.38	32.13	0.461	1.63E-04		-3.788	
GW-57B1	11.e(2)	Unit 3 Sand	22.38	32.13	0.334	1.18E-04		-3.928	
GW-57B2	11.e(2)	Unit 3 Sand	22.38	32.13	0.527	1.86E-04	1.56E-04	-3.731	-3.816
GW-58A1	11.e(2)	Unit 3 Sand	20.58	31.77	1.590	5.61E-04		-3.251	
GW-58B1	11.e(2)	Unit 3 Sand	20.58	31.77	1.322	4.66E-04		-3.331	
GW-58B2	11.e(2)	Unit 3 Sand	20.58	31.77	0.950	3.35E-04	4.54E-04	-3.475	-3.352
GW-60-A1	11.e(2)	Unit 3 Sand	23.71	29.44	5.694	2.01E-03		-2.697	
GW-60-A3	11.e(2)	Unit 3 Sand	23.71	29.44	13.565	4.79E-03	3.40E-03	-2.320	-2.509
GW-63-A1	11.e(2)	Unit 3 Sand	20.75		2.532	8.93E-04		-3.049	
GW-63-A2	11.e(2)	Unit 3 Sand	20.75	31.1	2.462	8.69E-04		-3.061	
GW-63-A3	11.e(2)	Unit 3 Sand	20.75	31.1	1.279	4.51E-04	7.38E-04	-3.346	-3.152
GW-64-B1	LARW	Unit 2 Clay	29.08	36.61	2.048	7.22E-04		-3.141	
GW-64-B2	LARW	Unit 2 Clay	29.08	36.61	1.875	6.61E-04		-3.180	
GW-64-B4	LARW	Unit 2 Clay	29.08		1.970	6.95E-04	6.93E-04	-3.158	-3.160
GW-66A1	MW	Unit 2 Clay	29.74	37.36	0.218	7.68E-05		-4.115	
GW-66B1	MW	Unit 2 Clay	29.74	37.36	0.148	5.21E-05		-4.283	
GW-66B2	MW	Unit 2 Clay	29.74	37.36	0.290	1.02E-04	7.71E-05	-3.990	-4.129
GW-67A1	MW	Unit 2 Clay	32.85	39.63	0.976	3.44E-04		-3.463	
GW-67B1	MW	Unit 2 Clay	32.85	39.63	1.192	4.21E-04		-3.376	
GW-67B2	MW	Unit 2 Clay	32.85	39.63	1.166	4.11E-04		-3.386	
GW-67 #1	MW	Unit 2 Clay	32.54	40.83	1.98	6.99E-04		-3.156	
GW-67 #2	MW	Unit 2 Clay	32.54	40.83	1.97	6.95E-04	5.14E-04	-3.158	-3.308
GW-67R#1	MW	Unit 2 Clay	31.8	39.3	5.32	1.88E-03		-2.727	
GW-67R#2	MW	Unit 2 Clay	31.8	39.3	5.25	1.85E-03	1.86E-03	-2.732	-2.729
GW-68A1	MW	Unit 2 Clay	33.23	42.09	0.327	1.16E-04		-3.937	
GW-68B1	MW	Unit 2 Clay	33.23	42.09	0.270	9.54E-05		-4.020	
GW-68B2	MW	Unit 2 Clay	33.23	42.09	0.260	9.17E-05		-4.037	
GW-68 #1	MW	Unit 2 Clay	32.75	43.96	0.94	3.32E-04		-3.479	
GW-68 #2	MW	Unit 2 Clay	32.75	43.96	0.93	3.28E-04	1.92E-04	-3.484	-3.792
GW-68R#1	MW	Unit 2 Clay	32.62	39.15	8.24	2.91E-03		-2.537	
GW-68R#2	MW	Unit 2 Clay	32.62	39.15	8.44	2.98E-03	2.94E-03	-2.526	-2.531
GW-69B1	MW	Unit 2 Clay	32.44	40.68	0.124	4.39E-05		-4.358	
GW-69A1	MW	Unit 2 Clay	32.44	40.68	0.131	4.63E-05		-4.334	
GW-69 #1	MW	Unit 2 Clay	32.11	42.35	2.82	9.95E-04		-3.002	
GW-69 #2	MW	Unit 2 Clay	32.11	42.35	2.12	7.48E-04	4.58E-04	-3.126	-3.705
GW-69R#1	MW	Unit 2 Clay	32.13	39.4	4.25	1.50E-03		-2.824	
GW-69R#2	MW	Unit 2 Clay	32.13	39.4	3.32	1.17E-03	1.34E-03	-2.931	-2.878
GW-70A1	MW	Unit 2 Clay	32.82	42.36	0.463	1.63E-04		-3.787	
GW-70B1	MW	Unit 2 Clay	32.82	42.36	0.606	2.14E-04		-3.670	
GW-70B2	MW	Unit 2 Clay	32.82	42.36	0.480	1.69E-04		-3.772	
GW-70 #1	MW	Unit 2 Clay	32.46	42.45	7.98	2.82E-03		-2.550	
GW-70 #2	MW	Unit 2 Clay	32.46	42.45	7.79	2.75E-03	1.22E-03	-2.561	-3.268
GW-71A1	MW	Unit 2 Clay	32.51	42.4	4.355	1.54E-03		-2.814	
GW-71B1	MW	Unit 2 Clay	32.51	42.4	2.402	8.47E-04		-3.072	
GW-71B2	MW	Unit 2 Clay	32.51	42.4	2.203	7.77E-04		-3.109	
GW-71 #1	MW	Unit 2 Clay	32.08	43.97	8.89	3.14E-03		-2.504	
GW-71 #2	MW	Unit 2 Clay	32.08	43.97	8.86	3.13E-03	1.88E-03	-2.505	-2.801
GW-75A1	LARW	Unit 2 Clay	28.9		0.026	9.33E-06		-5.030	
GW-75A2	LARW	Unit 2 Clay	28.9		0.066	2.33E-05	1.63E-05	-4.633	-4.832
GW-76A1	LARW	Unit 2 Clay	27.81		0.046	1.61E-05		-4.794	
GW-76A2	LARW	Unit 2 Clay	27.81		0.282	9.94E-05	5.77E-05	-4.003	-4.398
GW-77 #1	LARW	Unit 2 Clay	32.7	40	2.56	9.03E-04		-3.044	
GW-77 #2	LARW	Unit 2 Clay	32.7	40	2.5	8.82E-04	8.93E-04	-3.055	-3.049
GW-78 #1		Unit 2 Clay	30.98	40	5.08	1.79E-03		-2.747	
GW-78 #2		Unit 2 Clay	30.98	40	4.15	1.46E-03	1.63E-03	-2.834	-2.791
GW-79 #1	MW	Unit 2 Clay	30.32	36.5	4.5	1.59E-03		-2.799	
GW-79 #2	MW	Unit 2 Clay	30.32	36.5	4.12	1.45E-03	1.52E-03	-2.838	-2.818
GW-80 #1	MW	Unit 2 Clay	26.04	36.18	4.91	1.73E-03		-2.761	
GW-80 #2	MW	Unit 2 Clay	26.04	36.18	5.01	1.77E-03	1.75E-03	-2.753	-2.757
GW-81 #1	WLARW	Unit 2 Clay	28.12	36.71	1.490	5.26E-04		-3.279	
GW-81 #2	WLARW	Unit 2 Clay	28.12	36.71	1.470	5.19E-04	5.22E-04	-3.285	-3.282
GW-82 #1	WLARW	Unit 2 Clay	27.68	36.44	1.820	6.42E-04		-3.192	
GW-82 #2	WLARW	Unit 2 Clay	27.68	36.44	1.450	5.12E-04	5.77E-04	-3.291	-3.242
GW-83 #1	WLARW	Unit 3 Sand	27.71	36.45	8.540	3.01E-03		-2.521	
GW-83 #2	WLARW	Unit 3 Sand	27.71	36.45	8.760	3.09E-03	3.05E-03	-2.510	-2.516
GW-84 #1	WLARW	Unit 2 Clay	27.95	36.76	10.950	3.86E-03		-2.413	
GW-84 #2	WLARW	Unit 2 Clay	27.95	36.76	10.300	3.63E-03	3.75E-03	-2.440	-2.426
GW-85 #1	WLARW	Unit 2 Clay	28.47	37.34	11.140	3.93E-03		-2.406	
GW-85 #2	WLARW	Unit 2 Clay	28.47	37.34	11.180	3.94E-03	3.94E-03	-2.404	-2.405
GW-86 #1	WLARW	Unit 2 Clay	28.73	41.4	4.800	1.69E-03		-2.771	
GW-86 #2	WLARW	Unit 2 Clay	28.73	41.4	4.570	1.61E-03	1.65E-03	-2.793	-2.782
GW-88 #1	WLARW	Unit 2 Clay	29.86	36.78	2.660	9.38E-04		-3.028	
GW-88 #2	WLARW	Unit 2 Clay	29.86	36.78	2.920	1.03E-03	9.84E-04	-2.987	-3.007
GW-89 #1	WLARW	Unit 2 Clay	29.43	37.02	1.670	5.89E-04		-3.230	
GW-89 #2	WLARW	Unit 2 Clay	29.43	37.02	1.880	6.63E-04	6.26E-04	-3.178	-3.204
GW-90 #1	WLARW	Unit 2 Clay	28.64	36.84	8.860	3.13E-03		-2.505	
GW-90 #2	WLARW	Unit 2 Clay	28.64	36.84	7.780	2.74E-03	2.94E-03	-2.562	-2.533
GW-91 #1	WLARW	Unit 2 Clay	28.37	36.92	5.730	2.02E-03		-2.694	
GW-91 #2	WLARW	Unit 2 Clay	28.37	36.92	5.480	1.93E-03	1.98E-03	-2.714	-2.704
GW-92 #1	WLARW	Unit 2 Clay	28.33	36.93	2.450	8.64E-04		-3.063	
GW-92 #2	WLARW	Unit 2 Clay	28.33	36.93	2.470	8.71E-04	8.68E-04	-3.060	-3.062
GW-93 #1	WLARW	Unit 2 Clay	27.28	37.49	17.04	6.01E-03		-2.221	
GW-93 #2	WLARW	Unit 2 Clay	27.28	37.49	16.72	5.90E-03	5.96E-03	-2.229	-2.225
GW-94 #1	WLARW	Unit 2 Clay	26.15	36.91	12.730	4.49E-03		-2.348	

TABLE 16. SITE-WIDE HYDRAULIC CONDUCTIVITY TEST RESULTS

Well/Test	Cell	Test Unit	Static Water Level (ft.btc)	Total Depth (ft)	Hydraulic Conductivity (ft/day)	Hydraulic Conductivity (cm/sec)	Well Hydraulic Conductivity (cm/sec)	Log Hydraulic Conductivity (log[cm/sec])	Well Hydraulic Conductivity (log[cm/sec])
GW-94 #2	WLARW	Unit 2 Clay	26.15	36.91	13.710	4.84E-03	4.66E-03	-2.315	-2.332
GW-95 #1	WLARW	Unit 3 Sand	26.9	31.99	1.040	3.67E-04		-3.435	
GW-95 #2	WLARW	Unit 3 Sand	26.9	31.99	1.010	3.56E-04	3.62E-04	-3.448	-3.442
GW-99 #1	WLARW	Unit 3 Sand	24.43	31.8	0.850	3.00E-04		-3.523	
GW-99 #2	WLARW	Unit 3 Sand	24.43	31.8	0.820	2.89E-04	2.95E-04	-3.539	-3.531
GW-100 #1	WLARW	Unit 3 Sand	25.24	32.95	1.780	6.28E-04		-3.202	
GW-100 #2	WLARW	Unit 3 Sand	25.24	32.95	1.870	6.60E-04	6.44E-04	-3.181	-3.191
GW-101 #1	WLARW	Unit 3 Sand	26.1	36.53	2.360	8.33E-04		-3.080	
GW-101 #2	WLARW	Unit 3 Sand	26.1	36.53	1.910	6.74E-04	7.53E-04	-3.171	-3.126
GW-102 #1	WLARW	Unit 3 Sand	26.85	36.8	2.370	8.36E-04		-3.078	
GW-102 #2	WLARW	Unit 3 Sand	26.85	36.8	2.460	8.68E-04	8.52E-04	-3.062	-3.070
GW-103	LARW	Unit 2 Clay	27.79	41.32	11.45	4.04E-03		-2.394	
GW-103	LARW	Unit 2 Clay	27.79	41.32	11.67	4.12E-03		-2.386	
GW-103	LARW	Unit 2 Clay	27.79	41.32	17.83	6.29E-03		-2.201	
GW-103	LARW	Unit 2 Clay	27.79	41.32	8.85	3.12E-03	4.39E-03	-2.505	-2.372
GW-104	LARW	Unit 2 Clay	28.39	40.28	7.17	2.53E-03		-2.597	
GW-104	LARW	Unit 2 Clay	28.39	40.28	10.39	3.66E-03		-2.436	
GW-104	LARW	Unit 2 Clay	28.39	40.28	8.89	3.14E-03	3.11E-03	-2.503	-2.512
GW-105	LARW	Unit 2 Clay	28.92	38.58	15.72	5.55E-03		-2.256	
GW-105	LARW	Unit 2 Clay	28.92	38.58	15.18	5.35E-03		-2.271	
GW-105	LARW	Unit 2 Clay	28.92	38.58	15.80	5.57E-03	5.49E-03	-2.254	-2.260
I-1-30A1	MW	Unit 2 Clay	29.71	37.72	2.203	7.77E-04		-3.109	
I-1-30A2	MW	Unit 2 Clay	29.71	37.72	2.402	8.47E-04		-3.072	
I-1-30A3	MW	Unit 2 Clay	29.71	37.72	2.359	8.32E-04	8.19E-04	-3.080	-3.087
I-2-30A2	LARW	Unit 2 Clay	30.37	40.22	0.494	1.74E-04	1.74E-04	-3.759	-3.759
I-3-30A1	MW	Unit 2 Clay	32.29	37.12	1.097	3.87E-04		-3.412	
I-3-30B1	MW	Unit 2 Clay	32.29	37.12	0.633	2.23E-04		-3.651	
I-3-30B2	MW	Unit 2 Clay	32.29	37.12	0.670	2.36E-04	2.82E-04	-3.627	-3.563
GW-106	A,B&C		27.26		1.75	6.19E-04		-3.208	
GW-106	A,B&C		27.26		1.68	5.94E-04	6.07E-04	-3.226	-3.217
GW-107	A,B&C		26.98		1.41	4.96E-04		-3.305	
GW-107	A,B&C		26.98		1.54	5.45E-04	5.21E-04	-3.264	-3.284
GW-108	A,B&C		26.56		1.82	6.41E-04		-3.193	
GW-108	A,B&C		26.56		1.74	6.13E-04	6.27E-04	-3.213	-3.203
GW-109	A,B&C		27.38		1.84	6.50E-04		-3.187	
GW-109	A,B&C		27.38		1.71	6.04E-04	6.27E-04	-3.219	-3.203
GW-110	A,B&C		27.55		2.27	8.00E-04		-3.097	
GW-110	A,B&C		27.55		2.10	7.41E-04	7.71E-04	-3.130	-3.114
GW-111	A,B&C		27.81		5.39	1.90E-03		-2.721	
GW-111	A,B&C		27.81		4.39	1.55E-03	1.73E-03	-2.810	-2.765
GW-112	A,B&C		28.31		5.95	2.10E-03		-2.678	
GW-112	A,B&C		28.31		6.49	2.29E-03	2.20E-03	-2.640	-2.659
GW-113	A,B&C		29.56		3.12	1.10E-03		-2.959	
GW-113	A,B&C		29.56		2.69	9.50E-04	1.03E-03	-3.022	-2.990
GW-114	A,B&C		30.04		3.03	1.07E-03		-2.971	
GW-114	A,B&C		30.04		3.37	1.19E-03	1.13E-03	-2.924	-2.948
GW-115	A,B&C		30.46		3.94	1.39E-03		-2.857	
GW-115	A,B&C		30.46		4.11	1.45E-03	1.42E-03	-2.839	-2.848
GW-116	A,B&C		31.35		6.72	2.37E-03		-2.625	
GW-116	A,B&C		31.35		7.06	2.49E-03	2.43E-03	-2.604	-2.615
GW-117	A,B&C		30.46		5.75	2.03E-03		-2.693	
GW-117	A,B&C		30.46		6.32	2.23E-03	2.13E-03	-2.652	-2.672
GW-118	MW		35.05	46.6	6.98	2.46E-03		-2.608	
GW-118	MW		35.05	46.6	6.70	2.36E-03	2.41E-03	-2.627	-2.618
GW-119	MW		35.55	46.6	0.78	2.73E-04		-3.563	
GW-119	MW		35.55	46.6	3.04	1.07E-03	6.72E-04	-2.970	-3.267
GW-120	MW		36.31	46.5	5.76	2.03E-03		-2.692	
GW-120	MW		36.31	46.5	6.88	2.43E-03	2.23E-03	-2.615	-2.654
GW-121	MW		36.75	46.22	0.34	1.21E-04		-3.919	
GW-121	MW		36.75	46.22	0.34	1.18E-04	1.20E-04	-3.927	-3.923
GW-122	MW		36.54	44.53	2.21	7.79E-04		-3.108	
GW-122	MW		36.54	44.53	2.35	8.28E-04	8.04E-04	-3.082	-3.095
GW-123	MW		39.91	51.4	5.45	1.92E-03		-2.716	
GW-123	MW		39.91	51.4	1.82	6.43E-04	1.28E-03	-3.192	-2.954
GW-124	MW		29.19	42.44	0.80	2.84E-04		-3.547	
GW-124	MW		29.19	42.44	0.72	2.55E-04	2.69E-04	-3.594	-3.571
GW-38R	11e.(2)		24.55	37.33	0.28	1.00E-04		-3.999	
GW-38R	11e.(2)		24.55	37.33	0.29	1.04E-04	1.02E-04	-3.983	-3.991
P3-95 NEC	Pond		33.78	41.92	0.98	3.46E-04		-3.461	
P3-95 NEC	Pond		33.78	41.92	0.81	2.87E-04		-3.542	
P3-95 NEC	Pond		33.78	41.92	0.85	3.01E-04	3.11E-04	-3.522	-3.508
P3-95 SWC	Pond		31.15	39.3	0.13	4.53E-05		-4.344	
P3-95 SWC	Pond		31.15	39.3	0.10	3.48E-05	4.01E-05	-4.458	-4.401
P3-97 NEC	Pond		32.95	36.96	0.73	2.58E-04		-3.589	
P3-97 NEC	Pond		32.95	36.96	0.32	1.13E-04	1.86E-04	-3.945	-3.767

		Mean log[K]	-3.215
Mean K (cm/s)	1.18E-03	Geo Mean K:	6.09E-04

Site-wide mean K 1.18E-03
Site-wide Geometric Mean K 6.09E-04

90% UCL Site-wide Geometric Mean K 7.67E-04
90% LCL Site-wide Geometric Mean K 4.81E-04

TABLE 27. SORPTION COEFFICIENT (K_d) VALUES FOR RADIONUCLIDES AND METALS

Ac-225	4.5	Sheppard, M.I. and Thibault, D.H. 1990 gave a calculated Kd value = 450 L/kg, which was determined using the soil-to-plant ratio (CR), which is strongly correlated with Kd. In the model, the Kd value was conservatively set two orders of magnitude lower than calculated value by Sheppard and Thibault Lowest value from McKinley, I.G., et al. 1991, in surficial sediments is 250 L/kg.
Ag-105 Ag-108m Ag-110m Ag-111 Ag	2.7	Lowest Kd value in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values). The range of 12 reported values in sand was 2.7 to 1,000 L/kg, with a mean value of 90 L/kg. Lowest Kd value found in Looney, et al., March, 1987, Table 1, is 10 L/kg. Recommended value is 100 L/kg. Site-specific in-situ Kd value of 218 L/kg (+/- 0.5) determined by Enchemica (2002). MFG (2000) determined site-specific batch Kd of 0.579 L/kg, with a range of 0 to 6.72 L/kg.
Al-26	15	Default Kd estimated to be 1500 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA.
Am-241 Am-242 Am-242m Am-243	1	Lowest Kd value from "Estimation of Geochemical Parameters for Assessing Subsurface Transport at the Savannah River Plant," by B.B. Looney, M.W. Grant, and C.M. King, DuPont DPST-85-904, March 1987, Table 1, is 1 L/kg. Recommended value is 100 L/kg. Lowest Kd value for soil/surface sediments found in McKinley, I.G. and Scholtis, A., 1993, Table 4. Kd values for soil/surface sediments ranged from 100 to 100,000 L/kg. Lowest Kd value found in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values), is 8.2 L/kg. The range of 29 reported values in sand was 8.2 to 300,000 L/kg, with a mean value of 1,900 L/kg.
As-73 As-74 As	1	Lowest Kd value found in Looney, et al., March, 1987, Table 1, is 10 L/kg. Reported range is 1-10. Recommended value is 3.16 L/kg. Site-specific in-situ Kd value of 103 L/kg (+/- 1.6) determined by Enchemica (2002). MFG (2000) determined site-specific batch Kd of 4.5 L/kg, with a range of 3.66 to 45.6 L/kg.
Au-195 Au-198 Au-199	0.25	Default Kd estimated to be 25 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA.
Ba-133 Ba-140 Ba	10	Literature range of Ba Kd values in Bingham (1993) report is 10 - 1,000,000 L/kg, and 10 L/kg value was by DRC in previous modeling. The contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984) uses a default Kd value of 60 L/kg. Site-specific in-situ Kd value of 9,224 L/kg (+/- 77) determined by Enchemica (2002). MFG (2000) determined site-specific batch Kd of 14.2 L/kg, with a range of 9 to 22.2 L/kg.
Be-7 Be	2.5	Sheppard, M.I. and Thibault, D.H. (1990) calculated Kd value = 250 L/kg, which was determined using the soil-to-plant ratio (CR), which is strongly correlated with Kd. In the model, the Kd value conservatively set two orders of magnitude lower than calculated value by Sheppard and Thibault The CR values used were taken from Baes et al. (1984) Site-specific in-situ Kd value of 121 L/kg (+/- 0.15) determined by Enchemica (2002). MFG (2000) determined site-specific batch Kd of 27.9 L/kg, with a range of >27.9 to >2,862 L/kg.
Bk-249 Bk-250	0.001	Kd unknown, therefore conservatively assigned a value of 0.001 L/kg. Berkelium is a member of the actinide rare earth series. All rare earth elements have similar physical and chemical properties. ("General Chemistry" by Nebergall, et al., 1976.) Kd values are available for Np, Am and Cm, which are also actinide rare earth elements. Consequently, it is reasonable to assign the lowest Kd value from these three elements (Am) to berkelium, Kd = 1 L/kg.
Bi-205 Bi-206 Bi-207 Bi-210m	1	Kd value conservatively set two orders of magnitude lower than calculated value by Sheppard, M.I. and Thibault, D.H. 1990. Calculated Kd value = 100 L/kg, was determined using the soil-to-plant ratio (CR), which is strongly correlated with Kd. The CR values used were taken from Baes et al. (1984)
C-14	8.52	Kd value from site-specific measurements. See the Response to Interrogatories (ABC 1997) which includes a re-evaluation of the Bingham (1995) Kd values. (Summary of Results, Radionuclide Kd Tests, Bingham Environmental, Inc. August 3, 1995). The lowest Kd value found in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values), is 1.7 L/kg. The range of 3 reported values in sand was 1.7 to 7.1 L/kg, with a mean value of 5 L/kg.
Ca-45 Ca-47	0.05	Kd value conservatively set two orders of magnitude lower than calculated value by Sheppard, M.I. and Thibault, D.H. 1990. Calculated Kd value = 50 L/kg, was determined using the soil-to-plant ratio (CR), which is strongly correlated with Kd. The CR values used were taken from Baes et al. (1984)
Cd-109 Cd-113m Cd	1	Lowest Kd value found in Looney, et al., March, 1987, Table 1, is 1 L/kg. Recommended value is 6.3 L/kg. Lowest Kd value found in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values), is 2.7 L/kg. The range of 14 reported values in sand was 2.7 to 625 L/kg, with the mean value at 80 L/kg. Site-specific laboratory batch Kd of 2.39 determined by MFG (2000), with a range of 0.703 to 4.0 L/kg.
Ce-139 Ce-141 Ce-143 Ce-144	1	Lowest Kd value found in Looney, et al., March, 1987, Table 1. Recommended value is 1000 L/kg. Lowest Kd value found in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values), is 40 L/kg. The range of 12 reported values in sand was 40 to 3,968 L/kg, with a mean value of 500 L/kg.
Cf Cf-248 Cf-249 Cf-250 Cf-251 Cf-252	2	Kd value of 2.0 is two orders of magnitude lower than the default Kd value of 200 L/kg used in the RESRAD code (EAD, 2001; Yu et al., 1993, 2000). The RESRAD code was developed at Argonne National Laboratory and is authorized for use at DOE Sites, under DOE Order 5400.5. Kd value of 2.0 approved by DRC (DRC, Sept 2001.) In NUREG/CR-5512, Vol. 1, a Cf Kd value of 510 is used (Kennedy and Strenge, 1992). A letter report prepared by Sandia National Laboratory for the NRC reviewed the parameter data for NUREG/CR-5512 and suggesgted a Kd value of 158 for Cf (Beveler, et al., 1998.) Californium is a member of the actinide rare earth series. All rare earth elements have similar physical and chemical properties. ("General Chemistry" by Nebergall, Schmidt, and Holtzclaw, D.C. Health and Company, 1976, p. 905). Kd values are available for Np, Am and Cm, which are also actinide rare earth elements

TABLE 27. SORPTION COEFFICIENT (K_d) VALUES FOR RADIONUCLIDES AND METALS

Cl-36	0.0025	Default Kd estimated to be 0.25 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). Kd value in model is conservatively set two orders of magnitude lower than the default value used by TERRA.
Cm-241 Cm-242 Cm-243 Cm-244 Cm-245 Cm-246 Cm-247 Cm-248	93.3	Lowest Kd value found in Baes, C.F. and Sharp, R.D. (1983) is 93.3. The range of the 31 reported values was 93.3 to 51,900 L/kg in agricultural soils and clays. The lowest Kd value found in Looney, et al., March, 1987, Table 1 is 100 L/kg. Recommended value is 3162 L/kg. Lowest Kd value found in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values), is 780 L/kg. The range of 2 reported values in sand was 780 to 22,970 L/kg, with a mean value of 4,000 L/kg.
Co-56 Co-57 Co-58 Co-60	370	Site-specific Kd, reported by Bingham, 1996. Consistent with range of values in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1. The range of 33 reported values in sand was 0.07 to 9,000 L/kg, with a mean value of 60 L/kg. Lowest Kd value found in Looney, et al., March, 1987, Table 1, is 0.1 L/kg. Recommended value is 1 L/kg.
Cr Cr-51	1	Lowest Kd value found in Looney, et al., March, 1987, Table 1. Recommended value is 39.8 L/kg. Lowest Kd value found in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values), is 1.7 L/kg . The range of 15 reported values in sand was 1.7 to 1,729 L/kg, with a mean value of 70 L/kg. Site-specific in-situ Kd value of 459 L/kg (+/- 3.0) determined by Enchemica (2002). MFG (2000) determined site-specific batch Kd of 6.23 L/kg, with a range of 5.69 to 758 L/kg.
Cs-134 Cs-135 Cs-136 Cs-137	133	Site-specific Kd, reported by Bingham, 1996. Consistent with range of values in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (Range of 81 reported values in sand was 0.2 to 10,000 L/kg, with a mean value of 280 L/kg.) Lowest Kd value found in Looney, et al., March, 1987, Table 1, is 10 L/kg. Recommended value is 501.1 L/kg.
Cu Cu-67	1	Lowest Kd value found in Looney, et al., March, 1987, Table 1 is 1 L/kg. Recommended value is 25.11 L/kg. Site-specific laboratory batch Kd of 8.58 determined by MFG (2000), with a range of 0 to >2,365 L/kg.
Dy-166	6.5	Default Kd estimated to be 650 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA.
Es-253 Es-254	0.001	Kd unknown, therefore conservatively assigned a value of 0.001 L/kg.
Eu-152 Eu-154 Eu-155 Eu-156	6.5	Default Kd estimated to be 650 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA.
Fe-52 Fe-55 Fe-59 Fe-60	1.4	Lowest Kd value found in Baes, C.F. and Sharp, R.D. (1983) is 1.4. The range of the 30 reported values was 1.4 to 1,000 L/kg in agricultural soils and clays. Lowest Kd value in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values) is 5 L/kg. The range of 16 reported values in sand was 5 to 6,000 L/kg, with a mean value of 280 L/kg. Lowest Kd value found in Looney, et al., March, 1987, Table 1. Recommended value is 100 L/kg.
Fm-252	0.001	Kd unknown, therefore conservatively assigned a value of 0.001 L/kg.
Ga-67	15	Default Kd estimated to be 1500 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA.
Gd-148 Gd-153	6.5	Default Kd estimated to be 650 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA.
Ge-68	0.25	Default Kd estimated to be 25 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA.
H-3	0.04	Lowest Kd value in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values).
Hf-172 Hf-175 Hf-181	4.5	Kd value conservatively set two orders of magnitude lower than calculated value by Sheppard, M.I. and Thibault, D.H. 1990. Calculated Kd value = 450 L/kg, was determined using the soil-to-plant ratio (CR), which is strongly correlated with Kd. The CR values used were taken from Baes et al. (1984)
Hg Hg-194 Hg-203	10	Kd value of 10.0 was from DRC, taken from Bingham Environmental value for stable mercury. (May, 1993 Report, Table 4-2 and August, 1993 Report, Table 3-4. Lowest Kd value found in Buchter et al., 1989, Table 3, for a sandy loam soil is 19.6 L/kg. The range of 11 reported values in various soil types was 19.6 to 299.2 L/kg. Kd values in interbed sediment range from 80.8 to 998 L/kg (Del Debbio, J.A., 1991). Site-specific laboratory batch Kd of 387 determined by MFG (2000), with a range of 0.586 to >388 L/kg.
Ho-166m	2.5	Kd value conservatively set two orders of magnitude lower than calculated value by Sheppard, M.I. and Thibault, D.H. 1990. Calculated Kd value = 250 L/kg, was determined using the soil-to-plant ratio (CR), which is strongly correlated with Kd.
I-125 I-126 I-129 I-131 I-133	0.12	Kd value from Summary of Results, Radionuclide Kd Tests (Bingham Environmental, Inc. August 3, 1995) was 0.7 L/Kg. Re-evaluated in Response to Interrogatories (ABC 1997), with a recommended value of 0.46. Lowest slope of curve is 0.12 L/kg. The lowest Kd value found in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values), is 0.04 L/kg. The range of 22 reported values in sand was 0.04 to 81 L/kg, with a mean value of 1.0 L/kg.
In-111 In-113m In-114 In-114m	15	Default Kd estimated to be 1500 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA.
Ir-192	1.5	Default Kd estimated to be 150 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA.
K-40	0.15	Kd value conservatively set two orders of magnitude lower than calculated value by Sheppard, M.I. and Thibault, D.H. 1990. Calculated Kd value = 15 L/kg, was determined using the soil-to-plant ratio (CR), which is strongly correlated with Kd. The CR values used were taken from Baes et al. (1984) The lowest published Kd value for potassium is 2.0, found in Dragun (1988)
Kr-85	0.001	Kd unknown, therefore conservatively assigned a value of 0.001 L/kg.

TABLE 27. SORPTION COEFFICIENT (K_d) VALUES FOR RADIONUCLIDES AND METALS

La-140	6.5	Default Kd estimated to be 650 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA.
Mn-52 Mn-52m Mn-54	6.4	Lowest Kd value in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values). The range of 54 reported values was 6.4 to 5,000 L/kg, with a mean value of 50 L/kg.
Mo Mo-99	1.0	Lowest Kd value found in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values), is 1.0 L/kg. The range of 15 reported values in sand was 1.0 to 32 L/kg, with a geometric mean value of 10 L/kg. Kd conservatively set one order of magnitude lower than site-specific in-situ Kd value of 6.5 L/kg (+/- 0.51) determined by Enchemica (2002). MFG (2000) determined site-specific batch Kd of 0 L/kg, with a range of 0 to 0.260 L/kg.
Na-22	1	Default Kd estimated to be 100 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA.
Nb-93m Nb-94	1.6	Kd value conservatively set two orders of magnitude lower than calculated value by Sheppard, M.I. and Thibault, D.H. 1990. Calculated Kd value = 160 L/kg, was determined using the soil-to-plant ratio (CR), which is strongly correlated with Kd. The CR values used were taken from Baes et al. (1984)
Nd-144 Nd-147	6.5	Kd assigned a conservatively low value of 6.5 L/kg. The contaminant transport modeling code "TERRA" developed by ORNL uses a default value of 650 L/kg (Baes et al. 1984).
Ni-59 Ni-63 Ni-63	10	Lowest Kd value found in Looney, et al., March, 1987, Table 1, is 10 L/kg. Recommended value is 100 L/kg. Lowest Kd value found in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values), is 60 L/kg. The range of 11 reported values was 60 to 3,600 L/kg, with a mean value of 400 L/kg. Site-specific in-situ Kd value of 170 L/kg (+/- 2.7) determined by Enchemica (2002). MFG (2000) determined site-specific batch Kd of 18.6 L/kg, with a range of >7.96 to 60.9 L/kg.
Np-235 Np-237	3	Kd value from Summary of Results, Radionuclide Kd Tests (Bingham Environmental, Inc. August 3, 1995) was 400. Re-evaluation of the data (ABC 1997 Response to Interrogatories) calculated a Kd of 425. DRC recommended using the literature value. Lowest Kd value in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kds), is 0.5 L/kg, but applies to pH 2.0 solutions. Lowest value for pH>4.0 is greater than 3 L/kg. For pH = 7, Kd is over 20.
Os-191 Os-191m Os-194	4.5	Default Kd estimated to be 450 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA.
Pa-231 Pa-233 Pa-234 Pa-234m	5.5	Kd value conservatively set two orders of magnitude lower than calculated value by Sheppard, M.I. and Thibault, D.H. 1990. Calculated Kd value = 550 L/kg, was determined using the soil-to-plant ratio (CR), which is strongly correlated with Kd. The CR values used were taken from Baes et al. (1984)
P-32 P-33	0.035	Default Kd estimated to be 3.5 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA.
Pb-203 Pb-210	19	Note: Lowest Kd value found in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values), is 19 L/kg. The range of 3 reported values in sand was 19 to 1,405 L/kg, with a mean value of 150 L/kg. Geometric mean Kd is 270 L/kg. Default Kd estimated to be 900 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). Site-specific in-situ Kd value of 686 L/kg (+/- 1.4) determined by Enchemica (2002). MFG (2000) determined site-specific batch Kd of 10.6 L/kg, with a range of >10.6 to >3,194 L/kg.
Pd-103	0.55	Kd value conservatively set two orders of magnitude lower than calculated value by Sheppard, M.I. and Thibault, D.H. 1990. Calculated Kd value = 55 L/kg, was determined using the soil-to-plant ratio (CR), which is strongly correlated with Kd. The CR values used were taken from Baes et al. (1984)
Pm-143 Pm-147	6.5	Default Kd estimated to be 650 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA.
Po-208 Po-210	9	Note: Lowest Kd value found in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values), is 9 L/kg. The range of 36 reported values in sand was 9 to 7,020 L/kg, with a mean value of 150 L/kg.

TABLE 27. SORPTION COEFFICIENT (K_d) VALUES FOR RADIONUCLIDES AND METALS

Pu-236 Pu-238 Pu-239 Pu-240 Pu-241 Pu-242 Pu-243 Pu-244	10	Lowest Kd value found in Looney, et al., March, 1987, Table 1. Recommended value is 100 L/kg. Lowest Kd value found in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values), is 27 L/kg. The range of 39 reported values in sand was 27 to 36,000 L/kg, with a mean value of 550 L/kg.
Pt-193	0.9	Kd assigned a conservatively low value of 0.9 L/kg. The contaminant transport modeling code "TERRA" developed by ORNL uses a default value of 90 L/kg (Baes et al. 1984).
Ra-225 Ra-226 Ra-228	10	Lowest Kd value found in Looney, et al., March, 1987, Table 1. Recommended value is 100 L/kg. Lowest Kd value found in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values), is 57 L/kg. The range of 3 reported values in sand was 57 to 21,000 L/kg, with a mean value of 500 L/kg.
Re-183 Re-184 Re-184m Re-186 Re-187 Re-188	0.075	Default Kd estimated to be 7.5 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA.
Rb-82 Rb-83 Rb-84 Rb-86	0.55	Kd value conservatively set two orders of magnitude lower than calculated value by Sheppard, M.I. and Thibault, D.H. 1990. Calculated Kd value = 55 L/kg, was determined using the soil-to-plant ratio (CR), which is strongly correlated with Kd. The CR values used were taken from Baes et al. (1984)
Rh-103m	0.001	Kd not reported in literature. Therefore assigned a value of 0.001 L/kg.
Ru-103 Ru-106	5	Lowest Kd value in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values). The range of 7 reported values in sand was 5 to 490 L/kg, with a mean value of 55 L/kg. Lowest Kd value found in Looney, et al., March, 1987, Table 1, is 100 L/kg. Recommended value is 158 L/kg.
S-35	0.075	Default Kd estimated to be 7.5 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA.
Sb-122 Sb-124 Sb-125 Sb-126 Sb-126m	100	Lowest Kd value found in Looney, et al., March, 1987, Table 1. Recommended value is 3162 L/kg. Lowest Kd value found in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values), is 45 L/kg, from one reported observation in sand.
Sc-44 Sc-46 Sc-47	10	Default Kd estimated to be 1000 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA.
Se-75 Se-79	1	Lowest Kd value found in Looney, et al., March, 1987, Table 1, is 1 L/kg. Recommended value is 2.5 L/kg. Lowest Kd value for soil/surface sediments found in McKinley, I.G. and Scholtis, A., 1993, Table 4. Kd values for soil/surface sediments ranged from 1 to 50 L/kg. Lowest Kd value found in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values), is 36 L.kg. The range of 3 reported values in sand was 36 to 70 L/kg, with a mean value of 55 L/kg. Lowest Kd value found for Se (IV) in Baes, C.F. and Sharp, R.D. (1983) is 1.2. The range of the 19 reported values was 1.2 to 8.6 L/kg. Site-specific in-situ Kd value of 62 L/kg (+/- 0.4) determined by Enchemica (2002). MFG (2000) determined site-specific batch Kd of 29.3 L/kg, with a range of 13.0 to >405 L/kg.
Si-32	0.35	Kd value conservatively set two orders of magnitude lower than calculated value by Sheppard, M.I. and Thibault, D.H. 1990. Calculated Kd value = 35 L/kg, was determined using the soil-to-plant ratio (CR), which is strongly correlated with Kd.
Sm-145 Sm-151 Sm-153	2.45	Kd value conservatively set two orders of magnitude lower than calculated value by Sheppard, M.I. and Thibault, D.H. 1990. Calculated Kd value = 245 L/kg, was determined using the soil-to-plant ratio (CR), which is strongly correlated with Kd. The CR values used were taken from Baes et al. (1984)
Sn-113 Sn-117m Sn-119m Sn-121 Sn-121m Sn-126	50	Lowest Kd value for soil/surface sediments found in McKinley, I.G. and Scholtis, A., 1993, Table 4. Kd values for soil/surface sediments ranged from 50 to 700 L/kg. Sheppard, M.I. and Thibault, D.H. (1990) calculated Kd value = 130 L/kg; calculated using the soil-to-plant ratio (CR), which is strongly correlated with Kd. The CR values used were taken from Baes et al. (1984) Recommended Kd value found in Looney, et al., March, 1987, Table 1, is 100 L/kg.
Sr-82 Sr-85 Sr-89 Sr-90	0.05	Lowest Kd value in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values). The range of 81 reported values in sand was 0.05 to 190 L/kg, with a mean value of 15 L/kg. Average Kd in near-neutral pH, saline brines is 0.66 L/kg, based on data from NTIS (1981) and Serne, et al. (1977). Lowest Kd value found in Looney, et al., March, 1987, Table 1, is 1 L/kg. Recommended value is 2.5 L/kg.
Ta-182	2.2	Kd value conservatively set two orders of magnitude lower than calculated value by Sheppard, M.I. and Thibault, D.H. 1990. Calculated Kd value = 220 L/kg, was determined using the soil-to-plant ratio (CR), which is strongly correlated with Kd. The CR values used were taken from Baes et al. (1984)
Te-123m Te-125m Te-129 Te-129m	1.25	Kd value conservatively set two orders of magnitude lower than calculated value by Sheppard, M.I. and Thibault, D.H. 1990. Calculated Kd value = 125 L/kg, was determined using the soil-to-plant ratio (CR), which is strongly correlated with Kd. The CR values used were taken from Baes et al. (1984)
Tb-157 Tb-158 Tb-160	6.5	Default Kd estimated to be 650 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA.
Tc-95 Tc-95m Tc-99 Tc-99m	0.11	Site-specific Kd value from Summary of Results, Radionuclide Kd Tests (Bingham Environmental, Inc. August 3, 1995) was 0.07 L/kg. Re-evaluated in Response to Interrogatories (ABC 1997), result 0.11 L/kg . The lowest Kd value found in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values), is 0.01 L/kg. The range of 19 reported values in sand was 0.01 to 16 L/kg, with a mean value of 0.1 L/kg.
Th-229 Th-230		Lowest Kd value for soil/surface sediments found in McKinley, I.G. and Scholtis, A., 1993, Table 4. Kd values for soil/surface sediments ranged from 80 to 60,000 L/kg.

TABLE 27. SORPTION COEFFICIENT (K_d) VALUES FOR RADIONUCLIDES AND METALS

Th-231 Th-232	10	Lowest Kd value found in Looney, et al., March, 1987, Table 1. Recommended value is 100 L/kg. Lowest Kd value found in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values), is 207 L/kg. The range of 10 reported values in sand was 207 to 150,000 L/kg, with a mean value of 3,200 L/kg.
Ti-44	10	Default Kd estimated to be 1000 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA.
Tl-201 Tl-202 Tl-204	0.15	Based on similarities between ionic radii and valance, thallium Kd estimated using lowest published potassium value of 2.0 found in Dragun, 1988 (Whetstone Associates, 2000). The 'Kd value for potassium was conservatively set two orders of magnitude lower than calculated value by Sheppard, M.I. and Thibault, D.H. 1990. Calculated Kd value = 15 L/kg, was determined using the soil-to-plant ratio (CR), which is strongly correlated with Kd. Due to similarities in ionic structure, thallium Kd values would be similar to potassium
Tm-170 Tm-171	6.5	Default Kd estimated to be 650 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA.
U-232 U-233 U-234 U-235 U-236 U-238 U-238	6	Site-specific Kd value from Summary of Results, Radionuclide Kd Tests (Bingham Environmental, Aug 3, 1995). Lowest Kd value found in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values), is 0.03 L/kg. The range of 24 reported values in sand was 0.03 to 2,200 L/kg, with a mean value of 35 L/kg. Lowest Kd value found in Looney, et al., March, 1987, Table 1, is 0.1 L/kg. Recommended value is 39.8 L/kg.
V-48	10	Default Kd estimated to be 1000 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA.
W-181 W-185 W-188	1.5	Default Kd estimated to be 150 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA.
Xe-127 Xe-133 Xe-131m Xe-133m	0.001	Kd unknown, therefore conservatively assigned a value of 0.001 L/kg.
Y-88 Y-91	1.7	Kd value conservatively set two orders of magnitude lower than calculated value by Sheppard, M.I. and Thibault, D.H. 1990. Calculated Kd value = 170 L/kg, was determined using the soil-to-plant ratio (CR), which is strongly correlated with Kd. The CR values used were taken from Baes et al. (1984)
Yb-169	6.5	Default Kd estimated to be 650 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA.
Zn Zn-65	368	Site-specific in-situ Kd value of 374 L/kg (+/- 4.1) determined by Enchemica (2002). MFG (2000) determined site-specific batch Kd of 116 L/kg, with a range of >116 to >1,648 L/kg. Site specific value of 368 L/kg approved by DRC (DRC, Feb 2003). Lowest Kd value in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values) is 0.1 L/kg. The range of 22 reported values in sand was 0.1 to 8,000 L/kg, with a mean value of 200 L/kg. Lowest Kd value found in Looney, et al., March, 1987, Table 1, is also 0.1 L/kg. Recommended value is 15.8 L/kg.
Zr-88 Zr-93 Zr-95	10	Lowest Kd value for soil/surface sediments found in McKinley, I.G. and Scholtis, A., 1993, Table 4. Kd values for soil/surface sediments ranged from 10 to 8,300 L/kg. Sheppard, M.I. and Thibault, D.H. (1990) calculated a Kd value of 600 L/kg. Calculation was based on the soil-to-plant ratio (CR), which is strongly correlated with Kd.

TABLE 37.

PEAK RADIONUCLIDE CONCENTRATIONS AND TIME TO EXCEED GWPL AT THE WATER TABLE

VERTICAL PATHRAE RESULTS FOR CLASS A SOUTH CELL TOP SLOPE (0.276 CM/YR INFILTRATION)

NUCLIDE	TIME TO EXCEED (Year)	PEAK CONCENTRATION (Ci/m^3)	PEAK CONCENTRATION (pCi/L)	PEAK YEAR
Ac-227	-1	0		> 10,000
Ag-108m	-1	3.08E+02	3.08E+11	4,852
Al-26	-1	0		> 10,000
Am-241	875	4.32E-04	4.32E+05	2.381
Am-242m	-1	9.95E-08	9.95E+01	1,799
Am-243	900	3.57E-03	3.57E+06	2.689
Ba-133	-1	0		> 10,000
Be-10	-1	4.20E+03	4.20E+12	6,548
Bi-207	-1	1.33E-07	1.33E+02	1,020
Bi-210m	670	2.61E+02	2.61E+11	2.718
Bk-247	145	6.62E-10	6.62E-01	167
C-14	-1	0		> 10,000
Ca-41	215	8.71E-06	8.71E+03	292
Cd-113	-1	1.98E-07	1.98E+02	2,718
Cd-113m	-1	0		---
Cf-249	-1	3.91E-07	3.91E+02	3,748
Cf-250	-1	0		---
Cf-251	-1	5.50E-05	5.50E+04	4,535
Cf-252	-1	0		---
Cl-36	155	2.04E-06	2.04E+03	172
Cm-243	-1	0		> 10,000
Cm-244	-1	0		> 10,000
Cm-245	-1	0		> 10,000
Cm-246	-1	0		> 10,000
Cm-247	-1	0		> 10,000
Cm-248	-1	0		> 10,000
Co-60	-1	0		> 10,000
Cs-135	-1	0		> 10,000
Cs-137	-1	0		> 10,000
Eu-152	-1	0		> 10,000
Eu-154	-1	0		> 10,000
Eu-155	-1	0		> 10,000
Fe-55	-1	0		---
Fe-60	850	1.33E+03	1.33E+12	3 736
Gd-148	-1	0		> 10,000
H-3	115	7.54E-04	7.54E+05	174
Hg-194	-1	0		> 10,000
Ho-166m	-1	1.02E+04	1.02E+13	> 5,680
I-129	155	1.32E-02	1.32E+07	472
K-40	160	1.60E+01	1.60E+10	548
Ks-20	-1	0		---
Ks-21	-1	0		---
Ks-22	-1	0		---
Ks-23	-1	0		---
Ks-24	-1	0		> 10,000
Ks-25	-1	0		> 10,000
Ks-26	-1	0		---
Mn-53	-1	0		> 10,000
Na-22	-1	0		---
Nb-91	925	3.15E+04	3.15E+13	3.624
Nb-92	-1	3.31E+01	3.31E+10	4.246
Nb-93m	-1	0		---
Nb-94	-1	3.32E-03	3.32E+06	4.226
Ni-59	-1	0		> 10.000
Ni-63	-1	0		> 10,000
Np-237	-1	3.58E-02	3.58E+07	> 10,750
Os-194	-1	0		> 10,000
Pa-231	-1	0		> 10,000
Pb-202	-1	0		> 10,000
Pb-210	-1	0		> 10,000
Pd-107	470	4.07E+02	4.07E+11	1,570
Pm-145	-1	0		> 10,000
Pm-147	-1	0		> 10,000
Po-208	-1	0		> 10,000
Po-209	-1	0		> 10,000
Pt-193	720	4.28E-03	4.28E+06	1,165
Pu-236	-1	0		> 10,000
Pu-238	-1	0		> 10,000
Pu-239	-1	0		> 10,000
Pu-240	-1	0		> 10,000
Pu-241	-1	0		> 10,000
Pu-242	-1	0		> 10,000
Pu-244	-1	0		> 10,000
Ra-226	-1	0		> 10,000
Ra-228	-1	0		> 10,000
Re-187	185	6.23E-02	6.23E+07	356
Se-79	620	3.11E+04	3.11E+13	2,714
Si-32	210	1.50E+06	1.50E+15	905
Sm-151	-1	1.53E-06	1.53E+03	2.604
Sn-121m	-1	0		> 10,000
Sn-126	-1	0		> 10.000
Sr-90	100	2.12E-04	2.12E+05	231
Tb-157	-1	0		> 10,000
Tb-158	-1	0		> 10.000
Tc-99	160	5.25E-01	5.25E+08	446
Te-123	-1	1.09E-04	1.09E+05	3,354
Th-229	-1	0		> 10,000
Th-230	-1	0		> 10,000
Th-232	-1	0		> 10,000
Ti-44	-1	0		> 10,000
Tl-204	-1	0		---
Tm-170	-1	0		> 10,000
U-232	-1	0		> 10,000
U-233	-1	0		> 10,000
U-234	-1	0		> 10,000
U-235	-1	0		> 10,000
U-236	-1	0		> 10,000
U-238	-1	0		> 10,000
V-50	-1	0		> 10,000
Zr-93	-1	0		> 10,000

NOTES: -1 indicates that nuclide did not exceed standard within the 1,000 years modeled

— indicates that concentrations do not peak at the water table within 10 000 yrs

TABLE 38. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE--VERTICAL PATHRAE MODEL RESULTS FOR THE CLASS A SOUTH CELL TOP SLOPE (0.276 CM/YR INFILTRATION)

NUCLIDE	YEAR TO EXCEED	1	3	6	9	12	15	18	21	24	27	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120
Ac-227	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ag-108m	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Al-26	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-241	875	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-242m	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-243	900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ba-133	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Be-10	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-210m	670	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bk-247	145	0	0	0	0	0	0	0	0	0	0	0	0	0	2.8E-10	1E-08	1.9E-07	2.1E-06	1.5E-05	7.9E-05	3.2E-04	1.1E-03	3.0E-03	7.2E-03	1.5E-02	3.0E-02	5.2E-02	8.5E-02	1.3E-01	1.8E-01
C-14	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ca-41	215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.2E-10	4.6E-09	1E-07	1.4E-06	1.4E-05	0.00011	6.4E-04	3.1E-03	1.3E-02	4.4E-02	1.4E-01	3.8E-01	9.4E-01
Cd-113	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cd-113m	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-249	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-250	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-251	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-252	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cl-36	155	0	0	0	0	0	0	0	0	0	0	0	0	3.3E-09	3.7E-07	1.5E-05	3.0E-04	3.4E-03	2.6E-02	1.5E-01	6.2E-01	2.1E+00	6.1E+00	1.5E+01	3.4E+01	6.7E+01	1.2E+02	2.0E+02	3.1E+02	4.6E+02
Cm-243	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-244	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-245	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-246	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-247	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-248	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Co-60	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cs-135	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cs-137	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-152	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-154	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-155	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-55	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-60	850	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gd-148	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	115	0	0	0	0	0	0	0	0	0	0	0	0	0	3.3E-09	8.7E-07	7.6E-05	0.0029	0.06	0.75	6.3	38	180	6.7E+02	2.1E+03	5.5E+03	1.3E+04	2.7E+04	4.9E+04	8.4E+04
Hg-194	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ho-166m	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I-129	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.1E-11	5.9E-10	1.1E-08	1.6E-07	1.7E-06	1.4E-05	9.7E-05	0.00056	0.0028
K-40	160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.5E-10	4.6E-09	1E-07	1.6E-06	1.9E-05	0.00019	0.0015	0.0095
Ks-20	-1	0	0	0	0	0	0	0	0	0	0	0	0	1.2E-11	3.6E-11	4.2E-11	2.4E-11	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-21	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-22	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-23	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-24	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-25	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-26	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mn-53	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Na-22	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-91	925	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-92	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-93m	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-94	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni-59	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni-63	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Np-237	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Os-194	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pa-231	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb-202	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb-210	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pd-107	470	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pm-145	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pm-147	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 38. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE--VERTICAL PATHRAE MODEL RESULTS FOR THE CLASS A SOUTH CELL TOP SLOPE (0.276 CM/YR INFILTRATION)

NUCLIDE	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230
Ac-227	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ag-108m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Al-26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-242m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ba-133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Be-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-210m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bk-247	2.5E-01	3.2E-01	3.9E-01	4.6E-01	5.2E-01	5.8E-01	6.2E-01	6.5E-01	6.6E-01	6.6E-01	6.5E-01	6.2E-01	5.9E-01	5.5E-01	5.0E-01	4.5E-01	4.1E-01	3.6E-01	3.2E-01	2.8E-01	2.4E-01	2.0E-01
C-14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ca-41	2.2E+00	4.6E+00	9.2E+00	1.7E+01	3.1E+01	5.2E+01	8.5E+01	1.3E+02	2.0E+02	2.9E+02	4.1E+02	5.7E+02	7.6E+02	1.0E+03	1.3E+03	1.6E+03	2.0E+03	2.4E+03	2.9E+03	3.4E+03	3.9E+03	4.4E+03
Cd-113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cd-113m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-249	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-251	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-252	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cl-36	6.4E+02	8.3E+02	1.0E+03	1.3E+03	1.5E+03	1.7E+03	1.8E+03	1.9E+03	2.0E+03	2.0E+03	2.0E+03	2.0E+03	1.9E+03	1.8E+03	1.7E+03	1.6E+03	1.4E+03	1.3E+03	1.1E+03	1.0E+03	8.7E+02	7.5E+02
Cm-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-246	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-247	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-248	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Co-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cs-135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cs-137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gd-148	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	1.3E+05	2.0E+05	2.7E+05	3.5E+05	4.4E+05	5.3E+05	6.1E+05	6.7E+05	7.2E+05	7.5E+05	7.5E+05	7.4E+05	7.1E+05	6.7E+05	6.2E+05	5.5E+05	4.9E+05	4.3E+05	3.7E+05	3.1E+05	2.6E+05	2.1E+05
Hg-194	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ho-166m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I-129	0.012	0.046	0.16	0.49	1.4	3.8	9.3	22	48	100	200	3.8E+02	7.0E+02	1.2E+03	2.1E+03	3.5E+03	5.6E+03	8.8E+03	1.3E+04	2.0E+04	2.9E+04	4.1E+04
K-40	0.053	0.26	1.1	4.3	15	48	140	390	990	2400	5500	12000	2.5E+04	4.9E+04	9.3E+04	1.7E+05	3.1E+05	5.3E+05	8.9E+05	1.4E+06	2.3E+06	3.6E+06
Ks-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mn-53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Na-22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-93m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni-59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni-63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Np-237	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Os-194	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pa-231	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb-202	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb-210	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pd-107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.3E-11	5.9E-11	2.5E-10
Pm-145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pm-147	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 38. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE--VERTICAL PATHRAE MODEL RESULTS FOR THE CLASS A SOUTH CELL TOP SLOPE (0.276 CM/YR INFILTRATION)

NUCLIDE	235	240	245	250	255	260	265	270	275	280	285	290	295	300	310	320	330	340	350	360	370	380
Ac-227	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ag-108m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Al-26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-242m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ba-133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Be-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.9E-11	2E-10
Bi-210m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bk-247	1.7E-01	1.4E-01	1.2E-01	1.0E-01	8.3E-02	6.8E-02	5.6E-02	4.5E-02	3.7E-02	3.0E-02	2.4E-02	1.9E-02	1.5E-02	1.2E-02	7.6E-03	4.7E-03	2.9E-03	1.7E-03	1.0E-03	6.3E-04	3.7E-04	2.2E-04
C-14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ca-41	4.9E+03	5.5E+03	6.0E+03	6.5E+03	7.0E+03	7.4E+03	7.8E+03	8.1E+03	8.3E+03	8.5E+03	8.6E+03	8.7E+03	8.7E+03	8.6E+03	8.4E+03	7.9E+03	7.3E+03	6.7E+03	5.9E+03	5.2E+03	4.5E+03	3.8E+03
Cd-113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cd-113m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-249	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-251	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-252	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cl-36	6.5E+02	5.5E+02	4.7E+02	3.9E+02	3.3E+02	2.7E+02	2.3E+02	1.9E+02	1.5E+02	1.3E+02	1.0E+02	8.3E+01	6.7E+01	5.4E+01	3.4E+01	2.2E+01	1.4E+01	8.4E+00	5.2E+00	3.2E+00	1.9E+00	1.2E+00
Cm-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-246	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-247	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-248	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Co-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cs-135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cs-137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gd-148	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	1.7E+05	1.4E+05	1.1E+05	8.4E+04	6.5E+04	5.0E+04	3.8E+04	2.9E+04	2.1E+04	1.6E+04	1.2E+04	8.6E+03	6.2E+03	4.5E+03	2.3E+03	1.2E+03	5.7E+02	2.8E+02	1.3E+02	6.2E+01	2.9E+01	1.3E+01
Hg-194	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ho-166m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I-129	5.8E+04	8.0E+04	1.1E+05	1.4E+05	1.9E+05	2.5E+05	3.1E+05	4.0E+05	5.0E+05	6.1E+05	7.5E+05	9.0E+05	1.1E+06	1.3E+06	1.8E+06	2.4E+06	3.0E+06	3.8E+06	4.7E+06	5.7E+06	6.7E+06	7.7E+06
K-40	5.4E+06	8.1E+06	1.2E+07	1.7E+07	2.4E+07	3.3E+07	4.5E+07	6.1E+07	8.0E+07	1.1E+08	1.4E+08	1.7E+08	2.2E+08	2.8E+08	4.2E+08	6.2E+08	8.8E+08	1.2E+09	1.6E+09	2.1E+09	2.7E+09	3.4E+09
Ks-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mn-53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Na-22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-93m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni-59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni-63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Np-237	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Os-194	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pa-231	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb-202	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb-210	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pd-107	9.9E-10	3.7E-09	1.3E-08	4.5E-08	1.4E-07	4.4E-07	1.3E-06	3.6E-06	9.9E-06	0.000026	0.000065	0.00016	0.00038	0.00087	0.0042	0.019	0.074	0.27	0.92	2.9	8.7	24
Pm-145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pm-147	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 38. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE--VERTICAL PATHRAE MODEL RESULTS FOR THE CLASS A SOUTH CELL TOP SLOPE (0.276 CM/YR INFILTRATION)

NUCLIDE	390	400	410	420	430	440	450	460	470	480	490	500	510	520	530	540	550	560	570	580	590	600
Ac-227	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ag-108m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Al-26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-241	0	0	0	0	0	0	1.3E-11	4.6E-11	1.5E-10	4.5E-10	1.3E-09	3.6E-09	9.7E-09	2.5E-08	6.2E-08	1.5E-07	3.4E-07	7.6E-07	1.6E-06	3.5E-06	7.1E-06	0.000014
Am-242m	0	0	0	0	0	0	0	0	0	1.9E-11	5.3E-11	1.4E-10	3.7E-10	9.2E-10	2.2E-09	5.1E-09	1.1E-08	2.4E-08	5.1E-08	1E-07	2.1E-07	4E-07
Am-243	0	0	0	0	0	0	0	1.9E-11	6.2E-11	1.9E-10	5.6E-10	1.6E-09	4.3E-09	1.1E-08	2.8E-08	6.9E-08	1.6E-07	3.6E-07	8E-07	1.7E-06	3.6E-06	7.3E-06
Ba-133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Be-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	8.9E-10	3.8E-09	1.4E-08	5.2E-08	1.7E-07	5.4E-07	1.6E-06	4.4E-06	0.000011	0.000029	0.000068	0.00015	0.00034	0.00071	0.0014	0.0028	0.0052	0.0095	0.017	0.029	0.049	0.079
Bi-210m	4.9E-11	2.6E-10	1.2E-09	5.5E-09	2.3E-08	8.9E-08	3.2E-07	1.1E-06	3.6E-06	0.000011	0.000033	0.000095	0.00026	0.00067	0.0017	0.0041	0.0096	0.022	0.048	0.1	0.21	0.44
Bk-247	1.3E-04	7.4E-05	4.3E-05	2.5E-05	1.4E-05	8.2E-06	4.6E-06	2.6E-06	1.5E-06	8.4E-07	4.7E-07	2.7E-07	1.5E-07	8.3E-08	4.7E-08	2.6E-08	1.4E-08	8.0E-09	4.4E-09	2.4E-09	1.3E-09	7.4E-10
C-14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ca-41	3.2E+03	2.7E+03	2.2E+03	1.8E+03	1.5E+03	1.2E+03	9.4E+02	7.4E+02	5.8E+02	4.6E+02	3.5E+02	2.7E+02	2.1E+02	1.6E+02	1.2E+02	9.3E+01	7.0E+01	5.3E+01	3.9E+01	2.9E+01	2.2E+01	1.6E+01
Cd-113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.7E-11	3.6E-11	7.8E-11	1.6E-10	3.3E-10
Cd-113m	0	0	0	0	0	1.4E-11	3.2E-11	6.7E-11	1.3E-10	2.5E-10	4.6E-10	7.9E-10	1.3E-09	2.1E-09	3.2E-09	4.8E-09	6.9E-09	9.5E-09	1.3E-08	1.7E-08	2.2E-08	2.7E-08
Cf-249	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-251	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-252	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cl-36	6.9E-01	4.1E-01	2.4E-01	1.4E-01	8.3E-02	4.9E-02	2.8E-02	1.6E-02	9.4E-03	5.4E-03	3.1E-03	1.8E-03	1.0E-03	5.8E-04	3.3E-04	1.9E-04	1.1E-04	6.0E-05	3.4E-05	1.9E-05	1.1E-05	6.0E-06
Cm-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-246	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-247	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-248	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Co-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cs-135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cs-137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-60	0	0	0	0	0	0	0	0	0	0	0	0	0	3.3E-11	1.2E-10	4.2E-10	1.4E-09	4.3E-09	1.3E-08	3.8E-08	1.1E-07	2.9E-07
Gd-148	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	6.0E+00	2.7E+00	1.2E+00	5.3E-01	2.3E-01	1.0E-01	4.3E-02	1.8E-02	7.9E-03	3.3E-03	1.4E-03	5.9E-04	2.5E-04	1.0E-04	4.2E-05	1.7F-05	7.2E-06	2.9E-06	1.2E-06	4.9E-07	2.0E-07	8.1E-08
Hg-194	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ho-166m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I-129	8.7E+06	9.6E+06	1.1E+07	1.1E+07	1.2E+07	1.3E+07	1.3E+07	1.3E+07	1.3E+07	1.3E+07	1.3E+07	1.3E+07	1.2E+07	1.2E+07	1.1E+07	1.1E+07	9.9E+06	9.2E+06	8.5E+06	7.9E+06	7.2E+06	6.5E+06
K-40	4.2E+09	5.1E+09	6.0E+09	7.0E+09	8.0E+09	9.1E+09	1.0E+10	1.1E+10	1.2E+10	1.3E+10	1.4E+10	1.4E+10	1.5E+10	1.5E+10	1.6E+10	1.6E+10	1.6E+10	1.6E+10	1.6E+10	1.5E+10	1.5E+10	1.4E+10
Ks-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mn-53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Na-22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4E-11	1.5E-10	5.6E-10	2E-09	6.6E-09	2.1E-08	6.6E-08
Nb-92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-93m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni-59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni-63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Np-237	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Os-194	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pa-231	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb-202	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb-210	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pd-107	64	160	380	870	1900	4000	8200	16000	31000	57000	100000	180000	310000	5.2E+05	8.6E+05	1.4E+06	2.2E+06	3.4E+06	5.1E+06	7.6E+06	1.1E+07	1.6E+07
Pm-145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pm-147	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 38. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE--VERTICAL PATHRAE MODEL RESULTS FOR THE CLASS A SOUTH CELL TOP SLOPE (0.276 CM/YR INFILTRATION)

NUCLIDE	610	620	630	640	650	660	670	680	690	700	720	740	760	780	800	825	850	875	900	925	950
Ac-227	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ag-108m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6E-11	4.3E-10	2.8E-09
Al-26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-241	0.000028	0.000053	0.000099	0.00018	0.00032	0.00057	0.00098	0.0017	0.0028	0.0046	0.012	0.028	0.066	0.14	0.3	0.73	1.6	3.5	7.1	14	26
Am-242m	7.6E-07	1.4E-06	2.5E-06	4.5E-06	7.8E-06	0.000013	0.000022	0.000036	0.000058	0.000093	0.00022	0.00051	0.0011	0.0022	0.0044	0.0097	0.02	0.04	0.075	0.13	0.23
Am-243	0.000014	0.000028	0.000053	0.000098	0.00018	0.00032	0.00056	0.00096	0.0016	0.0027	0.0072	0.018	0.043	0.097	0.21	0.52	1.2	2.7	5.7	12	22
Ba-133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Be-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.2E-11	3.4E-10	2E-09
Bi-207	0.13	0.2	0.3	0.45	0.65	0.94	1.3	1.8	2.5	3.3	5.7	9.2	14	21	29	42	57	73	89	100	120
Bi-210m	0.87	1.7	3.2	5.9	11	19	34	58	98	160	430	1100	2600	5900	13000	32000	75000	170000	3.5E+05	7.1E+05	1.4E+06
Bk-247	4.1E-10	2.2E-10	1.2E-10	6.8E-11	3.7E-11	2.0E-11	1.1E-11	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
C-14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ca-41	1.2E+01	8.9E+00	6.6E+00	4.8E+00	3.5E+00	2.6E+00	1.9E+00	1.4E+00	1.0E+00	7.3E-01	3.8E-01	2.0E-01	1.0E-01	5.3E-02	2.7E-02	1.2E-02	5.1E-03	2.2E-03	9.3E-04	3.9E-04	1.7E-04
Cd-113	6.6E-10	1.3E-09	2.4E-09	4.5E-09	8.2E-09	1.5E-08	2.6E-08	4.4E-08	7.5E-08	1.2E-07	3.3E-07	8.3E-07	0.000002	4.5E-06	9.7E-06	0.000024	0.000057	0.00013	0.00027	0.00054	0.0011
Cd-113m	3.2E-08	3.9E-08	4.5E-08	5.1E-08	5.7E-08	6.2E-08	6.6E-08	7E-08	7.2E-08	7.4E-08	7.3E-08	6.9E-08	6.1E-08	5.2E-08	4.2E-08	3.1E-08	2.1E-08	1.4E-08	8.5E-09	5E-09	2.9E-09
Cf-249	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.3E-11	5.2E-11
Cf-250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-251	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4E-11	1.6E-10
Cf-252	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cl-36	3.4E-06	1.9E-06	1.1E-06	5.9E-07	3.3E-07	1.8E-07	1.0E-07	5.7E-08	3.2E-08	1.8E-08	5.5E-09	1.7E-09	5.1E-10	1.6E-10	4.8E-11	1.1E-11	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Cm-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-246	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-247	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-248	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Co-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cs-135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cs-137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-60	7.6E-07	1.9E-06	4.7E-06	0.000011	0.000026	0.00006	0.00013	0.00029	0.0006	0.0012	0.005	0.018	0.063	0.2	0.62	2.3	7.8	25	73	200	540
Gd-148	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	3.3E-08	1.3E-08	5.3E-09	2.1E-09	8.5E-10	3.4E-10	1.4E-10	5.4E-11	2.2E-11	0.0E+00	0.0E+00	0.0E+00	0.0F+00	0.0E+00	0.0E+00	0	0	0	0	0	0
Hg-194	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ho-166m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.5E-11	3.6E-10	2.5E-09	1.6E-08	9.3E-08
I-129	5.9E+06	5.3E+06	4.8E+06	4.2E+06	3.8E+06	3.3E+06	2.9E+06	2.6E+06	2.2E+06	2.0E+06	1.5E+06	1.1E+06	8.1E+05	5.9E+05	4.3E+05	2.8E+05	1.8E+05	1.2E+05	7.5E+04	4.8E+04	3.0E+04
K-40	1.4E+10	1.3E+10	1.3E+10	1.2E+10	1.1E+10	1.0E+10	9.7E+09	9.0E+09	8.3E+09	7.7E+09	6.4E+09	5.3E+09	4.3E+09	3.5E+09	2.8E+09	2.0E+09	1.5E+09	1.1E+09	7.7E+08	5.4E+08	3.8E+08
Ks-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mn-53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Na-22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-91	2E-07	5.6E-07	1.6E-06	4.2E-06	0.000011	0.000027	0.000067	0.00016	0.00037	0.00085	0.0041	0.018	0.072	0.27	0.94	4.1	17	61	210	650	1900
Nb-92	0	2.1E-11	5.8E-11	1.6E-10	4.1E-10	1E-09	2.6E-09	6.2E-09	1.5E-08	3.4E-08	1.6E-07	7.3E-07	0.000003	0.000012	0.000041	0.00019	0.00076	0.0029	0.01	0.033	0.099
Nb-93m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-94	0	0	0	0	0	0	0	0	0	0	1.9E-11	8.3E-11	3.4E-10	1.3E-09	4.7E-09	2.1E-08	8.6E-08	3.2E-07	1.1E-06	3.7E-06	0.000011
Ni-59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni-63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Np-237	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Os-194	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pa-231	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb-202	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb-210	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pd-107	2.3E+07	3.3E+07	4.6E+07	6.3E+07	8.6E+07	1.2E+08	1.5E+08	2.0E+08	2.7E+08	3.4E+08	5.6E+08	8.8E+08	1.4E+09	2.0E+09	2.9E+09	4.5E+09	6.7E+09	9.8E+09	1.4E+10	1.9E+10	2.5E+10
Pm-145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pm-147	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 38. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE--VERTICAL PATHRAE MODEL RESULTS FOR THE CLASS A SOUTH CELL TOP SLOPE (0.276 CM/YR INFILTRATION)

NUCLIDE	YEAR TO EXCEED:	1	3	6	9	12	15	18	21	24	27	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120
Po-208	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Po-209	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	720	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-236	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-238	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-239	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-240	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-241	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-242	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-244	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ra-226	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ra-228	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	185	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.9E-11	3.3E-09	1.5E-07	3.9E-06	6.7E-05	0.00081	0.0074	0.052	0.3	1.5	6	22	70
Se-79	620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Si-32	210	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sm-151	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sn-121m	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sn-126	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.2E-11	5.2E-09	3.5E-07	1.2E-05	0.00023	0.0029	0.026	0.17	0.9	3.8	14	43	1.2E+02	2.9E+02	6.4E+02
Tb-157	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tb-158	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tc-99	160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.6E-10	1.7E-08	3.9E-07	6.4E-06	7.7E-05	0.00071	0.0053	0.033	0.17	0.76
Te-123	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-229	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-230	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-232	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ti-44	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tl-204	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2E-11	6.3E-11	1.7E-10
Tm-170	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-232	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-233	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-234	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-235	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-236	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-238	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V-50	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

NOTE: Year to exceed GWPL = Year to exceed GWPL reported to next lowest model output year. -1 indicates nuclide does not exceed GWPL in years modeled

TABLE 38. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE--VERTICAL PATHRAE MODEL RESULTS FOR THE CLASS A SOUTH CELL TOP SLOPE (0.276 CM/YR INFILTRATION)

NUCLIDE	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230
Po-208	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Po-209	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-236	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-238	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-239	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-240	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-242	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ra-226	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ra-228	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	2.0E+02	5.3E+02	1.3E+03	2.9E+03	6.3E+03	1.3E+04	2.4E+04	4.3E+04	7.5E+04	1.2E+05	2.0E+05	3.1E+05	4.7E+05	6.9E+05	9.9E+05	1.4E+06	1.9E+06	2.5E+06	3.3E+06	4.3E+06	5.4E+06	6.8E+06
Se-79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Si-32	0	6.9E-11	1.2E-09	1.8E-08	2.1E-07	2.1E-06	0.000019	0.00014	0.00093	0.0055	0.029	0.14	0.63	2.6	9.7	34	110	350	1000	2900	7700	20000
Sm-151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sn-121m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sn-126	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	1.3E+03	2.5E+03	4.3E+03	7.2E+03	1.1E+04	1.7E+04	2.5E+04	3.4E+04	4.6E+04	5.9E+04	7.4E+04	9.1E+04	1.1E+05	1.3E+05	1.4E+05	1.6E+05	1.7E+05	1.9E+05	2.0E+05	2.0E+05	2.1E+05	2.1E+05
Tb-157	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tb-158	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tc-99	3	11	34	99	270	660	1600	3.4E+03	7.2E+03	1.4E+04	2.7E+04	5.0E+04	8.7E+04	1.5E+05	2.4E+05	3.9E+05	6.0E+05	9.1E+05	1.3E+06	1.9E+06	2.7E+06	3.8E+06
Te-123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-229	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-232	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ti-44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tl-204	3.7E-10	7.2E-10	1.2E-09	1.9E-09	2.7E-09	3.4E-09	4E-09	4.4E-09	4.5E-09	4.3E-09	4E-09	3.5E-09	2.9E-09	2.3E-09	1.7E-09	1.3E-09	9.1E-10	6.3E-10	4.2E-10	2.7E-10	1.7E-10	1.1E-10
Tm-170	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-232	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-233	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-234	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-235	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-236	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-238	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V-50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 38. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE--VERTICAL PATHRAE MODEL RESULTS FOR THE CLASS A SOUTH CELL TOP SLOPE (0.276 CM/YR INFILTRATION)

NUCLIDE:	235	240	245	250	255	260	265	270	275	280	285	290	295	300	310	320	330	340	350	360	370	380
Po-208	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Po-209	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4E-11	3.2E-10	2.3E-09	1.4E-08	7.9E-08	4E-07	1.8E-06
Pu-236	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-238	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-239	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-240	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-242	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ra-226	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ra-228	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	8.4E+06	1.0E+07	1.2E+07	1.4E+07	1.7E+07	1.9E+07	2.2E+07	2.5E+07	2.8E+07	3.1E+07	3.5E+07	3.8E+07	4.1E+07	4.4E+07	4.9E+07	5.4E+07	5.8E+07	6.1E+07	6.2E+07	6.2E+07	6.1E+07	5.9E+07
Se-79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.4E-11	1.7E-10	1E-09
Si-32	48000	110000	250000	560000	1200000	2400000	4800000	9200000	17000000	32000000	57000000	1E+08	1.7E+08	2.9E+08	7.7E+08	1.9E+09	4.5E+09	1.0E+10	2.1E+10	4.2E+10	8.0E+10	1.5E+11
Sm-151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sn-121m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sn-126	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	2.1E+05	2.1E+05	2.0E+05	1.9E+05	1.8E+05	1.7E+05	1.6E+05	1.5E+05	1.4E+05	1.2E+05	1.1E+05	9.9E+04	8.8E+04	7.7E+04	5.9E+04	4.4E+04	3.2E+04	2.3E+04	1.6E+04	1.1E+04	7.5E+03	5.0E+03
Tb-157	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tb-158	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tc-99	5.2E+06	7.0E+06	9.2E+06	1.2E+07	1.5E+07	1.9E+07	2.4E+07	3.0E+07	3.7E+07	4.4E+07	5.3E+07	6.3E+07	7.4E+07	8.6E+07	1.1E+08	1.5E+08	1.8E+08	2.2E+08	2.6E+08	3.1E+08	3.5E+08	3.9E+08
Te-123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-229	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-232	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ti-44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tl-204	6.6E-11	3.9E-11	2.3E-11	1.3E-11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tm-170	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-232	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-233	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-234	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-235	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-236	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-238	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V-50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 38. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE--VERTICAL PATHRAE MODEL RESULTS FOR THE CLASS A SOUTH CELL TOP SLOPE (0.276 CM/YR INFILTRATION)

NUCLIDE	390	400	410	420	430	440	450	460	470	480	490	500	510	520	530	540	550	560	570	580	590	600
Po-208	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Po-209	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	7.6E-06	0.000029	0.00011	0.00036	0.0011	0.0033	0.0092	0.025	0.062	0.15	0.35	0.77	1.6	3.4	6.8	13	24	45	79	140	230	380
Pu-236	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-238	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-239	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-240	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-242	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ra-226	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ra-228	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	5.7E+07	5.3E+07	4.9E+07	4.5E+07	4.1E+07	3.7E+07	3.2E+07	2.8E+07	2.5E+07	2.1E+07	1.8E+07	1.6E+07	1.3E+07	1.1E+07	9.3E+06	7.7E+06	6.4E+06	5.2E+06	4.3E+06	3.5E+06	2.8E+06	2.3E+06
Se-79	6E-09	3.1E-08	1.5E-07	6.7E-07	2.8E-06	0.000011	0.000039	0.00014	0.00044	0.0014	0.0041	0.012	0.031	0.082	0.21	0.5	1.2	2.7	5.8	13	26	53
Si-32	2.6E+11	4.4E+11	7.4E+11	1.2E+12	1.8E+12	2.8E+12	4.2E+12	6.0E+12	8.6E+12	1.2E+13	1.6E+13	2.2E+13	2.9E+13	3.8E+13	4.9E+13	6.1E+13	7.7E+13	9.5E+13	1.2E+14	1.4E+14	1.7E+14	2.0E+14
Sm-151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sn-121m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sn-126	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	3.3E+03	2.2E+03	1.4E+03	9.0E+02	5.8E+02	3.6E+02	2.3E+02	1.4E+02	8.7E+01	5.4E+01	3.3E+01	2.0E+01	1.2E+01	7.2E+00	4.3E+00	2.6E+00	1.5E+00	9.0E-01	5.3E-01	3.1E-01	1.8E-01	1.1E-01
Tb-157	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tb-158	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tc-99	4.2E+08	4.6E+08	4.8E+08	5.0E+08	5.2E+08	5.2E+08	5.2E+08	5.2E+08	5.1E+08	4.9E+08	4.7E+08	4.5E+08	4.2E+08	3.9E+08	3.7E+08	3.4E+08	3.1E+08	2.8E+08	2.5E+08	2.3E+08	2.0E+08	1.8E+08
Te-123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-229	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-232	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ti-44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tl-204	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tm-170	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-232	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-233	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-234	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-235	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-236	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-238	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V-50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 38. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE--VERTICAL PATHRAE MODEL RESULTS FOR THE CLASS A SOUTH CELL TOP SLOPE (0.276 CM/YR INFILTRATION)

NUCLIDE	610	620	630	640	650	660	670	680	690	700	720	740	760	780	800	825	850	875	900	925	950
Po-208	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Po-209	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	610	960	1500	2200	3300	4900	7000	9900	14000	19000	34000	59000	97000	150000	230000	3.7E+05	5.5E+05	7.9E+05	1.1E+06	1.4E+06	1.8E+06
Pu-236	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-238	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-239	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-240	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-242	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ra-226	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ra-228	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	1.9E+06	1.5E+06	1.2E+06	9.6E+05	7.6E+05	6.0E+05	4.8E+05	3.8E+05	3.0E+05	2.3E+05	1.4E+05	8.8E+04	5.3E+04	3.2E+04	1.9E+04	9.9E+03	5.1E+03	2.6E+03	1.3E+03	6.8E+02	3.4E+02
Se-79	110	200	390	720	1300	2300	4100	7100	12000	20000	53000	130000	320000	720000	1600000	3900000	9.1E+06	2.0E+07	4.3E+07	8.7E+07	1.7E+08
Si-32	2.3E+14	2.7E+14	3.1E+14	3.5E+14	4.0E+14	4.5E+14	5.0E+14	5.5E+14	6.1E+14	6.7E+14	7.9E+14	9.1E+14	1.0E+15	1.1E+15	1.2E+15	1.3E+15	1.4E+15	1.5E+15	1.5E+15	1.5E+15	1.5E+15
Sm-151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.2E-11	2.4E-10	1.2E-09	5.7E-09
Sn-121m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sn-126	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	6.2E-02	3.6E-02	2.1E-02	1.2E-02	6.9E-03	4.0E-03	2.3E-03	1.3E-03	7.5E-04	4.3E-04	1.4E-04	4.5E-05	1.4E-05	4.6E-06	1.5E-06	3.5E-07	8.1E-08	1.9E-08	4.4E-09	1.0E-09	2.4E-10
Tb-157	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tb-158	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tc-99	1.6E+08	1.4E+08	1.2E+08	1.1E+08	9.3E+07	8.0E+07	6.9E+07	6.0E+07	5.1E+07	4.4E+07	3.2E+07	2.3E+07	1.6E+07	1.1E+07	7.8E+06	4.9E+06	3.1E+06	1.9E+06	1.2E+06	7.0E+05	4.2E+05
Te-123	2.2E-11	5.1E-11	1.1E-10	2.5E-10	5.3E-10	1.1E-09	2.2E-09	4.4E-09	8.6E-09	1.6E-08	5.6E-08	1.8E-07	5.4E-07	1.5E-06	4.1E-06	0.000013	0.000039	0.00011	0.00028	0.0007	0.0016
Th-229	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-232	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ti-44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tl-204	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tm-170	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-232	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-233	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-234	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-235	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-236	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-238	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V-50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 40.

PEAK RADIONUCLIDE CONCENTRATIONS AND TIME TO EXCEED GWPL AT THE WATER TABLE
VERTICAL PATHRAE RESULTS FOR CLASS A SOUTH CELL SIDE SLOPE (0.286 CM/YR INFILTRATION)

NUCLIDE	TIME TO EXCEED (Year)	PEAK CONCENTRATION (Ci/m^3)	PEAK CONCENTRATION (pCi/L)	PEAK YEAR
Ac-227	-1	0		> 10,000
Ag-108m	-1	4.21E+02	4.21E+11	4,717
Al-26	-1	0		> 10,000
Am-241	850	5.00E-04	5.00E+05	2,295
Am-242m	975	1.41E-07	1.41E+02	1,750
Am-243	850	3.62E-03	3.62E+06	2,585
Ba-133	-1	0		> 10,000
Be-10	-1	4.21E+03	4.21E+12	6,298
Bi-207	-1	3.18E-07	3.18E+02	996
Bi-210m	640	2.62E+02	2.62E+11	2,614
Bk-247	145	6.14E-10	6.14E-01	161
C-14	-1	0		> 10,000
Ca-41	220	6.48E-06	6.48E+03	282
Cd-113	-1	1.99E-07	1.99E+02	2,614
Cd-113m	-1	0		---
Cf-249	-1	5.21E-07	5.21E+02	3,642
Cf-250	-1	0		---
Cf-251	-1	6.31E-05	6.31E+04	4,382
Cf-252	-1	0		---
Cl-36	155	1.93E-06	1.93E+03	165
Cm-243	-1	0		> 10,000
Cm-244	-1	0		> 10,000
Cm-245	-1	0		> 10,000
Cm-246	-1	0		> 10,000
Cm-247	-1	0		> 10,000
Cm-248	-1	0		> 10,000
Co-60	-1	0		> 10,000
Cs-135	-1	0		> 10,000
Cs-137	-1	0		> 10,000
Eu-152	-1	0		> 10,000
Eu-154	-1	0		> 10,000
Eu-155	-1	0		> 10,000
Fe-55	-1	0		---
Fe-60	800	1.33E+03	1.33E+12	3,593
Gd-148	-1	0		> 10,000
H-3	110	1.10E-03	1.10E+06	170
Hg-194	-1	0		> 10,000
Ho-166m	-1	1.16E+04	1.16E+13	5,493
I-129	150	1.33E-02	1.33E+07	453
K-40	155	1.60E+01	1.60E+10	527
Ks-20	-1	0		---
Ks-21	-1	0		---
Ks-22	-1	0		---
Ks-23	-1	0		---
Ks-24	-1	0		> 10,000
Ks-25	-1	0		> 10,000
Ks-26	-1	0		---
Mn-53	-1	0		> 10,000
Na-22	-1	0		---
Nb-91	875	3.63E+04	3.63E+13	3,503
Nb-92	-1	3.32E+01	3.32E+10	4,090
Nb-93m	-1	0		---
Nb-94	-1	3.34E-03	3.34E+06	4,064
Ni-59	-1	0		> 10,000
Ni-63	-1	0		> 10,000
Np-237	-1	3.57E-02	3.57E+07	> 10,375
Os-194	-1	0		> 10,000
Pa-231	-1	0		> 10,000
Pb-202	-1	0		> 10,000
Pb-210	-1	0		> 10,000
Pd-107	450	4.08E+02	4.08E+11	1,510
Pm-145	-1	0		> 10,000
Pm-147	-1	0		> 10,000
Po-208	-1	0		> 10,000
Po-209	-1	0		> 10,000
Pt-193	680	8.02E-03	8.02E+06	1,137
Pu-236	-1	0		> 10,000
Pu-238	-1	0		> 10,000
Pu-239	-1	0		> 10,000
Pu-240	-1	0		> 10,000
Pu-241	-1	0		> 10,000
Pu-242	-1	0		> 10,000
Pu-244	-1	0		> 10,000
Ra-226	-1	0		> 10,000
Ra-228	-1	0		> 10,000
Re-187	195	1.95E-02	1.95E+07	343
Se-79	590	3.12E+04	3.12E+13	2,610
Si-32	200	1.73E+06	1.73E+15	875
Sm-151	-1	3.32E-06	3.32E+03	2,546
Sn-121m	-1	0		> 10,000
Sn-126	-1	0		> 10,000
Sr-90	100	2.63E-04	2.63E+05	224
Tb-157	-1	0		> 10,000
Tb-158	-1	0		> 10,000
Tc-99	160	2.18E-01	2.18E+08	429
Te-123	-1	1.09E-04	1.09E+05	3,226
Th-229	-1	0		> 10,000
Th-230	-1	0		> 10,000
Th-232	-1	0		> 10,000
Ti-44	-1	0		> 10,000
Tl-204	-1	0		---
Tm-170	-1	0		> 10,000
U-232	-1	0		> 10,000
U-233	-1	0		> 10,000
U-234	-1	0		> 10,000
U-235	-1	0		> 10,000
U-236	-1	0		> 10,000
U-238	-1	0		> 10,000
V-50	-1	0		> 10,000
Zr-93	-1	0		> 10,000

NOTES: -1 indicates that nuclide did not exceed standard within the 1,000 years modeled

--- indicates that concentrations do not peak at the water table within 10,000 yrs

TABLE 41. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE--VERTICAL PATHRAE MODEL RESULTS FOR THE CLASS A SOUTH CELL SIDE SLOPE (0.286 CM/YR INFILTRATION)

NUCLIDE:	YEAR TO EXCEED:	1	3	6	9	12	15	18	21	24	27	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115
Ac-227	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ag-108m	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Al-26	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-241	850	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-242m	975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-243	850	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ba-133	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Be-10	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-210m	640	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bk-247	145	0	0	0	0	0	0	0	0	0	0	0	0	1.3E-11	1.0E-09	3.3E-08	5.3E-07	5.2E-06	3.4E-05	1.7E-04	6.2E-04	1.9E-03	5.1E-03	1.2E-02	2.4E-02	4.3E-02	7.3E-02	1.1E-01	1.6E-01
C-14	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ca-41	220	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.5E-10	1.8E-08	3.5E-07	4.4E-06	4.0E-05	2.8E-04	1.5E-03	6.8E-03	2.6E-02	8.5E-02	2.5E-01	6.5E-01
Cd-113	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cd-113m	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-249	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-250	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-251	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-252	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cl-36	155	0	0	0	0	0	0	0	0	0	0	0	4.6E-11	1.6E-08	1.4E-06	5.0E-05	8.7E-04	9.0E-03	6.2E-02	3.2E-01	1.2E+00	4.0E+00	1.1E+01	2.6E+01	5.4E+01	1.0E+02	1.8E+02	2.8E+02	4.2E+02
Cm-243	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-244	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-245	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-246	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-247	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-248	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Co-60	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cs-135	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cs-137	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-152	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-154	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-155	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-55	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-60	800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gd-148	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	110	0	0	0	0	0	0	0	0	0	0	0	0	3.6E-11	3.1E-08	6.5E-06	4.7E-04	1.5E-02	2.7E-01	3.0E+00	2.3E+01	1.3E+02	5.4E+02	1.9E+03	5.5E+03	1.4E+04	3.0E+04	5.9E+04	1.0E+05
Hg-194	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ho-166m	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I-129	150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.9E-10	4.6E-09	7.8E-08	9.8E-07	9.4E-06	7.3E-05	4.6E-04	2.5E-03
K-40	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.8E-11	1.6E-09	4.4E-08	8.5E-07	1.2E-05	1.3E-04	1.1E-03	8.2E-03
Ks-20	-1	0	0	0	0	0	0	0	0	0	0	0	0	5.8E-11	1.5E-10	1.5E-10	7.4E-11	2.3E-11	0	0	0	0	0	0	0	0	0	0	0
Ks-21	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-22	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-23	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-24	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-25	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-26	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mn-53	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Na-22	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-91	875	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-92	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-93m	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-94	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni-59	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni-63	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Np-237	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Os-194	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pa-231	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb-202	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb-210	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pd-107	450	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pm-145	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pm-147	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 41. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE--VERTICAL PATHRAE MODEL RESULTS FOR THE CLASS A SOUTH CELL SIDE SLOPE (0.286 CM/YR INFILTRATION)

NUCLIDE	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225
Ac-227	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ag-108m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Al-26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-242m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ba-133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Be-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-210m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bk-247	2.3E-01	2.9E-01	3.6E-01	4.3E-01	4.9E-01	5.4E-01	5.8E-01	6.0E-01	6.1E-01	6.1E-01	5.9E-01	5.6E-01	5.3E-01	4.9E-01	4.4E-01	4.0E-01	3.5E-01	3.1E-01	2.7E-01	2.3E-01	2.0E-01	1.7E-01
C-14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ca-41	1.6E+00	3.4E+00	7.0E+00	1.3E+01	2.4E+01	4.2E+01	6.9E+01	1.1E+02	1.6E+02	2.4E+02	3.4E+02	4.7E+02	6.4E+02	8.4E+02	1.1E+03	1.3E+03	1.7E+03	2.0E+03	2.4E+03	2.8E+03	3.2E+03	3.6E+03
Cd-113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cd-113m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-249	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-251	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-252	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cl-36	5.9E+02	7.8E+02	9.9E+02	1.2E+03	1.4E+03	1.6E+03	1.7E+03	1.8E+03	1.9E+03	1.9E+03	1.9E+03	1.8E+03	1.8E+03	1.7E+03	1.5E+03	1.4E+03	1.3E+03	1.1E+03	9.8E+02	8.6E+02	7.4E+02	6.3E+02
Cm-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-246	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-247	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-248	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Co-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cs-135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cs-137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gd-148	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	1.7E+05	2.6E+05	3.7E+05	4.9E+05	6.2E+05	7.5E+05	8.7E+05	9.7E+05	1.0E+06	1.1E+06	1.1E+06	1.1E+06	1.0E+06	9.8E+05	9.0E+05	8.0E+05	7.1E+05	6.1F+05	5.2E+05	4.4E+05	3.6E+05	2.9E+05
Hg-194	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ho-166m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I-129	1.1E-02	4.6E-02	1.7E-01	5.4E-01	1.6E+00	4.4E+00	1.1E+01	2.7E+01	5.9E+01	1.3E+02	2.5E+02	4.9E+02	9.0E+02	1.6E+03	2.8E+03	4.6E+03	7.4E+03	1.2E+04	1.8E+04	2.6E+04	3.8E+04	5.5E+04
K-40	5.0E-02	2.6E-01	1.2E+00	4.7E+00	1.7E+01	5.7E+01	1.7E+02	4.9E+02	1.3E+03	3.1E+03	7.3E+03	1.6E+04	3.3E+04	6.7E+04	1.3E+05	2.4E+05	4.3E+05	7.4E+05	1.2E+06	2.0E+06	3.2E+06	5.0E+06
Ks-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mn-53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Na-22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-93m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni-59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni-63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Np-237	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Os-194	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pa-231	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb-202	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb-210	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pd-107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.9E-11	1.8E-10	7.6E-10
Pm-145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pm-147	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 41. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE--VERTICAL PATHRAE MODEL RESULTS FOR THE CLASS A SOUTH CELL SIDE SLOPE (0.286 CM/YR INFILTRATION)

NUCLIDE	230	235	240	245	250	255	260	265	270	275	280	285	290	295	300	310	320	330	340	350	360	370
Ac-227	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ag-108m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Al-26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-242m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ba-133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Be-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.9E-11	1.1E-10	5.7E-10
Bi-210m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.0E-11
Bk-247	1.4E-01	1.2E-01	9.5E-02	7.8E-02	6.4E-02	5.2E-02	4.2E-02	3.3E-02	2.7E-02	2.1E-02	1.7E-02	1.3E-02	1.0E-02	8.2E-03	6.4E-03	3.9E-03	2.3E-03	1.4E-03	8.1E-04	4.7E-04	2.7E-04	1.6E-04
C-14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ca-41	4.0E+03	4.4E+03	4.8E+03	5.2E+03	5.5E+03	5.8E+03	6.0E+03	6.2E+03	6.3E+03	6.4E+03	6.5E+03	6.5E+03	6.4E+03	6.3E+03	6.2E+03	5.8E+03	5.3E+03	4.8E+03	4.2E+03	3.7E+03	3.1E+03	2.6E+03
Cd-113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cd-113m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-249	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-251	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-252	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cl-36	5.4E+02	4.5E+02	3.8E+02	3.1E+02	2.6E+02	2.1E+02	1.7E+02	1.4E+02	1.1E+02	9.3E+01	7.4E+01	5.9E+01	4.7E+01	3.8E+01	3.0E+01	1.8E+01	1.1E+01	6.8E+00	4.1E+00	2.4E+00	1.4E+00	8.5E-01
Cm-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-246	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-247	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-248	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Co-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cs-135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cs-137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gd-148	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	2.4E+05	1.9E+05	1.5E+05	1.1E+05	8.8E+04	6.7E+04	5.0E+04	3.8E+04	2.8E+04	2.1E+04	1.5E+04	1.1E+04	7.8E+03	5.6E+03	4.0E+03	2.0E+03	9.7E+02	4.6E+02	2.2E+02	1.0E+02	4.6E+01	2.1E+01
Hg-194	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ho-166m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I-129	7.6E+04	1.1E+05	1.4E+05	1.9E+05	2.5E+05	3.2E+05	4.1E+05	5.1E+05	6.3E+05	7.8E+05	9.5E+05	1.1E+06	1.4E+06	1.6E+06	1.9E+06	2.5E+06	3.3E+06	4.1E+06	5.1E+06	6.1E+06	7.1E+06	8.2E+06
K-40	7.6E+06	1.1E+07	1.6E+07	2.3E+07	3.3E+07	4.6E+07	6.2E+07	8.3E+07	1.1E+08	1.4E+08	1.8E+08	2.3E+08	3.0E+08	3.7E+08	4.5E+08	6.7E+08	9.6E+08	1.3E+09	1.8E+09	2.4E+09	3.0E+09	3.8E+09
Ks-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mn-53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Na-22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-93m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni-59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni-63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Np-237	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Os-194	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pa-231	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb-202	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb-210	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pd-107	3.0E-09	1.1E-08	4.1E-08	1.4E-07	4.4E-07	1.4E-06	4.0E-06	1.1E-05	3.0E-05	7.8E-05	2.0E-04	4.8E-04	1.1E-03	2.6E-03	5.7E-03	2.6E-02	1.1E-01	4.1E-01	1.4E+00	4.6E+00	1.4E+01	3.9E+01
Pm-145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pm-147	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 41. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE--VERTICAL PATHRAE MODEL RESULTS FOR THE CLASS A SOUTH CELL SIDE SLOPE (0.286 CM/YR INFILTRATION)

NUCLIDE	380	390	400	410	420	430	440	450	460	470	480	490	500	510	520	530	540	550	560	570	580	590
Ac-227	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ag-108m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Al-26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-241	0	0	0	0	0	0	3.5E-11	1.2E-10	3.9E-10	1.2E-09	3.5E-09	9.6E-09	2.6E-08	6.6E-08	1.6E-07	3.9E-07	8.9E-07	2.0E-06	4.3E-06	9.0E-06	1.8E-05	3.6E-05
Am-242m	0	0	0	0	0	0	0	0	1.7E-11	5.2E-11	1.5E-10	3.9E-10	1.0E-09	2.5E-09	6.0E-09	1.4E-08	3.1E-08	6.6E-08	1.4E-07	2.8E-07	5.6E-07	1.1E-06
Am-243	0	0	0	0	0	0	1.4E-11	4.9E-11	1.6E-10	5.0E-10	1.5E-09	4.2E-09	1.1E-08	2.9E-08	7.4E-08	1.8E-07	4.2E-07	9.4E-07	2.1E-06	4.4E-06	9.1E-06	1.8E-05
Ba-133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Be-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	2.7E-09	1.1E-08	4.5E-08	1.6E-07	5.5E-07	1.7E-06	5.1E-06	1.4E-05	3.7E-05	9.3E-05	2.2E-04	5.1E-04	1.1E-03	2.3E-03	4.6E-03	9.0E-03	1.7E-02	3.1E-02	5.4E-02	9.3E-02	1.5E-01	2.5E-01
Bi-210m	1.2E-10	6.3E-10	3.1E-09	1.4E-08	5.8E-08	2.3E-07	8.4E-07	2.9E-06	9.5E-06	3.0E-05	8.8E-05	2.5E-04	6.7E-04	1.8E-03	4.4E-03	1.1E-02	2.5E-02	5.6E-02	1.2E-01	2.6E-01	5.5E-01	1.1E+00
Bk-247	9.0E-05	5.1E-05	2.9E-05	1.6E-05	9.1E-06	5.1E-06	2.8E-06	1.6E-06	8.7E-07	4.8E-07	2.6E-07	1.4E-07	7.8E-08	4.3E-08	2.3E-08	1.3E-08	6.8E-09	3.7E-09	2.0E-09	1.1E-09	5.8E-10	3.1E-10
C-14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ca-41	2.2E+03	1.8E+03	1.5E+03	1.2E+03	9.4E+02	7.5E+02	5.9E+02	4.6E+02	3.5E+02	2.7E+02	2.1E+02	1.6E+02	1.2E+02	9.0E+01	6.7E+01	5.0E+01	3.7E+01	2.8E+01	2.0E+01	1.5E+01	1.1E+01	8.0E+00
Cd-113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.9E-11	4.3E-11	9.4E-11	2.0E-10	4.2E-10	8.4E-10
Cd-113m	0	0	0	0	2.5E-11	5.9E-11	1.3E-10	2.8E-10	5.7E-10	1.1E-09	2.0E-09	3.4E-09	5.6E-09	9.0E-09	1.4E-08	2.0E-08	2.9E-08	4.0E-08	5.4E-08	7.1E-08	9.0E-08	1.1E-07
Cf-249	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-251	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-252	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cl-36	5.0E-01	2.9E-01	1.7E-01	9.6E-02	5.5E-02	3.1E-02	1.8E-02	1.0E-02	5.6E-03	3.2E-03	1.8E-03	9.9E-04	5.5E-04	3.1E-04	1.7E-04	9.4E-05	5.2E-05	2.9E-05	1.6E-05	8.6E-06	4.7E-06	2.6E-06
Cm-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-246	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-247	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-248	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Co-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cs-135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cs-137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-60	0	0	0	0	0	0	0	0	0	0	0	0	3.3E-11	1.3E-10	4.6E-10	1.6E-09	5.2E-09	1.6E-08	4.9E-08	1.4E-07	4.0E-07	1.1E-06
Gd-148	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	9.4E+00	4.1E+00	1.8E+00	7.9E-01	3.4E-01	1.5E-01	6.2E-02	2.6E-02	1.1E-02	4.5E-03	1.9E-03	7.8E-04	3.2E-04	1.3E-04	5.3E-05	2.2E-05	8.7E-06	3.5E-06	1.4E-06	5.6E-07	2.3E-07	9.0E-08
Hg-194	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ho-166m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I-129	9.2E+06	1.0E+07	1.1E+07	1.2E+07	1.2E+07	1.3E+07	1.3E+07	1.3E+07	1.3E+07	1.3E+07	1.3E+07	1.2E+07	1.2E+07	1.1E+07	1.1E+07	9.9E+06	9.2E+06	8.4E+06	7.7E+06	7.0E+06	6.3E+06	5.7E+06
K-40	4.6E+09	5.6E+09	6.6E+09	7.7E+09	8.8E+09	9.8E+09	1.1E+10	1.2E+10	1.3E+10	1.4E+10	1.4E+10	1.5E+10	1.6E+10	1.6E+10	1.6E+10	1.6E+10	1.6E+10	1.6E+10	1.5E+10	1.5E+10	1.4E+10	1.4E+10
Ks-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mn-53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Na-22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-91	0	0	0	0	0	0	0	0	0	0	0	0	0	1.1E-11	4.5E-11	1.8E-10	7.1E-10	2.6E-09	9.0E-09	3.0E-08	9.6E-08	2.9E-07
Nb-92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.0E-11
Nb-93m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni-59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni-63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Np-237	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Os-194	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pa-231	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb-202	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb-210	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pd-107	1.0E+02	2.6E+02	6.3E+02	1.5E+03	3.2E+03	6.8E+03	1.4E+04	2.7E+04	5.2E+04	9.7E+04	1.7E+05	3.1E+05	5.2E+05	8.8E+05	1.4E+06	2.3E+06	3.6E+06	5.6E+06	8.4E+06	1.3E+07	1.8E+07	2.7E+07
Pm-145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pm-147	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 41. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE--VERTICAL PATHRAE MODEL RESULTS FOR THE CLASS A SOUTH CELL SIDE SLOPE (0.286 CM/YR INFILTRATION)

NUCLIDE	600	610	620	630	640	650	660	670	680	690	700	720	740	760	780	800	825	850	875	900	925	950
Ac-227	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ag-108m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.7E-11	1.4E-10	1.0E-09	6.9E-09	4.1E-08
Al-26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-241	7.1E-05	1.3E-04	2.5E-04	4.5E-04	8.1E-04	1.4E-03	2.4E-03	4.1E-03	6.7E-03	1.1E-02	1.8E-02	4.3E-02	1.0E-01	2.2E-01	4.7E-01	9.6E-01	2.2E+00	4.8E+00	9.9E+00	1.9E+01	3.6E+01	6.6E+01
Am-242m	2.0E-06	3.7E-06	6.6E-06	1.2E-05	2.0E-05	3.4E-05	5.6E-05	9.2E-05	1.5E-04	2.3E-04	3.6E-04	8.3E-04	1.8E-03	3.7E-03	7.4E-03	1.4E-02	3.0E-02	6.0E-02	1.1E-01	2.0E-01	3.5E-01	5.9E-01
Am-243	3.6E-05	7.0E-05	1.3E-04	2.4E-04	4.4E-04	7.8E-04	1.4E-03	2.3E-03	3.9E-03	6.4E-03	1.0E-02	2.7E-02	6.4E-02	1.5E-01	3.2E-01	6.7E-01	1.6E+00	3.6E+00	7.7E+00	1.6E+01	3.1E+01	5.7E+01
Ba-133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Be-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.5E-11	1.1E-10	7.4E-10	4.4E-09	2.4E-08
Bi-207	4.0E-01	6.2E-01	9.3E-01	1.4E+00	2.0E+00	2.9E+00	4.0E+00	5.5E+00	7.4E+00	9.9E+00	1.3E+01	2.1E+01	3.3E+01	4.9E+01	6.9E+01	9.3E+01	1.3E+02	1.7E+02	2.1E+02	2.4E+02	2.8E+02	3.0E+02
Bi-210m	2.2E+00	4.2E+00	7.9E+00	1.5E+01	2.6E+01	4.7E+01	8.2E+01	1.4E+02	2.4E+02	3.9E+02	6.3E+02	1.6E+03	3.9E+03	8.9E+03	1.9E+04	4.1E+04	9.8E+04	2.2E+05	4.7E+05	9.6E+05	1.9E+06	3.5E+06
Bk-247	1.7E-10	8.9E-11	4.8E-11	2.6E-11	1.4E-11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ca-41	5.9E+00	4.3E+00	3.1E+00	2.2E+00	1.6E+00	1.2E+00	8.4E-01	6.0E-01	4.3E-01	3.1E-01	2.2E-01	1.1E-01	5.6E-02	2.8E-02	1.4E-02	7.0E-03	2.9E-03	1.2E-03	4.9E-04	2.0E-04	8.2E-05	3.3E-05
Cd-113	1.7E-09	3.2E-09	6.0E-09	1.1E-08	2.0E-08	3.6E-08	6.2E-08	1.1E-07	1.8E-07	3.0E-07	4.8E-07	1.2E-06	3.0E-06	6.8E-06	1.5E-05	3.1E-05	7.4E-05	1.7E-04	3.6E-04	7.3E-04	1.4E-03	2.7E-03
Cd-113m	1.3E-07	1.6E-07	1.8E-07	2.1E-07	2.3E-07	2.5E-07	2.6E-07	2.7E-07	2.8E-07	2.9E-07	2.9E-07	2.7E-07	2.4E-07	2.1E-07	1.7E-07	1.3E-07	9.4E-08	6.2E-08	3.9E-08	2.3E-08	1.3E-08	7.3E-09
Cf-249	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.6E-11	1.0E-10	3.8E-10
Cf-250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-251	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.7E-11	7.7E-11	3.2E-10	1.2E-09
Cf-252	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cl-36	1.4E-06	7.8E-07	4.2E-07	2.3E-07	1.3E-07	6.8E-08	3.7E-08	2.0E-08	1.1E-08	5.9E-09	3.2E-09	9.4E-10	2.8E-10	8.0E-11	2.3E-11	0	0	0	0	0	0	0
Cm-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-246	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-247	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-248	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Co-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cs-135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cs-137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-60	2.8E-06	7.0E-06	1.7E-05	4.1E-05	9.4E-05	2.1E-04	4.6E-04	9.9E-04	2.1E-03	4.2E-03	8.5E-03	3.2E-02	1.1E-01	3.7E-01	1.1E+00	3.3E+00	1.1E+01	3.7E+01	1.1E+02	3.2E+02	8.4E+02	2.1E+03
Gd-148	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	3.6E-08	1.4E-08	5.6E-09	2.2E-09	8.7E-10	3.4E-10	1.3E-10	5.3E-11	2.1E-11	0	0	0	0	0	0	0	0	0	0	0	0	0
Hg-194	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ho-166m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9.0E-11	7.5E-10	5.5E-09	3.6E-08	2.1E-07	1.1E-06
I-129	5.1E+06	4.5E+06	4.0E+06	3.5E+06	3.1E+06	2.7E+06	2.4E+06	2.1E+06	1.8E+06	1.5E+06	1.3E+06	9.6E+05	7.0E+05	5.0E+05	3.6E+05	2.5E+05	1.6E+05	1.0E+05	6.3E+04	3.9E+04	2.4E+04	1.5E+04
K-40	1.3E+10	1.2E+10	1.2E+10	1.1E+10	1.0E+10	9.4E+09	8.6E+09	7.9E+09	7.2E+09	6.6E+09	6.0E+09	4.9E+09	3.9E+09	3.1E+09	2.4E+09	1.9E+09	1.4E+09	9.6E+08	6.7E+08	4.7E+08	3.2E+08	2.2E+08
Ks-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mn-53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Na-22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-91	8.7E-07	2.5E-06	6.8E-06	1.8E-05	4.7E-05	1.2E-04	2.8E-04	6.7E-04	1.5E-03	3.5E-03	7.6E-03	3.4E-02	1.4E-01	5.4E-01	1.9E+00	6.4E+00	2.6E+01	9.8E+01	3.4E+02	1.1E+03	3.3E+03	9.4E+03
Nb-92	3.1E-11	9.0E-11	2.5E-10	6.7E-10	1.7E-09	4.4E-09	1.1E-08	2.6E-08	6.0E-08	1.4E-07	3.0E-07	1.4E-06	5.8E-06	2.3E-05	8.2E-05	2.8E-04	1.2E-03	4.5E-03	1.6E-02	5.4E-02	1.7E-01	4.8E-01
Nb-93m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-94	0	0	0	0	0	0	0	0	0	1.5E-11	3.4E-11	1.6E-10	6.6E-10	2.6E-09	9.3E-09	3.1E-08	1.3E-07	5.1E-07	1.8E-06	6.0E-06	1.9E-05	5.4E-05
Ni-59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni-63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Np-237	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Os-194	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pa-231	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb-202	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb-210	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pd-107	3.8E+07	5.3E+07	7.4E+07	1.0E+08	1.4E+08	1.8E+08	2.4E+08	3.2E+08	4.1E+08	5.3E+08	6.8E+08	1.1E+09	1.6E+09	2.5E+09	3.6E+09	5.1E+09	7.6E+09	1.1E+10	1.6E+10	2.2E+10	2.9E+10	3.8E+10
Pm-145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pm-147	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 41. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE--VERTICAL PATHRAE MODEL RESULTS FOR THE CLASS A SOUTH CELL SIDE SLOPE (0.286 CM/YR INFILTRATION)

NUCLIDE:	YEAR TO EXCEED:	1	3	6	9	12	15	18	21	24	27	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115
Po-208	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Po-209	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	680	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-236	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-238	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-239	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-240	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-241	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-242	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-244	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ra-226	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ra-228	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	195	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.1E-10	8.0E-09	3.0E-07	7.0E-06	1.1E-04	1.2E-03	9.6E-03	6.3E-02	3.4E-01	1.5E+00	5.8E+00	2.0E+01
Se-79	590	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Si-32	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sm-151	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sn-121m	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sn-126	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.9E-10	3.8E-08	2.1E-06	6.2E-05	1.1E-03	1.2E-02	9.6E-02	5.9E-01	2.8E+00	1.1E+01	3.8E+01	1.1E+02	2.9E+02	6.7E+02
Tb-157	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tb-158	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tc-99	160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.3E-11	1.7E-09	5.4E-08	1.1E-06	1.6E-05	1.8E-04	1.5E-03	1.0E-02	5.8E-02	2.8E-01
Te-123	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-229	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-230	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-232	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ti-44	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tl-204	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.6E-11	1.3E-10	3.6E-10
Tm-170	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-232	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-233	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-234	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-235	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-236	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-238	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V-50	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

NOTE: Year to exceed GWPL = Year to exceed GWPL reported to next lowest model output year. -1 indicates nuclide does not exceed GWPL in years modeled

TABLE 41. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE--VERTICAL PATHRAE MODEL RESULTS FOR THE CLASS A SOUTH CELL SIDE SLOPE (0.286 CM/YR INFILTRATION)

NUCLIDE	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225
Po-208	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Po-209	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-236	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-238	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-239	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-240	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-242	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ra-226	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ra-228	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	6.0E+01	1.7E+02	4.2E+02	9.8E+02	2.1E+03	4.3E+03	8.4E+03	1.5E+04	2.7E+04	4.5E+04	7.3E+04	1.1E+05	1.7E+05	2.6E+05	3.7E+05	5.1E+05	7.0E+05	9.4E+05	1.2E+06	1.6E+06	2.0E+06	2.5E+06
Se-79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Si-32	0	7.1E-11	1.4E-09	2.2E-08	2.9E-07	3.1E-06	2.9E-05	2.3E-04	1.6E-03	9.7E-03	5.4E-02	2.7E-01	1.2E+00	5.0E+00	1.9E+01	6.9E+01	2.3E+02	7.3E+02	2.2E+03	6.1E+03	1.6E+04	4.2E+04
Sm-151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sn-121m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sn-126	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	1.4E+03	2.8E+03	5.0E+03	8.6E+03	1.4E+04	2.1E+04	3.1E+04	4.3E+04	5.8E+04	7.5E+04	9.4E+04	1.2E+05	1.4E+05	1.6E+05	1.8E+05	2.0E+05	2.2E+05	2.4E+05	2.5E+05	2.6E+05	2.6E+05	2.6E+05
Tb-157	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tb-158	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tc-99	1.2E+00	4.4E+00	1.5E+01	4.4E+01	1.2E+02	3.2E+02	7.6E+02	1.7E+03	3.6E+03	7.3E+03	1.4E+04	2.6E+04	4.6E+04	7.8E+04	1.3E+05	2.1E+05	3.2E+05	4.9E+05	7.2E+05	1.0E+06	1.5E+06	2.0E+06
Te-123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-229	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-232	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ti-44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tl-204	8.7E-10	1.8E-09	3.3E-09	5.3E-09	7.7E-09	1.0E-08	1.2E-08	1.4E-08	1.4E-08	1.4E-08	1.3E-08	1.2E-08	9.7E-09	7.8E-09	6.0E-09	4.4E-09	3.2E-09	2.2E-09	1.5E-09	9.6E-10	6.1E-10	3.8E-10
Tm-170	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-232	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-233	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-234	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-235	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-236	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-238	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V-50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 41. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE--VERTICAL PATHRAE MODEL RESULTS FOR THE CLASS A SOUTH CELL SIDE SLOPE (0.286 CM/YR INFILTRATION)

NUCLIDE	230	235	240	245	250	255	260	265	270	275	280	285	290	295	300	310	320	330	340	350	360	370
Po-208	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Po-209	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8.0E-11	6.8E-10	5.0E-09	3.2E-08	1.9E-07	9.6E-07	4.5E-06
Pu-236	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-238	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-239	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-240	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-242	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ra-226	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ra-228	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	3.1E+06	3.7E+06	4.4E+06	5.2E+06	6.1E+06	7.0E+06	7.9E+06	8.9E+06	9.9E+06	1.1E+07	1.2E+07	1.3E+07	1.4E+07	1.5E+07	1.6E+07	1.7E+07	1.8E+07	1.9E+07	1.9E+07	1.9E+07	1.9E+07	1.8E+07
Se-79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.3E-11	3.8E-10	2.5E-09
Si-32	1.0E+05	2.4E+05	5.4E+05	1.2E+06	2.5E+06	5.1E+06	1.0E+07	1.9E+07	3.7E+07	6.7E+07	1.2E+08	2.1E+08	3.6E+08	6.0E+08	9.8E+08	2.5E+09	6.0E+09	1.3E+10	2.9E+10	5.8E+10	1.1E+11	2.1E+11
Sm-151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sn-121m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sn-126	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	2.6E+05	2.5E+05	2.4E+05	2.3E+05	2.2E+05	2.1E+05	1.9E+05	1.7E+05	1.6E+05	1.4E+05	1.3E+05	1.1E+05	9.8E+04	8.6E+04	7.4E+04	5.5E+04	4.0E+04	2.8E+04	1.9E+04	1.3E+04	8.9E+03	5.9E+03
Tb-157	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tb-158	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tc-99	2.8E+06	3.7E+06	4.9E+06	6.3E+06	8.1E+06	1.0E+07	1.3E+07	1.6E+07	1.9E+07	2.3E+07	2.7E+07	3.2E+07	3.7E+07	4.3E+07	5.0E+07	6.4E+07	8.0E+07	9.8E+07	1.2E+08	1.3E+08	1.5E+08	1.7E+08
Te-123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-229	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-232	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ti-44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tl-204	2.3E-10	1.4E-10	8.0E-11	4.5E-11	2.6E-11	1.4E-11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tm-170	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-232	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-233	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-234	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-235	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-236	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-238	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V-50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 41. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE--VERTICAL PATHRAE MODEL RESULTS FOR THE CLASS A SOUTH CELL SIDE SLOPE (0.286 CM/YR INFILTRATION)

NUCLIDE	380	390	400	410	420	430	440	450	460	470	480	490	500	510	520	530	540	550	560	570	580	590
Po-208	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Po-209	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	1.9E-05	7.6E-05	2.8E-04	9.3E-04	3.0E-03	8.8E-03	2.5E-02	6.6E-02	1.7E-01	4.1E-01	9.4E-01	2.1E+00	4.5E+00	9.2E+00	1.8E+01	3.5E+01	6.6E+01	1.2E+02	2.1E+02	3.6E+02	6.1E+02	9.9E+02
Pu-236	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-238	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-239	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-240	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-242	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ra-226	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ra-228	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	1.7E+07	1.6E+07	1.5E+07	1.3E+07	1.2E+07	1.0E+07	9.2E+06	8.0E+06	6.9E+06	5.9E+06	5.0E+06	4.2E+06	3.5E+06	2.9E+06	2.4E+06	2.0E+06	1.6E+06	1.3E+06	1.0E+06	8.4E+05	6.8E+05	5.4E+05
Se-79	1.4E-08	7.6E-08	3.7E-07	1.7E-06	7.1E-06	2.8E-05	1.0E-04	3.5E-04	1.2E-03	3.6E-03	1.1E-02	3.0E-02	8.2E-02	2.1E-01	5.4E-01	1.3E+00	3.0E+00	6.9E+00	1.5E+01	3.2E+01	6.7E+01	1.3E+02
Si-32	3.7E+11	6.3E+11	1.0E+12	1.7E+12	2.6E+12	4.0E+12	5.9E+12	8.6E+12	1.2E+13	1.7E+13	2.3E+13	3.1E+13	4.1E+13	5.3E+13	6.8E+13	8.6E+13	1.1E+14	1.3E+14	1.6E+14	1.9E+14	2.3E+14	2.7E+14
Sm-151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sn-121m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sn-126	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	3.9E+03	2.5E+03	1.6E+03	1.0E+03	6.3E+02	3.9E+02	2.4E+02	1.5E+02	9.1E+01	5.5E+01	3.3E+01	2.0E+01	1.2E+01	6.9E+00	4.1E+00	2.4E+00	1.4E+00	8.1E-01	4.7E-01	2.7E-01	1.6E-01	9.0E-02
Tb-157	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tb-158	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tc-99	1.8E+08	2.0E+08	2.1E+08	2.1E+08	2.2E+08	2.2E+08	2.2E+08	2.1E+08	2.1E+08	2.0E+08	1.9E+08	1.8E+08	1.6E+08	1.5E+08	1.4E+08	1.3E+08	1.1E+08	1.0E+08	9.2E+07	8.1E+07	7.2E+07	6.3E+07
Te-123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.2E-11	3.0E-11
Th-229	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-232	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ti-44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tl-204	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tm-170	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-232	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-233	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-234	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-235	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-236	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-238	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V-50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 41. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE--VERTICAL PATHRAE MODEL RESULTS FOR THE CLASS A SOUTH CELL SIDE SLOPE (0.286 CM/YR INFILTRATION)

NUCLIDE	600	610	620	630	640	650	660	670	680	690	700	720	740	760	780	800	825	850	875	900	925	950
Po-208	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Po-209	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	1.6E+03	2.5E+03	3.8E+03	5.8E+03	8.5E+03	1.2E+04	1.8E+04	2.5E+04	3.5E+04	4.7E+04	6.3E+04	1.1E+05	1.8E+05	2.9E+05	4.4E+05	6.5E+05	9.9E+05	1.4E+06	2.0E+06	2.6E+06	3.4E+06	4.2E+06
Pu-236	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-238	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-239	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-240	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-242	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ra-226	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ra-228	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	4.3E+05	3.4E+05	2.7E+05	2.1E+05	1.7E+05	1.3E+05	1.0E+05	7.9E+04	6.2E+04	4.8E+04	3.7E+04	2.2E+04	1.3E+04	7.7E+03	4.5E+03	2.6E+03	1.3E+03	6.5E+02	3.2E+02	1.6E+02	7.8E+01	3.8E+01
Se-79	2.7E+02	5.1E+02	9.7E+02	1.8E+03	3.2E+03	5.7E+03	9.9E+03	1.7E+04	2.9E+04	4.7E+04	7.7E+04	2.0E+05	4.7E+05	1.1E+06	2.4E+06	5.0E+06	1.2E+07	2.7E+07	5.7E+07	1.2E+08	2.3E+08	4.3E+08
Si-32	3.1E+14	3.6E+14	4.1E+14	4.7E+14	5.3E+14	5.9E+14	6.5E+14	7.2E+14	7.9E+14	8.6E+14	9.4E+14	1.1E+15	1.2E+15	1.3E+15	1.5E+15	1.6E+15	1.7E+15	1.7E+15	1.7E+15	1.7E+15	1.7E+15	1.6E+15
Sm-151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.5E-11	1.0E-10	6.1E-10	3.2E-09	1.5E-08	6.6E-08
Sn-121m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sn-126	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	5.2E-02	3.0E-02	1.7E-02	9.6E-03	5.4E-03	3.1E-03	1.7E-03	9.8E-04	5.5E-04	3.1E-04	1.7E-04	5.5E-05	1.7E-05	5.3E-06	1.6E-06	5.0E-07	1.1E-07	2.6E-08	5.8E-09	1.3E-09	2.9E-10	6.4E-11
Tb-157	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tb-158	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tc-99	5.5E+07	4.8E+07	4.2E+07	3.6E+07	3.1E+07	2.6E+07	2.2E+07	1.9E+07	1.6E+07	1.4E+07	1.2E+07	8.1E+06	5.6E+06	3.9E+06	2.7E+06	1.8E+06	1.1E+06	6.6E+05	4.0E+05	2.4E+05	1.4E+05	8.1E+04
Te-123	7.1E-11	1.6E-10	3.6E-10	7.7E-10	1.6E-09	3.4E-09	6.8E-09	1.3E-08	2.6E-08	4.8E-08	9.0E-08	2.9E-07	8.9E-07	2.6E-06	6.9E-06	1.8E-05	5.4E-05	1.5E-04	4.1E-04	1.0E-03	2.4E-03	5.5E-03
Th-229	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-232	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ti-44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tl-204	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tm-170	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-232	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-233	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-234	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-235	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-236	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-238	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V-50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 43.

PEAK RADIONUCLIDE CONCENTRATIONS AND TIME TO EXCEED GWPL AT THE WATER TABLE VERTICAL PATHRAE RESULTS FOR CLASS A SOUTH CELL SIDE SLOPE (0.595 CM/YR INFILTRATION)

NUCLIDE	TIME TO EXCEED (Year)	PEAK CONCENTRATION (Ci/m^3)	PEAK CONCENTRATION (pCi/L)	PEAK YEAR
Ac-227	-1	0		---
Ag-108m	680	3.7E+04	3.7E+13	2,656.2
Al-26	-1	0		> 10,000
Am-241	390	4.1E-03	4.1E+06	1,255.0
Am-242m	410	2.0E-05	2.0E+04	999.8
Am-243	410	4.2E-03	4.2E+06	1,237.4
Ba-133	-1	0		> 10,000
Be-10	740	4.3E+03	4.3E+12	2,991.8
Bi-207	290	1.8E-01	1.8E+08	640.6
Bi-210m	300	2.7E+02	2.7E+11	1,243.3
Bk-247	70	6.3E-10	6.3E-01	79.5
C-14	-1	1.3E-01	1.3E+08	9,529.4
Ca-41	110	5.6E-06	5.6E+03	136.6
Cd-113	780	2.0E-07	2.0E+02	1,243.3
Cd-113m	330	3.4E-07	3.4E+02	460.7
Cf-249	780	3.1E-05	3.1E+04	2,023.7
Cf-250	-1	0		---
Cf-251	740	4.0E-04	4.0E+05	2,239.8
Cf-252	-1	0		---
Cl-36	75	1.9E-06	1.9E+03	81.4
Cm-243	-1	0		> 10,000
Cm-244	-1	0		> 10,000
Cm-245	-1	0		> 10,000
Cm-246	-1	0		> 10,000
Cm-247	-1	0		> 10,000
Cm-248	-1	0		> 10,000
Co-60	-1	0		> 10,000
Cs-135	-1	0		> 10,000
Cs-137	-1	0		> 10,000
Eu-152	-1	0		---
Eu-154	-1	0		---
Eu-155	-1	0		---
Fe-55	-1	0		---
Fe-60	380	1.4E+03	1.4E+12	1,708.2
Gd-148	-1	2.4E-10	2.4E-01	2,646.9
H-3	45	2.3E-01	2.3E+08	98.5
Hg-194	-1	0		> 10,000
Ho-166m	660	6.6E+04	6.6E+13	2,794.6
I-129	140	1.8E-07	1.8E+02	218
K-40	125	1.0E-04	1.0E+05	253.1
Ks-20	-1	3.9E-11	3.9E-02	32
Ks-21	-1	2.2E-12	2.2E-03	34.2
Ks-22	-1	0		---
Ks-23	-1	0		---
Ks-24	-1	0		> 10,000
Ks-25	-1	0		> 10,000
Ks-26	-1	0		---
Mn-53	-1	1.4E+02	1.4E+11	7,530.2
Na-22	-1	0		---
Nb-91	410	2.6E+05	2.6E+14	1,796.7
Nb-92	550	3.4E+01	3.4E+10	1,940.5
Nb-93m	-1	1.1E-10	1.1E-01	625.5
Nb-94	780	3.6E-03	3.6E+06	1,937.4
Ni-59	-1	0		> 10,000
Ni-63	-1	0		> 10,000
Np-237	-1	3.3E-02	3.3E+07	5,086.6
Os-194	-1	0		---
Pa-231	-1	3.7E+03	3.7E+12	6,451.8
Pb-202	-1	0		> 10,000
Pb-210	-1	0		> 10,000
Pd-107	215	4.1E+02	4.1E+11	719.3
Pm-145	-1	0		---
Pm-147	-1	0		---
Po-208	-1	0		---
Po-209	-1	7.2E-11	7.2E-02	3,638.3
Pt-193	275	9.7E+01	9.7E+10	708.3
Pu-236	-1	0		> 10,000
Pu-238	-1	0		> 10,000
Pu-239	-1	0		> 10,000
Pu-240	-1	0		> 10,000
Pu-241	-1	0		> 10,000
Pu-242	-1	0		> 10,000
Pu-244	-1	0		> 10,000
Ra-226	-1	0		> 10,000
Ra-228	-1	0		> 10,000
Re-187	-1	3.6E-06	3.6E+03	165.6
Se-79	280	3.2E+04	3.2E+13	1,241.3
Si-32	95	1.2E+07	1.2E+16	449.9
Sm-151	760	4.5E-01	4.5E+08	1,618.5
Sn-121m	-1	0		> 10,000
Sn-126	-1	0		> 10,000
Sr-90	60	1.5E-05	1.5E+04	120.8
Tb-157	-1	3.3E-11	3.3E-02	2,587.8
Tb-158	-1	2.7E-03	2.7E+06	3,816.1
Tc-99	155	8.2E-06	8.2E+03	206.6
Te-123	740	1.1E-04	1.1E+05	1,533.8
Th-229	-1	0		> 10,000
Th-230	-1	0		> 10,000
Th-232	-1	0		> 10,000
Ti-44	-1	0		> 10,000
Tl-204	-1	8.2E-10	8.2E-01	106.7
Tm-170	-1	0		---
U-232	-1	1.8E-10	1.8E-01	2,444.8
U-233	-1	6.0E-03	6.0E+06	7,053.3
U-234	-1	5.0E+02	5.0E+11	7,064.7
U-235	-1	1.6E-04	1.6E+05	7,064.7
U-236	-1	5.3E+00	5.3E+09	7,064.7
U-238	-1	2.8E-02	2.8E+07	7,064.7
V-50	-1	0		> 10,000
Zr-93	-1	0		> 10,000

NOTES: -1 indicates that nuclide did not exceed standard within the 1,000 years modeled

— indicates that concentrations do not peak at the water table within 10,000 yrs

TABLE 44. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE--VERTICAL PATHRAE MODEL RESULTS FOR THE CLASS A SOUTH CELL SIDE SLOPE (0.595 CM/YR INFILTRATION)

NUCLIDE:	YEAR TO EXCEED:	1	3	6	9	12	15	18	21	24	27	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120
Ac-227	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ag-108m	680	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Al-26	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-241	390	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-242m	410	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-243	410	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ba-133	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Be-10	740	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	290	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-210m	300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bk-247	70	0	0	0	0	0	0	0	0	0	0	7.7E-06	0.00022	0.0025	0.014	0.05	1.3E-01	2.5E-01	3.9E-01	5.2E-01	6.0E-01	6.3E-01	6.0E-01	5.2E-01	4.3E-01	3.4E-01	2.5E-01	1.8E-01	1.3E-01	8.6E-02
C-14	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ca-41	110	0	0	0	0	0	0	0	0	0	0	2.1E-09	1E-06	0.0001	0.0033	0.049	0.43	2.5	10	34	92	210	420	7.4E+02	1.2E+03	1.8E+03	2.5E+03	3.2E+03	3.9E+03	4.6E+03
Cd-113	780	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cd-113m	330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-249	780	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-250	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-251	740	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-252	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cl-36	75	0	0	0	0	0	0	0	0	0	0	0.014	0.43	5.1	31	1.2E+02	3.2E+02	6.4E+02	1.1E+03	1.5E+03	1.8E+03	1.9E+03	1.9E+03	1.7E+03	1.4E+03	1.2E+03	8.9E+02	6.6E+02	4.7E+02	3.3E+02
Cm-243	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-244	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-245	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-246	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-247	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-248	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Co-60	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cs-135	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cs-137	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-152	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-154	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-155	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-55	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-60	380	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gd-148	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	45	0	0	0	0	0	0	0	0	0	0	0.29	61	2900	51000	440000	2300000	8300000	2.2E+07	4.7E+07	8.3E+07	1.3E+08	1.7E+08	2.0E+08	2.3E+08	2.3E+08	2.2E+08	1.9E+08	1.6E+08	1.3E+08
Hg-194	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ho-166m	660	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I-129	140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7.1E-10	2.9E-08	6.1E-07	7.9E-06	6.9E-05	0.00043	0.0021	0.0084	0.028	0.08	0.2	0.46	0.95	1.8	3.2
K-40	125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.4E-10	5E-08	1.8E-06	3.7E-05	0.00047	0.0042	0.028	0.15	0.63	2.3	7	19	47	110	220
Ks-20	-1	0	0	0	0	0	0	0	0	0	0	0.035	0.032	0.011	0.002	0.00022	1.8E-05	1.1E-06	5.3E-08	2.2E-09	8E-11	0	0	0	0	0	0	0	0	0
Ks-21	-1	0	0	0	0	0	0	0	0	0	0	0.0014	0.0022	0.0011	0.00029	4.4E-05	4.5E-06	3.5E-07	2.2E-08	1.1E-09	5E-11	0	0	0	0	0	0	0	0	0
Ks-22	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-23	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-24	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-25	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-26	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mn-53	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Na-22	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-91	410	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-92	550	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-93m	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-94	780	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni-59	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni-63	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Np-237	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Os-194	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pa-231	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb-202	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb-210	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pd-107	215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.4E-10	4.5E-09	6.6E-08	7.8E-07
Pm-145	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pm-147	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 44. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE--VERTICAL PATHRAE MODEL RESULTS FOR THE CLASS A SOUTH CELL SIDE SLOPE (0.595 CM/YR INFILTRATION)

NUCLIDE	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230
Ac-227	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ag-108m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Al-26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.9E-11	7.2E-11	2.6E-10	8.8E-10	2.8E-09	8.6E-09
Am-242m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.6E-11	8.8E-11	2.8E-10	8.3E-10
Am-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2E-11	7.4E-11	2.5E-10	8.2E-10	2.5E-09
Ba-133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Be-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	8.4E-11	7.1E-10	5.2E-09	3.4E-08	2E-07	0.000001	4.9E-06	0.000021	0.000086	0.00032	0.0011	0.0036	0.011	0.032	0.089
Bi-210m	0	0	0	0	0	0	0	0	0	0	1.7E-11	1.1E-10	6.3E-10	3.3E-09	1.6E-08	7.3E-08	3E-07	1.2E-06	4.3E-06	0.000015	0.000048	0.00015
Bk-247	5.7E-02	3.7E-02	2.3E-02	1.5E-02	8.9E-03	5.4E-03	3.2E-03	1.9E-03	1.1E-03	6.5E-04	3.7E-04	2.1E-04	1.2E-04	6.9E-05	3.9E-05	2.2E-05	1.2E-05	6.6E-06	3.7E-06	2.0E-06	1.1E-06	6.0E-07
C-14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ca-41	5.1E+03	5.4E+03	5.6E+03	5.6E+03	5.4E+03	5.0E+03	4.6E+03	4.2E+03	3.7E+03	3.2E+03	2.7E+03	2.2E+03	1.9E+03	1.5E+03	1.2E+03	9.7E+02	7.7E+02	6.0E+02	4.7E+02	3.6E+02	2.8E+02	2.1E+02
Cd-113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cd-113m	0	0	0	0	0	0	0	0	3.3E-11	2.1E-10	1.2E-09	6.1E-09	2.8E-08	1.2E-07	4.4E-07	1.5E-06	0.000005	0.000015	0.000044	0.00012	0.0003	0.00071
Cf-249	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-251	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-252	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cl-36	2.2E+02	1.5E+02	9.4E+01	6.0E+01	3.8E+01	2.3E+01	1.4E+01	8.5E+00	5.1E+00	3.0E+00	1.8E+00	1.0E+00	6.0E-01	3.4E-01	2.0E-01	1.1E-01	6.3E-02	3.6E-02	2.0E-02	1.1E-02	6.2E-03	3.5E-03
Cm-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-246	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-247	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-248	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Co-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cs-135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cs-137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gd-148	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	1.0E+08	7.5E+07	5.3E+07	3.7E+07	2.5E+07	1.7E+07	1.1E+07	6.7E+06	4.2E+06	2.6E+06	1.5E+06	9.2E+05	5.4E+05	3.1E+05	1.8E+05	1.0E+05	5.8E+04	3.3E+04	1.8E+04	1.0E+04	5.5E+03	3.0E+03
Hg-194	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ho-166m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I-129	5.4	8.6	13	19	26	35	46	58	71	86	100	1.1E+02	1.3E+02	1.4E+02	1.5E+02	1.6E+02	1.7E+02	1.7E+02	1.8E+02	1.8E+02	1.8E+02	1.7E+02
K-40	420	750	1300	2100	3200	4800	6900	9600	13000	17000	22000	27000	3.3E+04	4.0E+04	4.7E+04	5.4E+04	6.1E+04	6.8E+04	7.5E+04	8.2E+04	8.8E+04	9.3E+04
Ks-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mn-53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Na-22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-93m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni-59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni-63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Np-237	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Os-194	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pa-231	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb-202	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb-210	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pd-107	7.4E-06	0.00006	0.00041	0.0024	0.013	0.059	0.25	0.94	3.3	11	32	92	240	620	1500	3400	7500	16000	32000	63000	120000	220000
Pm-145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pm-147	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 44. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE--VERTICAL PATHRAE MODEL RESULTS FOR THE CLASS A SOUTH CELL SIDE SLOPE (0.595 CM/YR INFILTRATION)

NUCLIDE	235	240	245	250	255	260	265	270	275	280	285	290	295	300	310	320	330	340	350	360	370	380
Ac-227	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ag-108m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Al-26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-241	2.5E-08	6.9E-08	1.8E-07	4.7E-07	1.1E-06	2.7E-06	6.2E-06	0.000014	0.000029	0.000061	0.00012	0.00025	0.00047	0.00089	0.003	0.0091	0.026	0.069	0.17	0.41	0.92	2
Am-242m	2.4E-09	6.5E-09	1.7E-08	4.2E-08	1E-07	2.4E-07	5.3E-07	1.2E-06	2.4E-06	0.000005	0.00001	0.000019	0.000037	0.000068	0.00022	0.00065	0.0018	0.0046	0.011	0.026	0.056	0.12
Am-243	7.4E-09	2.1E-08	5.5E-08	1.4E-07	3.5E-07	8.3E-07	1.9E-06	4.3E-06	9.2E-06	0.000019	0.000039	0.000079	0.00015	0.00029	0.00098	0.003	0.0088	0.024	0.06	0.15	0.33	0.72
Ba-133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Be-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	0.23	0.58	1.4	3.2	7.1	15	31	63	120	230	420	750	1300	2200	6000	15000	35000	76000	160000	300000	550000	960000
Bi-210m	0.00043	0.0012	0.0032	0.0082	0.02	0.048	0.11	0.25	0.54	1.1	2.3	4.6	8.9	17	57	180	510	1400	3500	8500	19000	42000
Bk-247	3.3E-07	1.8E-07	9.6E-08	5.2E-08	2.8E-08	1.5E-08	8.0E-09	4.3E-09	2.3E-09	1.2E-09	6.5E-10	3.5E-10	1.9E-10	9.8E-11	2.8E-11	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
C-14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ca-41	1.6E+02	1.2E+02	8.9E+01	6.6E+01	4.9E+01	3.6E+01	2.6E+01	1.9E+01	1.4E+01	1.0E+01	7.4E+00	5.3E+00	3.8E+00	2.8E+00	1.4E+00	7.1E-01	3.6E-01	1.8E-01	8.8E-02	4.3E-02	2.1E-02	1.0E-02
Cd-113	0	0	0	0	1.5E-11	3.7E-11	8.4E-11	1.9E-10	4.1E-10	8.5E-10	1.7E-09	3.5E-09	6.8E-09	1.3E-08	4.3E-08	1.3E-07	3.9E-07	1.1E-06	2.7E-06	6.5E-06	0.000015	0.000032
Cd-113m	0.0016	0.0036	0.0074	0.015	0.029	0.054	0.097	0.17	0.29	0.47	0.75	1.2	1.8	2.6	5.4	10	18	30	47	69	97	130
Cf-249	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-251	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-252	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cl-36	1.9E-03	1.1E-03	5.8E-04	3.2E-04	1.8E-04	9.6E-05	5.2E-05	2.8E-05	1.5E-05	8.4E-06	4.6E-06	2.5E-06	1.3E-06	7.2E-07	2.1E-07	6.0E-08	1.7E-08	5.0E-09	1.4E-09	4.1E-10	1.2E-10	3.3E-11
Cm-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-246	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-247	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-248	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Co-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cs-135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cs-137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-60	1.8E-11	7.7E-11	3.1E-10	1.1E-09	4.1E-09	1.4E-08	4.4E-08	1.4E-07	4E-07	1.1E-06	3.1E-06	8.2E-06	0.000021	0.000052	0.00029	0.0014	0.0065	0.027	0.1	0.35	1.2	3.5
Gd-148	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	1.6E+03	8.8E+02	4.7E+02	2.5E+02	1.3E+02	7.1E+01	3.8E+01	2.0E+01	1.0E+01	5.5E+00	2.9E+00	1.5E+00	7.8E-01	4.0E-01	1.1E-01	2.9E-02	7.5E-03	2.0E-03	5.1E-04	1.3E-04	3.4E-05	8.7E-06
Hg-194	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ho-166m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.5E-11
I-129	1.7E+02	1.6E+02	1.5E+02	1.4E+02	1.3E+02	1.2E+02	1.1E+02	1.0E+02	9.2E+01	8.3E+01	7.4E+01	6.6E+01	5.8E+01	5.1E+01	3.9E+01	2.9E+01	2.2E+01	1.6E+01	1.1E+01	8.0E+00	5.7E+00	3.9E+00
K-40	9.7E+04	1.0E+05	1.0E+05	1.0E+05	1.0E+05	1.0E+05	1.0E+05	9.8E+04	9.5E+04	9.1E+04	8.7E+04	8.2E+04	7.7E+04	7.2E+04	6.2E+04	5.3E+04	4.3E+04	3.5E+04	2.8E+04	2.2E+04	1.7E+04	1.3E+04
Ks-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mn-53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Na-22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-91	0	0	3.9E-11	1.7E-10	7.3E-10	2.9E-09	1.1E-08	3.9E-08	1.3E-07	4.4E-07	1.4E-06	4.2E-06	0.000012	0.000034	0.00024	0.0015	0.0083	0.041	0.19	0.79	3	11
Nb-92	0	0	0	0	0	0	0	0	0	1.1E-11	3.6E-11	1.1E-10	3.2E-10	8.9E-10	6.4E-09	4E-08	2.3E-07	1.1E-06	5.2E-06	0.000022	0.000086	0.00031
Nb-93m	0	0	0	0	0	0	0	2.1E-11	5.9E-11	1.6E-10	4E-10	9.7E-10	2.3E-09	5.2E-09	2.4E-08	9.8E-08	3.6E-07	1.2E-06	3.5E-06	9.6E-06	0.000024	0.000057
Nb-94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.6E-11	1.3E-10	6E-10	2.5E-09	9.8E-09	3.5E-08
Ni-59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni-63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Np-237	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Os-194	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pa-231	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb-202	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb-210	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pd-107	390000	680000	1100000	1900000	3100000	4900000	7600000	12000000	17000000	26000000	37000000	53000000	75000000	1E+08	1.9E+08	3.4E+08	5.9E+08	9.6E+08	1.5E+09	2.3E+09	3.5E+09	5E+09
Pm-145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pm-147	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 44. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE--VERTICAL PATHRAE MODEL RESULTS FOR THE CLASS A SOUTH CELL SIDE SLOPE (0.595 CM/YR INFILTRATION)

NUCLIDE	390	400	410	420	430	440	450	460	470	480	490	500	510	520	530	540	550	560	570	580	590	600
Ac-227	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ag-108m	0	2.2E-11	1.4E-10	8E-10	4.2E-09	2.1E-08	9.6E-08	4.1E-07	1.6E-06	6.2E-06	0.000022	0.000075	0.00024	0.00075	0.0022	0.0062	0.017	0.044	0.11	0.27	0.65	1.5
Al-26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-241	4	8	15	28	49	85	140	230	370	570	870	1300	1900	2700	3900	5400	7300	9900	13000	17000	23000	29000
Am-242m	0.23	0.44	0.8	1.4	2.4	4.1	6.6	10	16	24	36	51	73	100	140	190	250	320	410	530	660	820
Am-243	1.5	3	5.8	11	19	34	58	96	150	240	380	570	850	1200	1800	2500	3500	4800	6500	8600	11000	15000
Ba-133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Be-10	0	0	5.3E-11	2.7E-10	1.3E-09	5.8E-09	2.4E-08	9.3E-08	3.4E-07	1.2E-06	3.9E-06	0.000012	0.000037	0.00011	0.00029	0.00078	0.002	0.0049	0.012	0.027	0.061	0.13
Bi-207	1600000	2600000	4000000	6000000	8700000	12000000	17000000	22000000	29000000	37000000	46000000	56000000	66000000	78000000	90000000	1E+08	1.1E+08	1.2E+08	1.4E+08	1.5E+08	1.5E+08	1.6E+08
Bi-210m	88000	180000	340000	640000	1100000	2000000	3400000	5700000	9200000	14000000	22000000	34000000	51000000	74000000	1.1E+08	1.5E+08	2.1E+08	2.9E+08	3.9E+08	5.2E+08	6.8E+08	8.9E+08
Bk-247	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
C-14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ca-41	5.0E-03	2.4E-03	1.2E-03	5.6E-04	2.7E-04	1.3E-04	6.0E-05	2.9E-05	1.3E-05	6.3E-06	3.0E-06	1.4E-06	6.6E-07	3.1E-07	1.4E-07	6.7E-08	3.1E-08	1.5E-08	6.8E-09	3.1E-09	1.5E-09	6.7E-10
Cd-113	0.000067	0.00013	0.00026	0.00048	0.00087	0.0015	0.0026	0.0043	0.007	0.011	0.017	0.026	0.038	0.056	0.08	0.11	0.16	0.22	0.29	0.39	0.52	0.67
Cd-113m	170	200	240	270	300	320	330	340	340	320	310	280	260	230	200	180	150	130	100	85	68	54
Cf-249	0	0	0	3E-11	1E-10	3.3E-10	1E-09	2.9E-09	8E-09	2.1E-08	5.3E-08	1.3E-07	3E-07	6.9E-07	1.5E-06	3.2E-06	6.6E-06	0.000013	0.000026	0.000049	0.000091	0.00017
Cf-250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-251	0	0	1.4E-11	5E-11	1.7E-10	5.6E-10	1.7E-09	5E-09	1.4E-08	3.8E-08	9.6E-08	2.4E-07	5.6E-07	1.3E-06	2.9E-06	6.1E-06	0.000013	0.000026	0.000051	0.000099	0.00019	0.00034
Cf-252	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cl-36	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Cm-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-246	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-247	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-248	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Co-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cs-135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cs-137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-60	10	28	72	180	420	940	2100	4300	8800	17000	33000	61000	110000	190000	340000	560000	930000	1500000	2400000	3700000	5700000	8600000
Gd-148	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	2.2E-06	5.6E-07	1.4E-07	3.6E-08	9.0E-09	2.3E-09	5.7E-10	1.4E-10	3.5E-11	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Hg-194	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ho-166m	1E-10	6.1E-10	3.4E-09	1.7E-08	8.3E-08	3.7E-07	1.5E-06	5.9E-06	0.000021	0.000074	0.00024	0.00076	0.0023	0.0064	0.018	0.046	0.12	0.29	0.69	1.6	3.5	7.7
I-129	2.7E+00	1.9E+00	1.3E+00	8.6E-01	5.7E-01	3.8E-01	2.5E-01	1.7E-01	1.1E-01	7.2E-02	4.7E-02	3.1E-02	2.0E-02	1.3E-02	8.2E-03	5.3E-03	3.4E-03	2.2E-03	1.4E-03	8.7E-04	5.5E-04	3.5E-04
K-40	1.0E+04	7.8E+03	5.8E+03	4.3E+03	3.2E+03	2.3E+03	1.7E+03	1.2E+03	8.7E+02	6.2E+02	4.4E+02	3.1E+02	2.2E+02	1.6E+02	1.1E+02	7.6E+01	5.3E+01	3.6E+01	2.5E+01	1.7E+01	1.2E+01	8.1E+00
Ks-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mn-53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Na-22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-91	36	110	330	940	2500	6300	15000	36000	80000	170000	360000	740000	1400000	2800000	5200000	9400000	17000000	29000000	49000000	81000000	1.3E+08	2.1E+08
Nb-92	0.001	0.0033	0.0099	0.028	0.075	0.19	0.47	1.1	2.5	5.5	12	24	47	91	170	320	560	990	1700	2800	4700	7600
Nb-93m	0.00013	0.00026	0.0005	0.00092	0.0016	0.0027	0.0043	0.0065	0.0096	0.014	0.019	0.025	0.032	0.041	0.05	0.059	0.069	0.078	0.087	0.095	0.1	0.11
Nb-94	1.2E-07	3.8E-07	1.1E-06	3.2E-06	8.6E-06	0.000022	0.000054	0.00013	0.00029	0.00063	0.0013	0.0027	0.0054	0.01	0.02	0.036	0.064	0.11	0.19	0.32	0.53	0.86
Ni-59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni-63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Np-237	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Os-194	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pa-231	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb-202	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb-210	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pd-107	7.1E+09	9.8E+09	1.3E+10	1.7E+10	2.3E+10	2.9E+10	3.6E+10	4.5E+10	5.5E+10	6.6E+10	7.9E+10	9.3E+10	1.1E+11	1.2E+11	1.4E+11	1.6E+11	1.8E+11	2.0E+11	2.2E+11	2.4E+11	2.6E+11	2.8E+11
Pm-145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pm-147	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 44. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE--VERTICAL PATHRAE MODEL RESULTS FOR THE CLASS A SOUTH CELL SIDE SLOPE (0.595 CM/YR INFILTRATION)

NUCLIDE	610	620	630	640	650	660	670	680	690	700	720	740	760	780	800	825	850	875	900	925	950
Ac-227	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ag-108m	3.3	7.2	15	31	63	120	240	450	840	1500	4800	14000	39000	100000	250000	720000	1900000	4900000	12000000	27000000	57000000
Al-26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-241	37000	46000	57000	71000	86000	100000	130000	150000	180000	210000	280000	370000	470000	590000	730000	930000	1200000	1400000	1600000	1900000	2200000
Am-242m	1000	1200	1500	1800	2100	2400	2800	3200	3700	4200	5300	6500	7900	9300	11000	13000	14000	16000	17000	18000	19000
Am-243	19000	24000	31000	38000	48000	58000	71000	86000	100000	120000	170000	230000	310000	400000	510000	670000	860000	1100000	1300000	1600000	1900000
Ba-133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Be-10	0.28	0.59	1.2	2.4	4.6	8.7	16	29	53	93	270	760	2000	4900	12000	32000	83000	200000	460000	1000000	2100000
Bi-207	1.7E+08	1.7E+08	1.7E+08	1.7E+08	1.7E+08	1.7E+08	1.7E+08	1.6E+08	1.6E+08	1.5E+08	1.4E+08	1.2E+08	1E+08	86000000	70000000	54000000	40000000	29000000	21000000	14000000	9800000
Bi-210m	1.1E+09	1.5E+09	1.8E+09	2.3E+09	2.9E+09	3.5E+09	4.3E+09	5.2E+09	6.2E+09	7.4E+09	1E+10	1.4E+10	1.9E+10	2.4E+10	3.1E+10	4.1E+10	5.3E+10	6.6E+10	8.1E+10	9.8E+10	1.2E+11
Bk-247	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
C-14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ca-41	3.1E-10	1.4E-10	6.7E-11	3.1E-11	1.4E-11	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Cd-113	0.87	1.1	1.4	1.8	2.2	2.7	3.3	3.9	4.7	5.7	7.9	11	14	18	24	31	40	50	62	74	88
Cd-113m	43	34	26	20	15	11	8.4	6.2	4.6	3.3	1.7	0.89	0.44	0.21	0.1	0.04	0.015	0.0055	0.002	0.00069	0.00024
Cf-249	0.00029	0.00051	0.00088	0.0015	0.0024	0.0039	0.0063	0.0098	0.015	0.023	0.052	0.11	0.22	0.43	0.81	1.7	3.3	6.3	11	20	33
Cf-250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cf-251	0.00061	0.0011	0.0019	0.0032	0.0053	0.0087	0.014	0.022	0.035	0.054	0.12	0.27	0.56	1.1	2.1	4.6	9.3	18	34	60	100
Cf-252	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cl-36	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Cm-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-246	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-247	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cm-248	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Co-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cs-135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cs-137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eu-155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-60	13000000	19000000	27000000	39000000	54000000	76000000	1E+08	1.4E+08	1.9E+08	2.5E+08	4.4E+08	7.3E+08	1.2E+09	1.8E+09	2.8E+09	4.6E+09	7.2E+09	1.1E+10	1.6E+10	2.3E+10	3.3E+10
Gd-148	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0	0	0	0	0	0
Hg-194	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ho-166m	16	34	68	130	260	490	900	1600	2900	5100	15000	40000	100000	260000	600000	1600000	4100000	9900000	23000000	49000000	1E+08
I-129	2.2E-04	1.4E-04	8.7E-05	5.5E-05	3.4E-05	2.2E-05	1.3E-05	8.4E-06	5.3E-06	3.3E-06	1.3E-06	4.9E-07	1.9E-07	7.2E-08	2.7E-08	8.2E-09	2.4E-09	7.2E-10	2.1E-10	6.3E-11	1.9E-11
K-40	5.5E+00	3.8E+00	2.6E+00	1.7E+00	1.2E+00	8.0E-01	5.4E-01	3.6E-01	2.5E-01	1.6E-01	7.4E-02	3.3E-02	1.5E-02	6.6E-03	2.9E-03	1.0E-03	3.7E-04	1.3E-04	4.7E-05	1.7E-05	5.8E-06
Ks-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ks-26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mn-53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Na-22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-91	3.3E+08	5.2E+08	7.9E+08	1.2E+09	1.7E+09	2.5E+09	3.7E+09	5.2E+09	7.3E+09	1E+10	1.9E+10	3.4E+10	6E+10	1E+11	1.6E+11	2.8E+11	4.8E+11	7.8E+11	1.2E+12	1.9E+12	2.7E+12
Nb-92	12000	19000	29000	44000	66000	97000	140000	200000	290000	410000	770000	1400000	2500000	4300000	7100000	13000000	22000000	37000000	60000000	93000000	1.4E+08
Nb-93m	0.11	0.11	0.11	0.11	0.11	0.1	0.098	0.092	0.085	0.078	0.063	0.049	0.036	0.026	0.018	0.011	0.0067	0.0038	0.0021	0.0011	0.00057
Nb-94	1.4	2.1	3.3	5	7.5	11	16	23	33	46	87	160	280	480	800	1400	2500	4200	6700	10000	16000
Ni-59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni-63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Np-237	1.5E-11	3.7E-11	8.7E-11	2E-10	4.4E-10	9.6E-10	2E-09	4.2E-09	8.5E-09	1.7E-08	6.3E-08	2.2E-07	7E-07	2.1E-06	6.1E-06	0.000021	0.000067	0.0002	0.00056	0.0015	0.0037
Os-194	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pa-231	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.8E-11	1.3E-10	7.9E-10	4.5E-09
Pb-202	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb-210	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pd-107	3.0E+11	3.2E+11	3.4E+11	3.5E+11	3.7E+11	3.8E+11	3.9E+11	4.0E+11	4.0E+11	4.1E+11	4.1E+11	4.1E+11	4.0E+11	3.8E+11	3.6E+11	3.3E+11	2.9E+11	2.6E+11	2.2E+11	1.9E+11	1.6E+11
Pm-145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pm-147	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 44. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE--VERTICAL PATHRAE MODEL RESULTS FOR THE CLASS A SOUTH CELL SIDE SLOPE (0.595 CM/YR INFILTRATION)

NUCLIDE	YEAR TO EXCEED	1	3	6	9	12	15	18	21	24	27	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120
Po-208	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Po-209	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	275	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-236	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-238	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-239	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-240	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-241	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-242	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-244	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ra-226	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ra-228	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	-1	0	0	0	0	0	0	0	0	0	0	0	3.1E-10	8.7E-08	6.5E-06	0.00019	0.003	0.028	0.18	0.82	3	9.2	24	53	110	200	330	520	770	1100
Se-79	280	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Si-32	95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.7E-10	6.6E-08	1.1E-05	0.00085	0.039	1.1	22	310	3400	29000	200000	1100000	5700000
Sm-151	760	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sn-121m	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sn-126	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	60	0	0	0	0	0	0	0	0	0	0	6.1E-08	2.7E-05	0.0023	0.066	0.9	6.9	35	130	380	910	1800	3200	5100	7400	9700	12000	1.4E+04	1.5E+04	1.5E+04
Tb-157	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tb-158	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tc-99	155	0	0	0	0	0	0	0	0	0	0	0	0	1.6E-11	3.7E-09	2.8E-07	9.1E-06	0.00016	0.0018	0.014	0.076	0.33	1.2	3.7	9.8	23	49	96	170	300
Te-123	740	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-229	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-230	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-232	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ti-44	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tl-204	-1	0	0	0	0	0	0	0	0	0	0	0	0	2.3E-11	7.7E-09	6.5E-07	0.00002	0.00029	0.0024	0.012	0.044	0.12	0.25	0.42	0.6	0.74	0.81	0.8	0.71	0.59
Tm-170	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-232	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-233	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-234	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-235	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-236	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-238	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V-50	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

NOTE: Year to exceed GWPL = Year to exceed GWPL reported to next lowest model output year. -1 indicates nuclide does not exceed GWPL in years modeled

TABLE 44. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE--VERTICAL PATHRAE MODEL RESULTS FOR THE CLASS A SOUTH CELL SIDE SLOPE (0.595 CM/YR INFILTRATION)

NUCLIDE	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230
Po-208	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Po-209	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	2.1E-11	2.8E-10	3E-09	2.8E-08	2.3E-07	1.6E-06	9.9E-06	0.000055	0.00028	0.0013	0.0054	0.021	0.076	0.26	0.81	2.4	6.9	18	47
Pu-236	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-238	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-239	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-240	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-242	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ra-226	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ra-228	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	1.4E+03	1.8E+03	2.2E+03	2.6E+03	2.9E+03	3.2E+03	3.4E+03	3.6E+03	3.6E+03	3.6E+03	3.5E+03	3.3E+03	3.1E+03	2.9E+03	2.6E+03	2.4E+03	2.1E+03	1.8E+03	1.6E+03	1.4E+03	1.2E+03	9.8E+02
Se-79	0	0	0	0	0	0	0	0	3.4E-11	2.8E-10	2E-09	1.3E-08	7.6E-08	4.1E-07	0.000002	8.9E-06	0.000037	0.00014	0.00052	0.0018	0.0058	0.018
Si-32	2.4E+07	9.3E+07	3.2E+08	1E+09	2.8E+09	7.5E+09	1.9E+10	4.3E+10	9.4E+10	1.9E+11	3.8E+11	7.2E+11	1.3E+12	2.3E+12	3.9E+12	6.3E+12	1E+13	1.6E+13	2.3E+13	3.4E+13	5E+13	7E+13
Sm-151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sn-121m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sn-126	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	1.5E+04	1.4E+04	1.3E+04	1.2E+04	9.9E+03	8.2E+03	6.7E+03	5.3E+03	4.2E+03	3.2E+03	2.4E+03	1.8E+03	1.3E+03	9.4E+02	6.7E+02	4.8E+02	3.3E+02	2.3E+02	1.6E+02	1.1E+02	7.4E+01	5.0E+01
Tb-157	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tb-158	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tc-99	470	720	1000	1400	1900	2500	3100	3.8E+03	4.5E+03	5.2E+03	5.9E+03	6.6E+03	7.1E+03	7.5E+03	7.9E+03	8.1E+03	8.2E+03	8.2E+03	8.0E+03	7.8E+03	7.5E+03	7.1E+03
Te-123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-229	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-232	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ti-44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tl-204	0.45	0.33	0.22	0.14	0.089	0.053	0.03	0.017	0.0091	0.0048	0.0025	0.0012	0.0006	0.00029	0.00013	0.000062	0.000028	0.000013	5.6E-06	2.4E-06	0.000001	4.4E-07
Tm-170	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-232	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-233	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-234	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-235	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-236	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-238	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V-50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 44. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE--VERTICAL PATHRAE MODEL RESULTS FOR THE CLASS A SOUTH CELL SIDE SLOPE (0.595 CM/YR INFILTRATION)

NUCLIDE	235	240	245	250	255	260	265	270	275	280	285	290	295	300	310	320	330	340	350	360	370	380
Po-208	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Po-209	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	120	270	620	1300	2800	5800	11000	22000	41000	74000	130000	230000	380000	630000	1600000	3900000	8800000	19000000	37000000	71000000	1.3E+08	2.2E+08
Pu-236	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-238	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-239	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-240	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-242	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ra-226	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ra-228	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	8.2E+02	6.9E+02	5.7E+02	4.6E+02	3.8E+02	3.1E+02	2.5E+02	2.0E+02	1.6E+02	1.3E+02	1.0E+02	7.9E+01	6.2E+01	4.8E+01	2.9E+01	1.8E+01	1.0E+01	6.1E+00	3.6E+00	2.1E+00	1.2E+00	6.8E-01
Se-79	0.052	0.15	0.39	1	2.5	5.9	14	30	65	140	280	560	1100	2100	7000	22000	63000	170000	430000	1000000	2400000	5200000
Si-32	9.6E+13	1.3E+14	1.7E+14	2.3E+14	3E+14	3.8E+14	4.8E+14	5.9E+14	7.3E+14	8.9E+14	1.1E+15	1.3E+15	1.5E+15	1.8E+15	2.3E+15	3.0E+15	3.8E+15	4.6E+15	5.5E+15	6.5E+15	7.4E+15	8.3E+15
Sm-151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.3E-11
Sn-121m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sn-126	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	3.3E+01	2.2E+01	1.5E+01	9.7E+00	6.4E+00	4.2E+00	2.7E+00	1.8E+00	1.1E+00	7.3E-01	4.7E-01	3.0E-01	1.9E-01	1.2E-01	4.9E-02	1.9E-02	7.7E-03	3.0E-03	1.2E-03	4.5E-04	1.7E-04	6.7E-05
Tb-157	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tb-158	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tc-99	6.7E+03	6.2E+03	5.7E+03	5.3E+03	4.8E+03	4.3E+03	3.8E+03	3.4E+03	3.0E+03	2.6E+03	2.3E+03	2.0E+03	1.7E+03	1.5E+03	1.1E+03	7.8E+02	5.5E+02	3.9E+02	2.7E+02	1.8E+02	1.2E+02	8.2E+01
Te-123	0	0	0	0	0	0	0	0	1.2E-11	3.1E-11	7.7E-11	1.8E-10	4.2E-10	9.5E-10	4.4E-09	1.8E-08	7E-08	2.5E-07	8.1F-07	2.5E-06	0.000007	0.000019
Th-229	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-232	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ti-44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tl-204	1.8E-07	7.5E-08	3.1E-08	1.2E-08	5E-09	2E-09	7.7E-10	3E-10	1.2E-10	4.5E-11	1.7E-11	0	0	0	0	0	0	0	0	0	0	0
Tm-170	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-232	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-233	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-234	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-235	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-236	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-238	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V-50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 44. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE--VERTICAL PATHRAE MODEL RESULTS FOR THE CLASS A SOUTH CELL SIDE SLOPE (0.595 CM/YR INFILTRATION)

NUCLIDE	390	400	410	420	430	440	450	460	470	480	490	500	510	520	530	540	550	560	570	580	590	600
Po-208	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Po-209	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	3.7E+08	6E+08	9.4E+08	1.4E+09	2.1E+09	3E+09	4.1E+09	5.6E+09	7.4E+09	9.6E+09	1.2E+10	1.5E+10	1.9E+10	2.3E+10	2.7E+10	3.2E+10	3.7E+10	4.2E+10	4.8E+10	5.3E+10	5.9E+10	6.4E+10
Pu-236	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-238	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-239	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-240	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-242	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ra-226	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ra-228	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	3.8E-01	2.2E-01	1.2E-01	6.8E-02	3.8E-02	2.1E-02	1.2E-02	6.3E-03	3.5E-03	1.9E-03	1.0E-03	5.6E-04	3.0E-04	1.6E-04	8.9E-05	4.8E-05	2.6E-05	1.4E-05	7.4E-06	4.0E-06	2.1E-06	1.1E-06
Se-79	11000000	22000000	42000000	78000000	1.4E+08	2.5E+08	4.2E+08	6.9E+08	1.1E+09	1.8E+09	2.7E+09	4.1E+09	6.2E+09	9E+09	1.3E+10	1.8E+10	2.5E+10	3.5E+10	4.7E+10	6.3E+10	8.3E+10	1.1E+11
Si-32	9.2E+15	9.9E+15	1.1E+16	1.1E+16	1.1E+16	1.2E+16	1.2E+16	1.2E+16	1.2E+16	1.1E+16	1.1E+16	1.0E+16	9.7E+15	9.0E+15	8.4E+15	7.7E+15	7.0E+15	6.4E+15	5.7E+15	5.1E+15	4.5E+15	4.0E+15
Sm-151	3.8E-10	2.1E-09	1E-08	4.8E-08	2.1E-07	8.3E-07	3.1E-06	0.000011	0.000036	0.00011	0.00034	0.00095	0.0026	0.0067	0.017	0.04	0.094	0.21	0.46	0.96	2	3.9
Sn-121m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sn-126	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	2.5E-05	9.6E-06	3.6E-06	1.4E-06	5.2E-07	1.9E-07	7.2E-08	2.7E-08	1.0E-08	3.7E-09	1.4E-09	5.0E-10	1.9E-10	6.8E-11	2.5E-11	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Tb-157	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tb-158	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tc-99	5.5E+01	3.6E+01	2.4E+01	1.5E+01	1.0E+01	6.4E+00	4.1E+00	2.6E+00	1.7E+00	1.1E+00	6.7E-01	4.2E-01	2.6E-01	1.6E-01	1.0E-01	6.3E-02	3.9E-02	2.4E-02	1.5E-02	9.2E-03	5.7E-03	3.5E-03
Te-123	0.000049	0.00012	0.00027	0.00061	0.0013	0.0027	0.0053	0.01	0.019	0.035	0.061	0.11	0.18	0.29	0.47	0.74	1.2	1.8	2.6	3.9	5.6	8
Th-229	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-232	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ti-44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tl-204	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tm-170	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-232	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-233	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-234	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-235	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-236	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-238	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V-50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 44. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE--VERTICAL PATHRAE MODEL RESULTS FOR THE CLASS A SOUTH CELL SIDE SLOPE (0.595 CM/YR INFILTRATION)

NUCLIDE	610	620	630	640	650	660	670	680	690	700	720	740	760	780	800	825	850	875	900	925	950
Po-208	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Po-209	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	7E+10	7.4E+10	7.9E+10	8.3E+10	8.7E+10	9E+10	9.3E+10	9.5E+10	9.6E+10	9.7E+10	9.7E+10	9.4E+10	9E+10	8.4E+10	7.8E+10	6.8E+10	5.9E+10	4.9E+10	4.1E+10	3.3E+10	2.6E+10
Pu-236	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-238	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-239	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-240	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-242	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ra-226	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ra-228	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	6.1E-07	3.2E-07	1.7E-07	9.1E-08	4.8E-08	2.6E-08	1.4E-08	7.2E-09	3.8E-09	2.0E-09	5.6E-10	1.6E-10	4.3E-11	1.2E-11	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Se-79	1.4E+11	1.8E+11	2.2E+11	2.8E+11	3.5E+11	4.3E+11	5.2E+11	6.3E+11	7.6E+11	9.1E+11	1.3E+12	1.7E+12	2.3E+12	3E+12	3.8E+12	5E+12	6.4E+12	8.0E+12	9.9E+12	1.2E+13	1.4E+13
Si-32	3.5E+15	3.1E+15	2.7E+15	2.3E+15	2.0E+15	1.7E+15	1.5E+15	1.2E+15	1.0E+15	8.8E+14	6.2E+14	4.3E+14	3.0E+14	2.0E+14	1.4E+14	8.4E+13	5.0E+13	3.0E+13	1.7E+13	1.0E+13	5.8E+12
Sm-151	7.6	14	27	48	85	150	250	420	690	1100	2700	6300	14000	29000	58000	130000	270000	520000	980000	1700000	3000000
Sn-121m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sn-126	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Tb-157	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tb-158	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tc-99	2.1E-03	1.3E-03	7.9E-04	4.8E-04	2.9E-04	1.8E-04	1.1E-04	6.6E-05	4.0E-05	2.4E-05	8.7E-06	3.2E-06	1.1E-06	4.1E-07	1.5E-07	4.1E-08	1.1E-08	3.2E-09	8.7E-10	2.4E-10	6.5E-11
Te-123	11	16	22	29	40	53	69	90	120	150	240	370	550	810	1200	1700	2600	3600	5000	6800	8900
Th-229	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th-232	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ti-44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tl-204	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tm-170	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-232	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-233	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-234	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-235	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-236	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-238	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V-50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 46. CONCENTRATIONS (mg/L) AT THE WATER TABLE, VERTICAL PATHRAE MODEL RESULTS FOR CLASS A SOUTH 0.276 CM/YR TOP SLOPE, METALS AND FORMERLY CHARACTERISTIC WASTE

COMPOUND	YEAR TO EXCEED	18	21	24	27	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125
14DCB	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
245T	-1	0	0	0	0	0	0	0	0	0	0	2.6E-16	5.8E-15	7.2E-14	5.8E-13	3.2E-12	1.3E-11	4.3E-11	1.1E-10	2.5E-10	4.7E-10	7.7E-10	1.1E-09	1.5E-09	1.8E-09
246T	-1	0	0	0	0	0	0	0	0	9.8E-17	1.3E-15	9.1E-15	3.6E-14	9.4E-14	1.7E-13	2.4E-13	2.7E-13	2.5E-13	2.0E-13	1.4E-13	8.6E-14	4.8E-14	2.5E-14	1.2E-14	5.2E-15
24D	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ag	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
As	800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ba	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Be	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Benz	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cd	760	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CF	-1	0	0	0	0	0	0	7.8E-16	4.3E-14	8.0E-13	6.8E-12	3.2E-11	9.5E-11	2.0E-10	3.1E-10	3.8E-10	3.9E-10	3.4E-10	2.6E-10	1.8E-10	1.1E-10	6.3E-11	3.3E-11	1.6E-11	7.5E-12
ChlB	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clr	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cr	825	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crs	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ctet	-1	0	0	0	0	0	0	0	0	0	0	2.7E-17	8.2E-17	1.6E-16	2.2E-16	2.3E-16	1.9E-16	1.3E-16	7.5E-17	3.7E-17	1.7E-17	0	0	0	0
Cu	900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DCA	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DCE	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DNT	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
End	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hep	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hg	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCB	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCBd	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCh	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lind	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
mCrs	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEK	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mo	800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mox	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nbenz	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
oCrs	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PCP	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
pCrs	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pyr	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Se	800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Slvx	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCE	-1	0	0	0	0	0	0	3.6E-17	4.2E-15	1.5E-13	2.2E-12	1.7E-11	8.0E-11	2.6E-10	5.9E-10	1.1E-09	1.6E-09	1.9E-09	2.1E-09	1.9E-09	1.6E-09	1.3E-09	8.9E-10	5.9E-10	3.6E-10
TetCE	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	3.1E-17	7.1E-17	1.2E-16	1.6E-16	1.8E-16	1.7E-16	1.4E-16	9.6E-17	6.1E-17	3.5E-17	1.9E-17
Tox	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VC	-1	0	0	0	0	0	3.5E-15	7.2E-13	3.6E-11	6.7E-10	6.0E-09	3.1E-08	1.1E-07	2.6E-07	5.0E-07	7.6E-07	9.8E-07	1.1E-06	1.1E-06	9.4E-07	7.5E-07	5.6E-07	3.8E-07	2.5E-07	1.5E-07
Zn	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

NOTE: Year to exceed GWPL reported to next lowest model output year. -1 indicates constituent does not exceed GWPL in years modeled

TABLE 46. CONCENTRATIONS (mg/L) AT THE WATER TABLE, VERTICAL PATHRAE MODEL RESULTS FOR CLASS A SOUTH 0.276 CM/YR TOP SLOPE, METALS AND FORMERLY CHARACTERISTIC WASTE

COMPOUND	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235
14DCB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
245T	2.1E-09	2.2E-09	2.1E-09	2.0E-09	1.8E-09	1.5E-09	1.2E-09	9.6E-10	7.3E-10	5.4E-10	3.9E-10	2.7E-10	1.8E-10	1.2E-10	8.0E-11	5.1E-11	3.2E-11	2.0E-11	1.2E-11	7.2E-12	4.2E-12	2.5E-12
246T	2.2E-15	8.6E-16	3.2E-16	1.2E-16	4.1E-17	1.4E-17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ag	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
As	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ba	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Be	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Benz	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cd	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CF	3.3E-12	1.4E-12	5.6E-13	2.2E-13	8.1E-14	2.9E-14	1.0E-14	3.5E-15	1.2E-15	3.8E-16	1.2E-16	3.8E-17	1.2E-17	0	0	0	0	0	0	0	0	0
ChlB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ctet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DCA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DNT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
End	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCBd	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lind	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
mCrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mox	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nbenz	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
oCrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PCP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
pCrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pyr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Se	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Silvx	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCE	2.1E-10	1.2E-10	6.4E-11	3.3E-11	1.6E-11	7.7E-12	3.5E-12	1.6E-12	6.9E-13	3.0E-13	1.2E-13	5.0E-14	2.0E-14	7.9E-15	3.1E-15	1.2E-15	4.4E-16	1.6E-16	6.0E-17	2.2E-17	0	0
TetCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tox	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VC	8.8E-08	4.9E-08	2.6E-08	1.4E-08	6.7E-09	3.3E-09	1.5E-09	7.1E-10	3.2E-10	1.4E-10	6.0E-11	2.6E-11	1.1E-11	4.4E-12	1.8E-12	7.2E-13	2.9E-13	1.1E-13	4.4E-14	1.7E-14	6.5E-15	2.5E-15
Zn	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 46. CONCENTRATIONS (mg/L) AT THE WATER TABLE, VERTICAL PATHRAE MODEL RESULTS FOR CLASS A SOUTH 0.276 CM/YR TOP SLOPE, METALS AND FORMERLY CHARACTERISTIC WASTE

COMPOUND	240	245	250	255	260	265	270	275	280	285	290	295	300	310	320	330	340	350	360	370	380	390
14DCB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
245T	1.4E-12	8.0E-13	4.5E-13	2.5E-13	1.4E-13	7.4E-14	4.0E-14	2.1E-14	1.1E-14	5.9E-15	3.1E-15	1.6E-15	8.2E-16	2.1E-16	5.3E-17	1.3E-17	0	0	0	0	0	0
246T	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ag	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
As	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.5E-17	8.7E-17
Ba	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Be	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Benz	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cd	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.5E-17	8.7E-17
CF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ChlB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.5E-17	8.7E-17
Crs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ctet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.5E-17	8.7E-17
DCA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DNT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
End	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCBd	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lind	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
mCrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.5E-17	8.7E-17
Mox	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nbenz	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
oCrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PCP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
pCrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pyr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Se	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.5E-17	8.7E-17
Silvx	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TetCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tox	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VC	9.3E-16	3.5E-16	1.3E-16	4.8E-17	1.7E-17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zn	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 46. CONCENTRATIONS (mg/L) AT THE WATER TABLE, VERTICAL PATHRAE MODEL RESULTS FOR CLASS A SOUTH 0.276 CM/YR TOP SLOPE, METALS AND FORMERLY CHARACTERISTIC WASTE

COMPOUND	400	410	420	430	440	450	460	470	480	490	500	510	520	530	540	550	560	570	580	590	600	610
14DCB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
245T	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
246T	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ag	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
As	4.5E-16	2.2E-15	9.7E-15	4.0E-14	1.6E-13	5.7E-13	2.0E-12	6.4E-12	2.0E-11	5.9E-11	1.7E-10	4.5E-10	1.2E-09	3.0E-09	7.2E-09	1.7E-08	3.8E-08	8.5E-08	1.8E-07	3.8E-07	7.7E-07	1.5E-06
Ba	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Be	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Benz	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cd	4.5E-16	2.2E-15	9.7E-15	4.0E-14	1.6E-13	5.7E-13	2.0E-12	6.4E-12	2.0E-11	5.9E-11	1.7E-10	4.5E-10	1.2E-09	3.0E-09	7.2E-09	1.7E-08	3.8E-08	8.5E-08	1.8E-07	3.8E-07	7.7E-07	1.5E-06
CF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ChlB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cr	4.5E-16	2.2E-15	9.7E-15	4.0E-14	1.6E-13	5.7E-13	2.0E-12	6.4E-12	2.0E-11	5.9E-11	1.7E-10	4.5E-10	1.2E-09	3.0E-09	7.2E-09	1.7E-08	3.8E-08	8.5E-08	1.8E-07	3.8E-07	7.7E-07	1.5E-06
Crs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ctet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cu	4.5E-16	2.2E-15	9.7E-15	4.0E-14	1.6E-13	5.7E-13	2.0E-12	6.4E-12	2.0E-11	5.9E-11	1.7E-10	4.5E-10	1.2E-09	3.0E-09	7.2E-09	1.7E-08	3.8E-08	8.5E-08	1.8E-07	3.8E-07	7.7E-07	1.5E-06
DCA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DNT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
End	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCBd	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lind	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
mCrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mo	4.5E-16	2.2E-15	9.7E-15	4.0E-14	1.6E-13	5.7E-13	2.0E-12	6.4E-12	2.0E-11	5.9E-11	1.7E-10	4.5E-10	1.2E-09	3.0E-09	7.2E-09	1.7E-08	3.8E-08	8.5E-08	1.8E-07	3.8E-07	7.7E-07	1.5E-06
Mox	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nbenz	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
oCrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PCP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
pCrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pyr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Se	4.5E-16	2.2E-15	9.7E-15	4.0E-14	1.6E-13	5.7E-13	2.0E-12	6.4E-12	2.0E-11	5.9E-11	1.7E-10	4.5E-10	1.2E-09	3.0E-09	7.2E-09	1.7E-08	3.8E-08	8.5E-08	1.8E-07	3.8E-07	7.7E-07	1.5E-06
Silvx	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TetCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tox	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zn	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 46. CONCENTRATIONS (mg/L) AT THE WATER TABLE, VERTICAL PATHRAE MODEL RESULTS FOR CLASS A SOUTH 0.276 CM/YR TOP SLOPE, METALS AND FORMERLY CHARACTERISTIC WASTE

COMPOUND	620	630	640	650	660	670	680	690	700	720	740	760	780	800	825	850	875	900	925	950	975	1000
14DCB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
245T	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
246T	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ag	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.7E-17
As	3.0E-06	5.6E-06	1.0E-05	1.9E-05	3.4E-05	5.9E-05	1.0E-04	1.7E-04	2.9E-04	7.7E-04	1.9E-03	4.6E-03	1.0E-02	2.3E-02	5.6E-02	1.3E-01	2.9E-01	6.2E-01	1.3E+00	2.4E+00	4.6E+00	8.2E+00
Ba	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Be	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.5E-17	8.9E-17	4.7E-16	2.3E-15
Benz	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cd	3.0E-06	5.6E-06	1.0E-05	1.9E-05	3.4E-05	5.9E-05	1.0E-04	1.7E-04	2.9E-04	7.7E-04	1.9E-03	4.6E-03	1.0E-02	2.3E-02	5.6E-02	1.3E-01	2.9E-01	6.2E-01	1.3E+00	2.4E+00	4.6E+00	8.2E+00
CF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ChlB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cr	3.0E-06	5.6E-06	1.0E-05	1.9E-05	3.4E-05	5.9E-05	1.0E-04	1.7E-04	2.9E-04	7.7E-04	1.9E-03	4.6E-03	1.0E-02	2.3E-02	5.6E-02	1.3E-01	2.9E-01	6.2E-01	1.3E+00	2.4E+00	4.6E+00	8.2E+00
Crs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ctet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cu	3.0E-06	5.6E-06	1.0E-05	1.9E-05	3.4E-05	5.9E-05	1.0E-04	1.7E-04	2.9E-04	7.7E-04	1.9E-03	4.6E-03	1.0E-02	2.3E-02	5.6E-02	1.3E-01	2.9E-01	6.2E-01	1.3E+00	2.4E+00	4.6E+00	8.2E+00
DCA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DNT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
End	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCBd	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lind	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
mCrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mo	3.0E-06	5.6E-06	1.0E-05	1.9E-05	3.4E-05	5.9E-05	1.0E-04	1.7E-04	2.9E-04	7.7E-04	1.9E-03	4.6E-03	1.0E-02	2.3E-02	5.6E-02	1.3E-01	2.9E-01	6.2E-01	1.3E+00	2.4E+00	4.6E+00	8.2E+00
Mox	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nbenz	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
oCrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PCP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
pCrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pyr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Se	3.0E-06	5.6E-06	1.0E-05	1.9E-05	3.4E-05	5.9E-05	1.0E-04	1.7E-04	2.9E-04	7.7E-04	1.9E-03	4.6E-03	1.0E-02	2.3E-02	5.6E-02	1.3E-01	2.9E-01	6.2E-01	1.3E+00	2.4E+00	4.6E+00	8.2E+00
Silvx	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TetCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tox	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zn	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 48. CONCENTRATIONS (mg/L) AT THE WATER TABLE, VERTICAL PATHRAE MODEL RESULTS FOR CLASS A SOUTH 0.286 CM/YR SIDE SLOPE, METALS AND FORMERLY CHARACTERISTIC WASTE

COMPOUND	YEAR TO EXCEED:	18	21	24	27	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125
14DCB	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
245T	-1	0	0	0	0	0	0	0	0	0	4.6E-17	1.7E-15	3.2E-14	3.6E-13	2.5E-12	1.3E-11	4.8E-11	1.4E-10	3.5E-10	7.1E-10	1.3E-09	2.0E-09	2.7E-09	3.5E-09	4.0E-09
246T	-1	0	0	0	0	0	0	0	1.9E-17	5.4E-16	6.2E-15	3.7E-14	1.3E-13	3.0E-13	5.1E-13	6.6E-13	6.8E-13	6.0E-13	4.4E-13	2.9E-13	1.7E-13	9.1E-14	4.5E-14	2.0E-14	8.7E-15
24D	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ag	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
As	780	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ba	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Be	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Benz	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cd	720	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CF	-1	0	0	0	0	0	2.4E-17	4.7E-15	2.1E-13	3.3E-12	2.4E-11	1.0E-10	2.7E-10	5.1E-10	7.3E-10	8.4E-10	8.1E-10	6.7E-10	4.8E-10	3.1E-10	1.9E-10	1.0E-10	5.1E-11	2.4E-11	1.1E-11
ChlB	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clr	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cr	800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crs	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ctet	-1	0	0	0	0	0	0	0	0	0	2.5E-17	1.1E-16	3.0E-16	5.4E-16	6.7E-16	6.5E-16	4.9E-16	3.1E-16	1.7E-16	8.0E-17	3.4E-17	1.3E-17	0	0	0
Cu	875	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DCA	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DCE	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DNT	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
End	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hep	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hg	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCB	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCBd	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCh	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lind	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
mCrs	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEK	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mo	780	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mox	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nbenz	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
oCrs	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PCP	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.3E-17	1.6E-17	1.6E-17	1.4E-17	1.1E-17	0
pCrs	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pyr	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Se	780	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Silvx	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCE	-1	0	0	0	0	0	0	2.6E-16	2.4E-14	7.0E-13	8.9E-12	6.0E-11	2.5E-10	7.4E-10	1.6E-09	2.6E-09	3.6E-09	4.2E-09	4.2E-09	3.7E-09	3.0E-09	2.2E-09	1.5E-09	9.6E-10	5.7E-10
TetCE	-1	0	0	0	0	0	0	0	0	0	0	0	1.0E-17	4.4E-17	1.3E-16	2.6E-16	4.1E-16	5.1E-16	5.2E-16	4.5E-16	3.4E-16	2.3E-16	1.4E-16	7.8E-17	4.0E-17
Tox	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VC	-1	0	0	0	0	1.8E-17	2.3E-14	3.7E-12	1.5E-10	2.4E-09	1.9E-08	8.7E-08	2.7E-07	6.1E-07	1.1E-06	1.5E-06	1.9E-06	2.0E-06	1.8E-06	1.5E-06	1.2E-06	8.3E-07	5.5E-07	3.4E-07	2.0E-07
Zn	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

NOTE: Year to exceed GWPL reported to next lowest model output year. -1 indicates constituent does not exceed GWPL in years modeled

TABLE 48. CONCENTRATIONS (mg/L) AT THE WATER TABLE, VERTICAL PATHRAE MODEL RESULTS FOR CLASS A SOUTH 0.286 CM/YR SIDE SLOPE, METALS AND FORMERLY CHARACTERISTIC WASTE

COMPOUND	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235
14DCB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
245T	4.3E-09	4.4E-09	4.2E-09	3.8E-09	3.2E-09	2.7E-09	2.1E-09	1.6E-09	1.2E-09	8.6E-10	6.0E-10	4.1E-10	2.7E-10	1.8E-10	1.1E-10	7.1E-11	4.4E-11	2.6E-11	1.6E-11	9.2E-12	5.3E-12	3.1E-12
246T	3.5E-15	1.3E-15	4.9E-16	1.7E-16	5.9E-17	1.9E-17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ag	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
As	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ba	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Be	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Benz	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cd	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CF	4.6E-12	1.9E-12	7.3E-13	2.7E-13	9.9E-14	3.5E-14	1.2E-14	3.9E-15	1.3E-15	4.0E-16	1.3E-16	3.8E-17	1.2E-17	0	0	0	0	0	0	0	0	0
ChlB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ctet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DCA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DNT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
End	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCBd	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lind	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
mCrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mox	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nbenz	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
oCrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PCP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
pCrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pyr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Se	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Silvx	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCE	3.2E-10	1.8E-10	9.0E-11	4.5E-11	2.1E-11	9.9E-12	4.5E-12	1.9E-12	8.2E-13	3.4E-13	1.4E-13	5.5E-14	2.2E-14	8.3E-15	3.1E-15	1.2E-15	4.3E-16	1.6E-16	5.6E-17	2.0E-17	0	0
TetCE	1.9E-17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tox	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VC	1.1E-07	6.1E-08	3.1E-08	1.6E-08	7.6E-09	3.6E-09	1.6E-09	7.3E-10	3.2E-10	1.4E-10	5.7E-11	2.4E-11	9.7E-12	3.9E-12	1.6E-12	6.1E-13	2.4E-13	9.1E-14	3.5E-14	1.3E-14	4.9E-15	1.8E-15
Zn	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 48. CONCENTRATIONS (mg/L) AT THE WATER TABLE, VERTICAL PATHRAE MODEL RESULTS FOR CLASS A SOUTH 0.286 CM/YR SIDE SLOPE, METALS AND FORMERLY CHARACTERISTIC WASTE

COMPOUND	240	245	250	255	260	265	270	275	280	285	290	295	300	310	320	330	340	350	360	370	380	390
14DCB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
245T	1.7E-12	9.6E-13	5.3E-13	2.9E-13	1.5E-13	8.3E-14	4.4E-14	2.3E-14	1.2E-14	6.2E-15	3.2E-15	1.6E-15	8.1E-16	2.0E-16	5.0E-17	1.2E-17	0	0	0	0	0	0
246T	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ag	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
As	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.6E-17	2.1E-16	1.1E-15
Ba	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Be	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Benz	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cd	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.6E-17	2.1E-16	1.1E-15
CF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ChlB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.6E-17	2.1E-16	1.1E-15
Crs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ctet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.6E-17	2.1E-16	1.1E-15
DCA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DNT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
End	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCBd	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lind	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
mCrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.6E-17	2.1E-16	1.1E-15
Mox	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nbenz	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
oCrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PCP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
pCrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pyr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Se	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.6E-17	2.1E-16	1.1E-15
Silvx	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TetCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tox	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VC	6.8E-16	2.5E-16	9.1E-17	3.3E-17	1.2E-17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zn	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 48. CONCENTRATIONS (mg/L) AT THE WATER TABLE, VERTICAL PATHRAE MODEL RESULTS FOR CLASS A SOUTH 0.286 CM/YR SIDE SLOPE, METALS AND FORMERLY CHARACTERISTIC WASTE

COMPOUND	400	410	420	430	440	450	460	470	480	490	500	510	520	530	540	550	560	570	580	590	600	610
14DCB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
245T	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
246T	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ag	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
As	5.4E-15	2.4E-14	1.0E-13	4.0E-13	1.5E-12	5.1E-12	1.7E-11	5.2E-11	1.5E-10	4.4E-10	1.2E-09	3.1E-09	7.8E-09	1.9E-08	4.4E-08	9.9E-08	2.2E-07	4.6E-07	9.7E-07	2.0E-06	3.9E-06	7.4E-06
Ba	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Be	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Benz	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cd	5.4E-15	2.4E-14	1.0E-13	4.0E-13	1.5E-12	5.1E-12	1.7E-11	5.2E-11	1.5E-10	4.4E-10	1.2E-09	3.1E-09	7.8E-09	1.9E-08	4.4E-08	9.9E-08	2.2E-07	4.6E-07	9.7E-07	2.0E-06	3.9E-06	7.4E-06
CF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ChlB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cr	5.4E-15	2.4E-14	1.0E-13	4.0E-13	1.5E-12	5.1E-12	1.7E-11	5.2E-11	1.5E-10	4.4E-10	1.2E-09	3.1E-09	7.8E-09	1.9E-08	4.4E-08	9.9E-08	2.2E-07	4.6E-07	9.7E-07	2.0E-06	3.9E-06	7.4E-06
Crs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ctet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cu	5.4E-15	2.4E-14	1.0E-13	4.0E-13	1.5E-12	5.1E-12	1.7E-11	5.2E-11	1.5E-10	4.4E-10	1.2E-09	3.1E-09	7.8E-09	1.9E-08	4.4E-08	9.9E-08	2.2E-07	4.6E-07	9.7E-07	2.0E-06	3.9E-06	7.4E-06
DCA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DNT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
End	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCBd	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lind	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
mCrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mo	5.4E-15	2.4E-14	1.0E-13	4.0E-13	1.5E-12	5.1E-12	1.7E-11	5.2E-11	1.5E-10	4.4E-10	1.2E-09	3.1E-09	7.8E-09	1.9E-08	4.4E-08	9.9E-08	2.2E-07	4.6E-07	9.7E-07	2.0E-06	3.9E-06	7.4E-06
Mox	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nbenz	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
oCrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PCP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
pCrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pyr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Se	5.4E-15	2.4E-14	1.0E-13	4.0E-13	1.5E-12	5.1E-12	1.7E-11	5.2E-11	1.5E-10	4.4E-10	1.2E-09	3.1E-09	7.8E-09	1.9E-08	4.4E-08	9.9E-08	2.2E-07	4.6E-07	9.7E-07	2.0E-06	3.9E-06	7.4E-06
Silvx	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TetCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tox	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zn	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 48. CONCENTRATIONS (mg/L) AT THE WATER TABLE, VERTICAL PATHRAE MODEL RESULTS FOR CLASS A SOUTH 0.286 CM/YR SIDE SLOPE, METALS AND FORMERLY CHARACTERISTIC WASTE

COMPOUND	620	630	640	650	660	670	680	690	700	720	740	760	780	800	825	850	875	900	925	950	975	1000
14DCB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
245T	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
246T	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ag	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.4E-17	2.3E-16
As	1.4E-05	2.6E-05	4.7E-05	8.3E-05	1.4E-04	2.5E-04	4.2E-04	6.9E-04	1.1E-03	2.8E-03	6.9E-03	1.6E-02	3.4E-02	7.2E-02	1.7E-01	3.9E-01	8.3E-01	1.7E+00	3.3E+00	6.3E+00	1.1E+01	2.0E+01
Ba	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Be	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.4E-17	2.0E-16	1.1E-15	5.4E-15	2.5E-14
Benz	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cd	1.4E-05	2.6E-05	4.7E-05	8.3E-05	1.4E-04	2.5E-04	4.2E-04	6.9E-04	1.1E-03	2.8E-03	6.9E-03	1.6E-02	3.4E-02	7.2E-02	1.7E-01	3.9E-01	8.3E-01	1.7E+00	3.3E+00	6.3E+00	1.1E+01	2.0E+01
CF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ChlB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cr	1.4E-05	2.6E-05	4.7E-05	8.3E-05	1.4E-04	2.5E-04	4.2E-04	6.9E-04	1.1E-03	2.8E-03	6.9E-03	1.6E-02	3.4E-02	7.2E-02	1.7E-01	3.9E-01	8.3E-01	1.7E+00	3.3E+00	6.3E+00	1.1E+01	2.0E+01
Crs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ctet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cu	1.4E-05	2.6E-05	4.7E-05	8.3E-05	1.4E-04	2.5E-04	4.2E-04	6.9E-04	1.1E-03	2.8E-03	6.9E-03	1.6E-02	3.4E-02	7.2E-02	1.7E-01	3.9E-01	8.3E-01	1.7E+00	3.3E+00	6.3E+00	1.1E+01	2.0E+01
DCA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DNT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
End	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCBd	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lind	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
mCrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mo	1.4E-05	2.6E-05	4.7E-05	8.3E-05	1.4E-04	2.5E-04	4.2E-04	6.9E-04	1.1E-03	2.8E-03	6.9E-03	1.6E-02	3.4E-02	7.2E-02	1.7E-01	3.9E-01	8.3E-01	1.7E+00	3.3E+00	6.3E+00	1.1E+01	2.0E+01
Mox	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nbenz	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
oCrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PCP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
pCrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pyr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Se	1.4E-05	2.6E-05	4.7E-05	8.3E-05	1.4E-04	2.5E-04	4.2E-04	6.9E-04	1.1E-03	2.8E-03	6.9E-03	1.6E-02	3.4E-02	7.2E-02	1.7E-01	3.9E-01	8.3E-01	1.7E+00	3.3E+00	6.3E+00	1.1E+01	2.0E+01
Silvx	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TetCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tox	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zn	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 50. CONCENTRATIONS (mg/L) AT THE WATER TABLE, VERTICAL PATHRAE MODEL RESULTS FOR CLASS A SOUTH 0.595 CM/YR SIDE SLOPE, METALS AND FORMERLY CHARACTERISTIC WASTE

COMPOUND	YEAR TO EXCEED:	15	18	21	24	27	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120
14DCB	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
245T	-1	0	0	0	1.1E-17	4.4E-15	4.7E-13	1.5E-10	8.6E-09	1.6E-07	1.4E-06	6.9E-06	2.2E-05	5.0E-05	8.8E-05	1.3E-04	1.5E-04	1.6E-04	1.5E-04	1.3E-04	1.0E-04	7.6E-05	5.2E-05	3.4E-05	2.1E-05
246T	-1	0	0	1.9E-15	4.1E-13	2.0E-11	3.8E-10	1.1E-08	8.3E-08	2.7E-07	5.0E-07	5.9E-07	5.0E-07	3.3E-07	1.8E-07	8.2E-08	3.3E-08	1.2E-08	3.8E-09	1.1E-09	3.1E-10	8.1E-11	2.0E-11	4.6E-12	1.0E-12
24D	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ag	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
As	370	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ba	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Be	850	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Benz	-1	0	0	1.5E-16	3.2E-15	1.9E-14	5.0E-14	6.5E-14	2.8E-14	5.6E-15	6.8E-16	5.6E-17	0	0	0	0	0	0	0	0	0	0	0	0	0
Cd	340	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CF	-1	0	1.6E-14	8.8E-12	7.5E-10	1.9E-08	2.1E-07	3.1E-06	1.6E-05	3.8E-05	5.5E-05	5.5E-05	4.1E-05	2.5E-05	1.2E-05	5.3E-06	2.0E-06	6.9E-07	2.2E-07	6.4E-08	1.8E-08	4.6E-09	1.2E-09	2.8E-10	6.5E-11
ChlB	-1	0	0	0	0	0	0	3.1E-17	6.1E-17	4.4E-17	1.6E-17	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clr	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cr	380	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crs	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ctet	-1	0	0	6.8E-17	1.4E-14	6.7E-13	1.1E-11	2.6E-10	1.6E-09	4.1E-09	5.7E-09	5.0E-09	3.1E-09	1.5E-09	5.9E-10	2.0E-10	5.8E-11	1.5E-11	3.5E-12	7.5E-13	1.5E-13	2.8E-14	4.9E-15	8.2E-16	1.3E-16
Cu	420	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DCA	-1	0	1.6E-16	2.4E-14	6.3E-13	5.1E-12	1.8E-11	4.2E-11	3.4E-11	1.4E-11	3.3E-12	5.7E-13	7.3E-14	7.5E-15	6.4E-16	4.8E-17	0	0	0	0	0	0	0	0	0
DCE	-1	0	0	5.0E-17	1.1E-15	7.1E-15	1.9E-14	2.6E-14	1.1E-14	2.3E-15	2.9E-16	2.4E-17	0	0	0	0	0	0	0	0	0	0	0	0	0
DNT	-1	0	0	2.8E-15	1.5E-13	2.1E-12	1.1E-11	4.8E-11	6.2E-11	3.6E-11	1.2E-11	2.6E-12	4.3E-13	5.5E-14	5.9E-15	5.3E-16	4.3E-17	0	0	0	0	0	0	0	0
End	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hep	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hg	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCB	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCBd	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCh	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lind	-1	0	0	0	0	0	0	3.5E-17	1.9E-16	3.6E-16	3.4E-16	1.9E-16	6.9E-17	1.9E-17	0	0	0	0	0	0	0	0	0	0	0
mCrs	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEK	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mo	370	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mox	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nbenz	-1	0	0	1.0E-16	8.3E-15	1.7E-13	1.3E-12	9.0E-12	1.8E-11	1.5E-11	7.5E-12	2.4E-12	5.5E-13	1.0E-13	1.5E-14	1.9E-15	2.1E-16	2.1E-17	0	0	0	0	0	0	0
Ni	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
oCrs	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PCP	-1	0	0	0	0	0	0	2.6E-15	1.8E-13	3.5E-12	2.6E-11	1.0E-10	2.5E-10	4.1E-10	4.9E-10	4.7E-10	3.7E-10	2.5E-10	1.5E-10	7.6E-11	3.6E-11	1.6E-11	6.6E-12	2.5E-12	9.2E-13
pCrs	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pyr	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Se	370	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Silvx	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCE	-1	0	3.0E-16	3.6E-13	6.0E-11	2.6E-09	4.6E-08	1.3E-06	1.1E-05	4.3E-05	9.6E-05	1.4E-04	1.6E-04	1.4E-04	9.8E-05	6.0E-05	3.2E-05	1.5E-05	6.8E-06	2.7E-06	1.0E-06	3.7E-07	1.3E-07	4.1E-08	1.3E-08
TetCE	-1	0	0	0	0	6.7E-16	3.4E-14	3.6E-12	7.5E-11	5.4E-10	1.8E-09	3.6E-09	4.7E-09	4.5E-09	3.4E-09	2.1E-09	1.1E-09	5.0E-10	2.1E-10	7.7E-11	2.7E-11	8.6E-12	2.6E-12	7.3E-13	2.0E-13
Tox	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VC	-1	0	3.2E-12	1.2E-09	8.1E-08	1.8E-06	1.8E-05	2.6E-04	1.4E-03	3.8E-03	6.5E-03	7.8E-03	7.0E-03	5.2E-03	3.2E-03	1.7E-03	8.2E-04	3.6E-04	1.4E-04	5.4E-05	1.9E-05	6.6E-06	2.2E-06	6.8E-07	2.1E-07
Zn	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

NOTE: Year to exceed GWPL reported to next lowest model output year. -1 indicates constituent does not exceed GWPL in years modeled

TABLE 50. CONCENTRATIONS (mg/L) AT THE WATER TABLE, VERTICAL PATHRAE MODEL RESULTS FOR CLASS A SOUTH 0.595 CM/YR SIDE SLOPE, METALS AND FORMERLY CHARACTERISTIC WASTE

COMPOUND	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235
14DCB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
245T	1.2E-05	6.8E-06	3.7E-06	1.9E-06	9.6E-07	4.7E-07	2.3E-07	1.1E-07	4.9E-08	2.2E-08	9.8E-09	4.3E-09	1.8E-09	7.8E-10	3.3E-10	1.4E-10	5.6E-11	2.3E-11	9.2E-12	3.7E-12	1.5E-12	5.7E-13	2.3E-13
246T	2.3E-13	4.8E-14	9.7E-15	1.9E-15	3.8E-16	7.2E-17	1.3E-17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ag	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
As	0	0	0	0	0	0	0	0	0	0	2.9E-17	1.9E-16	1.1E-15	5.9E-15	2.9E-14	1.3E-13	5.3E-13	2.1E-12	7.6E-12	2.6E-11	8.4E-11	2.6E-10	7.5E-10
Ba	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Be	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Benz	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cd	0	0	0	0	0	0	0	0	0	0	2.9E-17	1.9E-16	1.1E-15	5.9E-15	2.9E-14	1.3E-13	5.3E-13	2.1E-12	7.6E-12	2.6E-11	8.4E-11	2.6E-10	7.5E-10
CF	1.5E-11	3.2E-12	7.0E-13	1.5E-13	3.1E-14	6.3E-15	1.3E-15	2.5E-16	5.0E-17	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ChlB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cr	0	0	0	0	0	0	0	0	0	0	2.9E-17	1.9E-16	1.1E-15	5.9E-15	2.9E-14	1.3E-13	5.3E-13	2.1E-12	7.6E-12	2.6E-11	8.4E-11	2.6E-10	7.5E-10
Crs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ctet	2.0E-17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cu	0	0	0	0	0	0	0	0	0	0	2.9E-17	1.9E-16	1.1E-15	5.9E-15	2.9E-14	1.3E-13	5.3E-13	2.1E-12	7.6E-12	2.6E-11	8.4E-11	2.6E-10	7.5E-10
DCA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DNT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
End	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCBd	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lind	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
mCrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mo	0	0	0	0	0	0	0	0	0	0	2.9E-17	1.9E-16	1.1E-15	5.9E-15	2.9E-14	1.3E-13	5.3E-13	2.1E-12	7.6E-12	2.6E-11	8.4E-11	2.6E-10	7.5E-10
Mox	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nbenz	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
oCrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PCP	3.2E-13	1.1E-13	3.3E-14	1.0E-14	3.0E-15	8.6E-16	2.4E-16	6.5E-17	1.7E-17	0	0	0	0	0	0	0	0	0	0	0	0	0	0
pCrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pyr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Se	0	0	0	0	0	0	0	0	0	0	2.9E-17	1.9E-16	1.1E-15	5.9E-15	2.9E-14	1.3E-13	5.3E-13	2.1E-12	7.6E-12	2.6E-11	8.4E-11	2.6E-10	7.5E-10
Silvx	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCE	3.9E-09	1.1E-09	3.3E-10	9.1E-11	2.5E-11	6.8E-12	1.8E-12	4.7E-13	1.2E-13	3.1E-14	7.8E-15	2.0E-15	4.9E-16	1.2E-16	2.9E-17	0	0	0	0	0	0	0	0
TetCE	5.1E-14	1.3E-14	3.0E-15	7.0E-16	1.6E-16	3.4E-17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tox	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VC	6.3E-08	1.8E-08	5.3E-09	1.5E-09	4.1E-10	1.1E-10	3.0E-11	8.1E-12	2.1E-12	5.6E-13	1.5E-13	3.8E-14	9.6E-15	2.4E-15	6.2E-16	1.6E-16	3.9E-17	0	0	0	0	0	0
Zn	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 50. CONCENTRATIONS (mg/L) AT THE WATER TABLE, VERTICAL PATHRAE MODEL RESULTS FOR CLASS A SOUTH 0.595 CM/YR SIDE SLOPE, METALS AND FORMERLY CHARACTERISTIC WASTE

COMPOUND	240	245	250	255	260	265	270	275	280	285	290	295	300	310	320	330	340	350	360	370	380	390
14DCB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
245T	8.8E-14	3.4E-14	1.3E-14	5.0E-15	1.9E-15	7.3E-16	2.8E-16	1.0E-16	3.9E-17	1.5E-17	0	0	0	0	0	0	0	0	0	0	0	0
246T	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ag	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
As	2.1E-09	5.6E-09	1.4E-08	3.6E-08	8.5E-08	2.0E-07	4.4E-07	9.4E-07	2.0E-06	4.1E-06	8.1E-06	1.6E-05	3.0E-05	1.0E-04	3.1E-04	9.1E-04	2.5E-03	6.2E-03	1.5E-02	3.4E-02	7.5E-02	1.6E-01
Ba	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Be	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Benz	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cd	2.1E-09	5.6E-09	1.4E-08	3.6E-08	8.5E-08	2.0E-07	4.4E-07	9.4E-07	2.0E-06	4.1E-06	8.1E-06	1.6E-05	3.0E-05	1.0E-04	3.1E-04	9.1E-04	2.5E-03	6.2E-03	1.5E-02	3.4E-02	7.5E-02	1.6E-01
CF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ChlB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cr	2.1E-09	5.6E-09	1.4E-08	3.6E-08	8.5E-08	2.0E-07	4.4E-07	9.4E-07	2.0E-06	4.1E-06	8.1E-06	1.6E-05	3.0E-05	1.0E-04	3.1E-04	9.1E-04	2.5E-03	6.2E-03	1.5E-02	3.4E-02	7.5E-02	1.6E-01
Crs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ctet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cu	2.1E-09	5.6E-09	1.4E-08	3.6E-08	8.5E-08	2.0E-07	4.4E-07	9.4E-07	2.0E-06	4.1E-06	8.1E-06	1.6E-05	3.0E-05	1.0E-04	3.1E-04	9.1E-04	2.5E-03	6.2E-03	1.5E-02	3.4E-02	7.5E-02	1.6E-01
DCA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DNT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
End	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCBd	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lind	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
mCrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mo	2.1E-09	5.6E-09	1.4E-08	3.6E-08	8.5E-08	2.0E-07	4.4E-07	9.4E-07	2.0E-06	4.1E-06	8.1E-06	1.6E-05	3.0E-05	1.0E-04	3.1E-04	9.1E-04	2.5E-03	6.2E-03	1.5E-02	3.4E-02	7.5E-02	1.6E-01
Mox	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nbenz	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
oCrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PCP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
pCrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pyr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Se	2.1E-09	5.6E-09	1.4E-08	3.6E-08	8.5E-08	2.0E-07	4.4E-07	9.4E-07	2.0E-06	4.1E-06	8.1E-06	1.6E-05	3.0E-05	1.0E-04	3.1E-04	9.1E-04	2.5E-03	6.2E-03	1.5E-02	3.4E-02	7.5E-02	1.6E-01
Silvx	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TetCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tox	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zn	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 50. CONCENTRATIONS (mg/L) AT THE WATER TABLE, VERTICAL PATHRAE MODEL RESULTS FOR CLASS A SOUTH 0.595 CM/YR SIDE SLOPE, METALS AND FORMERLY CHARACTERISTIC WASTE

COMPOUND	400	410	420	430	440	450	460	470	480	490	500	510	520	530	540	550	560	570	580	590	600	610
14DCB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
245T	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
246T	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ag	0	0	0	0	0	0	3.4E-17	1.4E-16	5.3E-16	1.9E-15	6.6E-15	2.2E-14	6.8E-14	2.0E-13	5.9E-13	1.6E-12	4.3E-12	1.1E-11	2.7E-11	6.6E-11	1.5E-10	3.5E-10
As	3.1E-01	6.0E-01	1.1E+00	2.0E+00	3.5E+00	6.0E+00	1.0E+01	1.6E+01	2.6E+01	4.0E+01	6.0E+01	8.9E+01	1.3E+02	1.9E+02	2.6E+02	3.7E+02	5.0E+02	6.8E+02	9.1E+02	1.2E+03	1.6E+03	2.0E+03
Ba	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Be	0	0	1.2E-17	5.9E-17	2.6E-16	1.1E-15	4.2E-15	1.6E-14	5.4E-14	1.8E-13	5.6E-13	1.7E-12	4.8E-12	1.3E-11	3.5E-11	9.0E-11	2.2E-10	5.3E-10	1.2E-09	2.8E-09	6.1E-09	1.3E-08
Benz	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cd	3.1E-01	6.0E-01	1.1E+00	2.0E+00	3.5E+00	6.0E+00	1.0E+01	1.6E+01	2.6E+01	4.0E+01	6.0E+01	8.9E+01	1.3E+02	1.9E+02	2.6E+02	3.7E+02	5.0E+02	6.8E+02	9.1E+02	1.2E+03	1.6E+03	2.0E+03
CF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ChlB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cr	3.1E-01	6.0E-01	1.1E+00	2.0E+00	3.5E+00	6.0E+00	1.0E+01	1.6E+01	2.6E+01	4.0E+01	6.0E+01	8.9E+01	1.3E+02	1.9E+02	2.6E+02	3.7E+02	5.0E+02	6.8E+02	9.1E+02	1.2E+03	1.6E+03	2.0E+03
Crs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ctet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cu	3.1E-01	6.0E-01	1.1E+00	2.0E+00	3.5E+00	6.0E+00	1.0E+01	1.6E+01	2.6E+01	4.0E+01	6.0E+01	8.9E+01	1.3E+02	1.9E+02	2.6E+02	3.7E+02	5.0E+02	6.8E+02	9.1E+02	1.2E+03	1.6E+03	2.0E+03
DCA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DNT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
End	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.0E-17	1.6E-17	2.4E-17	3.6E-17	5.2E-17	7.3E-17	1.0E-16
Hep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCBd	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lind	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
mCrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mo	3.1E-01	6.0E-01	1.1E+00	2.0E+00	3.5E+00	6.0E+00	1.0E+01	1.6E+01	2.6E+01	4.0E+01	6.0E+01	8.9E+01	1.3E+02	1.9E+02	2.6E+02	3.7E+02	5.0E+02	6.8E+02	9.1E+02	1.2E+03	1.6E+03	2.0E+03
Mox	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nbenz	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
oCrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PCP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
pCrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pyr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Se	3.1E-01	6.0E-01	1.1E+00	2.0E+00	3.5E+00	6.0E+00	1.0E+01	1.6E+01	2.6E+01	4.0E+01	6.0E+01	8.9E+01	1.3E+02	1.9E+02	2.6E+02	3.7E+02	5.0E+02	6.8E+02	9.1E+02	1.2E+03	1.6E+03	2.0E+03
Silvx	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TetCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tox	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zn	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 50. CONCENTRATIONS (mg/L) AT THE WATER TABLE, VERTICAL PATHRAE MODEL RESULTS FOR CLASS A SOUTH 0.595 CM/YR SIDE SLOPE, METALS AND FORMERLY CHARACTERISTIC WASTE

COMPOUND	620	630	640	650	660	670	680	690	700	720	740	760	780	800	825	850	875	900	925	950	975	1000
14DCB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
245T	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
246T	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ag	7.7E-10	1.7E-09	3.5E-09	7.1E-09	1.4E-08	2.8E-08	5.4E-08	1.0E-07	1.9E-07	6.1E-07	1.8E-06	5.2E-06	1.4E-05	3.6E-05	1.1E-04	3.0E-04	8.0E-04	2.0E-03	4.7E-03	1.1E-02	2.3E-02	4.7E-02
As	2.6E+03	3.3E+03	4.1E+03	5.1E+03	6.2E+03	7.6E+03	9.2E+03	1.1E+04	1.3E+04	1.8E+04	2.5E+04	3.3E+04	4.3E+04	5.5E+04	7.2E+04	9.3E+04	1.2E+05	1.4E+05	1.7E+05	2.0E+05	2.4E+05	2.7E+05
Ba	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Be	2.7E-08	5.4E-08	1.1E-07	2.1E-07	3.9E-07	7.3E-07	1.3E-06	2.4E-06	4.2E-06	1.2E-05	3.4E-05	9.0E-05	2.2E-04	5.3E-04	1.5E-03	3.8E-03	9.2E-03	2.1E-02	4.6E-02	9.7E-02	2.0E-01	3.8E-01
Benz	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cd	2.6E+03	3.3E+03	4.1E+03	5.1E+03	6.2E+03	7.6E+03	9.2E+03	1.1E+04	1.3E+04	1.8E+04	2.5E+04	3.3E+04	4.3E+04	5.5E+04	7.2E+04	9.3E+04	1.2E+05	1.4E+05	1.7E+05	2.0E+05	2.4E+05	2.7E+05
CF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ChlB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cr	2.6E+03	3.3E+03	4.1E+03	5.1E+03	6.2E+03	7.6E+03	9.2E+03	1.1E+04	1.3E+04	1.8E+04	2.5E+04	3.3E+04	4.3E+04	5.5E+04	7.2E+04	9.3E+04	1.2E+05	1.4E+05	1.7E+05	2.0E+05	2.4E+05	2.7E+05
Crs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ctet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cu	2.6E+03	3.3E+03	4.1E+03	5.1E+03	6.2E+03	7.6E+03	9.2E+03	1.1E+04	1.3E+04	1.8E+04	2.5E+04	3.3E+04	4.3E+04	5.5E+04	7.2E+04	9.3E+04	1.2E+05	1.4E+05	1.7E+05	2.0E+05	2.4E+05	2.7E+05
DCA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DNT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
End	1.4E-16	1.9E-16	2.4E-16	3.1E-16	4.0E-16	5.0E-16	6.1E-16	7.4E-16	8.9E-16	1.2E-15	1.6E-15	2.0E-15	2.4E-15	2.8E-15	3.2E-15	3.5E-15	3.6E-15	3.6E-15	3.5E-15	3.2E-15	2.9E-15	2.5E-15
Hep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCBd	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HxCh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lind	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
mCrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mo	2.6E+03	3.3E+03	4.1E+03	5.1E+03	6.2E+03	7.6E+03	9.2E+03	1.1E+04	1.3E+04	1.8E+04	2.5E+04	3.3E+04	4.3E+04	5.5E+04	7.2E+04	9.3E+04	1.2E+05	1.4E+05	1.7E+05	2.0E+05	2.4E+05	2.7E+05
Mox	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nbenz	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
oCrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PCP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
pCrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pyr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Se	2.6E+03	3.3E+03	4.1E+03	5.1E+03	6.2E+03	7.6E+03	9.2E+03	1.1E+04	1.3E+04	1.8E+04	2.5E+04	3.3E+04	4.3E+04	5.5E+04	7.2E+04	9.3E+04	1.2E+05	1.4E+05	1.7E+05	2.0E+05	2.4E+05	2.7E+05
Silvx	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TetCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tox	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zn	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 53. CONCENTRATIONS AT THE COMPLIANCE WELL
HORIZONTAL PATHRAE MODEL RESULTS FOR CLASS A SOUTH CELL TOP SLOPE (0.276 CM/YR INFILTRATION, 250 FOOT DISTANCE)

SYMBOL	EXCEEDS	1	10	15	20	25	30	35	40	45	50	55	60	65	70	80	90	100	110	120	130	140	150	160	180	190	200	210	220	240	260
Am-241	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-242m	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-243	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-210m	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bk-247	-1	0	0	0	0	0	0	0	0	0	0	1.1E-10	2.3E-09	3.1E-08	2.8E-07	9.6E-06	1.4E-04	1.1E-03	5.7E-03	2.1E-02	5.5E-02	1.2E-01	2.1E-01	3.2E-01	5.0E-01	5.5E-01	5.5E-01	5.2E-01	4.6E-01	3.2E-01	1.8E-01
Ca-41	500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.6E-10	4.5E-09	7.5E-08	8.8E-07	5.5E-05	3.1E-04	1.4E-03	5.7E-03	2.0E-02	1.7E-01	1.0E+00
Cl-36	-1	0	0	0	0	0	0	0	0	1.7E-11	1.8E-09	7.0E-08	1.6E-06	2.2E-05	2.3E-04	9.7E-03	1.7E-01	1.5E+00	8.9E+00	3.5E+01	1.0E+02	2.4E+02	4.7E+02	7.7E+02	1.4E+03	1.7E+03	1.8E+03	1.8E+03	1.7E+03	1.3E+03	8.8E+02
Fe-60	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9.0E-11	7.4E-09	2.5E-07	4.6E-06	5.0E-05	3.3E-04	1.5E-03	5.0E-03	2.6E-02	4.4E-02	6.6E-02	8.0E-02	9.8E-02	9.6E-02	8.7E-02
I-129	555	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
K-40	655	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-91	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pd-107	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.3E-10	9.0E-08	1.1E-06	9.1E-06	6.7E-05	4.6E-04	1.4E-02	2.2E-01
Se-79	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Si-32	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.0E-11	6.4E-10	2.1E-08	3.6E-07	4.2E-06	3.5E-05	1.0E-03	4.1E-03	1.3E-02	3.7E-02	9.3E-02	3.9E-01	1.1E+00
Tc-99	530	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.6E-10	1.5E-08

NOTE: Year to exceed GWPL reported to next lowest model output year. -1 indicates constituent does not exceed GWPL within the 2,000 years modeled
Radionuclide concentrations are reported in pCi/L

TABLE 53. CONCENTRATIONS AT THE COMPLIANCE WELL
HORIZONTAL PATHRAE MODEL RESULTS FOR CLASS A SOUTH CELL TOP SLOPE (0.276 CM/YR INFILTRATION, 250 FOOT DISTANCE)

SYMBOL	280	300	305	310	315	320	325	330	335	340	345	350	355	360	365
Am-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-242m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-210m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bk-247	9.6E-02	4.6E-02	3.7E-02	3.1E-02	2.5E-02	2.1E-02	1.7E-02	1.3E-02	1.0E-02	8.4E-03	6.5E-03	5.1E-03	4.0E-03	3.1E-03	2.4E-03
Ca-41	4.3E+00	1.5E+01	1.9E+01	2.6E+01	3.3E+01	4.3E+01	5.3E+01	6.7E+01	8.1E+01	1.0E+02	1.2E+02	1.5E+02	1.8E+02	2.1E+02	2.5E+02
Cl-36	5.1E+02	2.7E+02	2.2E+02	1.9E+02	1.6E+02	1.3E+02	1.1E+02	9.3E+01	7.6E+01	6.1E+01	4.9E+01	3.9E+01	3.1E+01	2.5E+01	2.0E+01
Fe-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	3.6E-02	1.6E-02	1.3E-02	1.0E-02	7.9E-03	6.1E-03	4.6E-03	3.5E-03	2.6E-03	2.0E-03	1.5E-03	1.1E-03	7.9E-04	5.8E-04	4.1E-04
I-129	4.3E-11	2.1E-09	5.3E-09	9.0E-09	2.2E-08	5.4E-08	9.3E-08	1.8E-07	4.4E-07	7.6E-07	1.3E-06	3.0E-06	5.2E-06	8.1E-06	1.7E-05
K-40	0	0	0	0	0	0	0	2.1E-11	8.4E-11	1.6E-10	3.0E-10	1.1E-09	2.7E-09	4.4E-09	8.4E-09
Nb-91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pd-107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	2.2E+00	1.7E+01	2.6E+01	4.3E+01	6.3E+01	9.7E+01	1.5E+02	2.1E+02	3.2E+02	4.3E+02	6.3E+02	8.7E+02	1.2E+03	1.7E+03	2.3E+03
Se-79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Si-32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	2.3E+00	3.9E+00	4.3E+00	4.8E+00	4.9E+00	5.4E+00	5.6E+00	5.9E+00	6.2E+00	6.3E+00	6.4E+00	6.5E+00	6.5E+00	6.4E+00	6.4E+00
Tc-99	5.3E-07	1.7E-05	3.4E-05	5.9E-05	1.5E-04	2.7E-04	4.6E-04	1.0E-03	1.6E-03	2.9E-03	6.0E-03	1.0E-02	1.6E-02	3.1E-02	5.0E-02

SYMBOL	370	375	380	385	390	395	400	405	410	415	420	425	430	435	440	445
Am-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-242m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-210m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bk-247	1.9E-03	1.4E-03	1.1E-03	8.6E-04	6.9E-04	5.3E-04	4.1E-04	3.2E-04	2.5E-04	1.9E-04	1.5E-04	1.1E-04	8.6E-05	6.7E-05	5.2E-05	3.9E-05
Ca-41	2.9E+02	3.5E+02	4.1E+02	4.6E+02	5.3E+02	6.0E+02	6.8E+02	7.7E+02	8.5E+02	9.6E+02	1.1E+03	1.2E+03	1.3E+03	1.4E+03	1.5E+03	1.7E+03
Cl-36	1.6E+01	1.3E+01	1.0E+01	7.6E+00	6.4E+00	5.0E+00	4.0E+00	3.1E+00	2.5E+00	2.0E+00	1.5E+00	1.2E+00	9.5E-01	7.5E-01	5.8E-01	4.5E-01
Fe-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	2.9E-04	2.1E-04	1.5E-04	1.0E-04	7.2E-05	5.1E-05	3.5E-05	2.4E-05	1.7E-05	1.1E-05	7.6E-06	5.2E-06	3.5E-06	2.4E-06	1.6E-06	1.0E-06
I-129	3.0E-05	4.4E-05	8.4E-05	1.5E-04	2.2E-04	3.7E-04	6.5E-04	9.3E-04	1.4E-03	2.5E-03	3.6E-03	5.2E-03	8.7E-03	1.2E-02	1.7E-02	2.7E-02
K-40	2.6E-08	5.3E-08	8.1E-08	1.7E-07	4.3E-07	7.7E-07	1.1E-06	2.6E-06	5.6E-06	9.0E-06	1.3E-05	2.9E-05	5.7E-05	8.2E-05	1.3E-04	2.6E-04
Nb-91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pd-107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	3.3E+03	4.1E+03	5.6E+03	7.2E+03	9.2E+03	1.2E+04	1.5E+04	1.9E+04	2.4E+04	3.1E+04	3.7E+04	4.5E+04	5.8E+04	6.9E+04	8.5E+04	1.0E+05
Se-79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Si-32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	6.2E+00	6.2E+00	5.9E+00	5.7E+00	5.3E+00	5.2E+00	4.8E+00	4.6E+00	4.2E+00	4.0E+00	3.7E+00	3.4E+00	3.1E+00	2.8E+00	2.6E+00	2.3E+00
Tc-99	7.3E-02	1.3E-01	2.1E-01	3.1E-01	5.3E-01	8.2E-01	1.2E+00	1.9E+00	2.8E+00	3.8E+00	6.0E+00	8.7E+00	1.2E+01	1.8E+01	2.5E+01	3.3E+01

TABLE 53. CONCENTRATIONS AT THE COMPLIANCE WELL
HORIZONTAL PATHRAE MODEL RESULTS FOR CLASS A SOUTH CELL TOP SLOPE (0.276 CM/YR INFILTRATION, 250 FOOT DISTANCE)

SYMBOL	450	455	460	465	470	475	480	485	490	495	500	505	510	515	520	525
Am-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-242m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-210m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bk-247	3.0E-05	2.3E-05	1.7E-05	1.3E-05	1.0E-05	7.7E-06	5.7E-06	4.4E-06	3.3E-06	2.5E-06	1.9E-06	1.4E-06	1.1E-06	8.3E-07	6.2E-07	4.7E-07
Ca-41	1.8E+03	2.0E+03	2.1E+03	2.2E+03	2.4E+03	2.5E+03	2.7E+03	2.8E+03	3.0E+03	3.1E+03	3.2E+03	3.3E+03	3.5E+03	3.6E+03	3.8E+03	3.8E+03
Cl-36	3.5E-01	2.7E-01	2.1E-01	1.7E-01	1.3E-01	1.0E-01	7.7E-02	5.9E-02	4.6E-02	3.6E-02	2.8E-02	2.1E-02	1.6E-02	1.3E-02	9.7E-03	7.4E-03
Fe-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	6.9E-07	4.6E-07	3.0E-07	2.0E-07	1.3E-07	8.3E-08	5.4E-08	3.5E-08	2.3E-08	1.4E-08	9.3E-09	5.9E-09	3.8E-09	2.4E-09	1.5E-09	9.6E-10
I-129	3.9E-02	5.2E-02	7.9E-02	1.1E-01	1.5E-01	2.1E-01	3.1E-01	3.9E-01	5.4E-01	7.9E-01	1.0E+00	1.3E+00	1.9E+00	2.3E+00	3.0E+00	4.2E+00
K-40	4.5E-04	6.1E-04	1.0E-03	1.9E-03	2.9E-03	3.9E-03	6.8E-03	1.2E-02	1.6E-02	2.2E-02	3.8E-02	6.0E-02	7.9E-02	1.1E-01	1.9E-01	2.7E-01
Nb-91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pd-107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	1.2E+05	1.5E+05	1.7E+06	2.1E+05	2.4E+05	2.9E+05	3.2E+05	3.8E+05	4.5E+05	5.1E+05	5.8E+05	6.7E+05	7.6E+05	8.5E+05	9.7E+05	1.1E+06
Se-79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Si-32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	2.1E+00	1.9E+00	1.7E+00	1.5E+00	1.3E+00	1.2E+00	1.1E+00	9.2E-01	8.1E-01	6.9E-01	6.0E-01	5.3E-01	4.6E-01	3.9E-01	3.4E-01	2.9E-01
Tc-99	4.8E+01	6.6E+01	8.6E+01	1.2E+02	1.7E+02	2.1E+02	2.9E+02	3.8E+02	4.8E+02	6.7E+02	8.5E+02	1.0E+03	1.4E+03	1.8E+03	2.1E+03	2.8E+03

SYMBOL	530	535	540	545	550	555	560	565	570	575	580	585	590	595	600
Am-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-242m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-210m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bk-247	3.5E-07	2.7E-07	2.0E-07	1.5E-07	1.1E-07	8.6E-08	6.4E-08	4.8E-08	3.6E-08	2.7E-08	2.0E-08	1.5E-08	1.1E-08	8.4E-09	6.3E-09
Ca-41	3.9E+03	4.1E+03	4.2E+03	4.2E+03	4.3E+03	4.4E+03	4.3E+03	4.5E+03	4.4E+03	4.5E+03	4.5E+03	5.0E+03	5.4E+03	5.2E+03	4.8E+03
Cl-36	5.8E-03	4.4E-03	3.4E-03	2.6E-03	2.0E-03	1.5E-03	1.2E-03	8.9E-04	6.9E-04	5.2E-04	4.1E-04	3.1E-04	2.4E-04	1.8E-04	1.4E-04
Fe-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	6.2E-10	4.0E-10	2.4E-10	1.3E-10	7.1E-11	3.2E-11	2.1E-11	0	0	0	0	0	0	0	0
I-129	5.3E+00	6.6E+00	8.8E+00	1.1E+01	1.4E+01	1.8E+01	2.3E+01	2.7E+01	3.5E+01	4.5E+01	5.3E+01	6.4E+01	8.1E+01	9.8E+01	1.2E+02
K-40	3.5E-01	5.1E-01	7.9E-01	1.1E+00	1.4E+00	2.1E+00	3.0E+00	3.9E+00	5.0E+00	7.4E+00	1.0E+01	1.3E+01	1.7E+01	2.4E+01	3.2E+01
Nb-91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pd-107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	1.2E+06	1.4E+06	1.5E+06	1.7E+06	1.9E+06	2.1E+06	2.3E+06	2.5E+06	2.8E+06	3.0E+06	3.3E+06	3.6E+06	3.9E+06	4.2E+06	4.6E+06
Se-79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Si-32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	2.5E-01	2.1E-01	1.8E-01	1.6E-01	1.3E-01	1.1E-01	9.4E-02	7.9E-02	6.6E-02	5.6E-02	4.6E-02	4.2E-02	3.8E-02	3.1E-02	2.3E-02
Tc-99	3.6E+03	4.3E+03	5.5E+03	6.8E+03	8.1E+03	1.0E+04	1.3E+04	1.5E+04	1.9E+04	2.3E+04	2.6E+04	3.3E+04	3.9E+04	4.4E+04	5.4E+04

TABLE 53. CONCENTRATIONS AT THE COMPLIANCE WELL

HORIZONTAL PATHRAE MODEL RESULTS FOR CLASS A SOUTH CELL TOP SLOPE (0.276 CM/YR INFILTRATION, 250 FOOT DISTANCE)

SYMBOL	605	610	615	620	625	630	635	640	645	650	655	660	665	670	675	680
Am-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-242m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-210m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bk-247	4.7E-09	3.5E-09	2.6E-09	1.9E-09	1.4E-09	1.0E-09	7.8E-10	5.7E-10	4.3E-10	3.1E-10	2.2E-10	1.6E-10	1.1E-10	8.0E-11	4.4E-11	2.3E-11
Ca-41	4.8E+03	4.9E+03	4.5E+03	4.2E+03	4.3E+03	4.4E+03	4.1E+03	3.9E+03	4.1E+03	4.1E+03	3.7E+03	3.5E+03	3.7E+03	3.6E+03	3.2E+03	3.3E+03
Cl-36	1.1E-04	8.1E-05	6.1E-05	4.7E-05	3.5E-05	2.7E-05	2.0E-05	1.6E-05	1.2E-05	9.0E-06	6.8E-06	5.2E-06	4.0E-06	3.0E-06	2.3E-06	1.7E-06
Fe-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I-129	1.5E+02	1.7E+02	2.0E+02	2.5E+02	3.1E+02	3.5E+02	4.3E+02	5.1E+02	5.8E+02	6.9E+02	8.3E+02	9.4E+02	1.1E+03	1.3E+03	1.5E+03	1.7E+03
K-40	3.8E+01	5.3E+01	7.3E+01	9.1E+01	1.1E+02	1.5E+02	2.0E+02	2.4E+02	3.0E+02	4.0E+02	5.1E+02	6.0E+02	7.6E+02	1.0E+03	1.2E+03	1.4E+03
Nb-91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pd-107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	4.9E+06	5.2E+06	5.7E+06	6.0E+06	6.5E+06	7.0E+06	7.3E+06	7.9E+06	8.2E+06	8.9E+06	9.3E+06	9.8E+06	1.0E+07	1.1E+07	1.2E+07	1.2E+07
Se-79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Si-32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	1.9E-02	1.6E-02	1.3E-02	1.0E-02	8.4E-03	7.1E-03	5.5E-03	4.3E-03	3.7E-03	3.1E-03	2.4E-03	1.9E-03	1.7E-03	1.4E-03	1.0E-03	8.5E-04
Tc-99	6.4E+04	7.2E+04	8.8E+04	1.0E+05	1.1E+05	1.4E+05	1.6E+05	1.8E+05	2.1E+05	2.4E+05	2.7E+05	3.2E+05	3.6E+05	3.9E+05	4.7E+05	5.2E+05

SYMBOL	685	690	695	700	705	710	715	720	725	730	735	740	745	750	755
Am-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-242m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-210m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bk-247	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ca-41	3.4E+03	3.1E+03	2.9E+03	2.9E+03	2.9E+03	2.7E+03	2.5E+03	2.6E+03	2.6E+03	2.3E+03	2.2E+03	2.2E+03	2.1E+03	1.9E+03	1.8E+03
Cl-36	1.3E-06	9.9E-07	7.5E-07	5.7E-07	4.3E-07	3.2E-07	2.4E-07	1.8E-07	1.4E-07	1.1E-07	8.0E-08	6.1E-08	4.8E-08	3.8E-08	2.9E-08
Fe-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I-129	2.0E+03	2.3E+03	2.6E+03	3.0E+03	3.4E+03	3.8E+03	4.6E+03	5.1E+03	5.8E+03	6.5E+03	7.4E+03	8.0E+03	9.2E+03	1.0E+04	1.1E+04
K-40	1.8E+03	2.3E+03	2.8E+03	3.3E+03	4.2E+03	5.2E+03	5.9E+03	7.1E+03	8.9E+03	1.1E+04	1.2E+04	1.5E+04	1.8E+04	2.1E+04	2.4E+04
Nb-91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pd-107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	1.3E+07	1.3E+07	1.4E+07	1.5E+07	1.5E+07	1.6E+07	1.6E+07	1.9E+07	2.2E+07	2.3E+07	2.1E+07	1.9E+07	2.0E+07	2.3E+07	2.3E+07
Se-79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Si-32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	7.2E-04	5.8E-04	4.4E-04	3.6E-04	3.1E-04	2.4E-04	1.8E-04	1.5E-04	1.3E-04	9.8E-05	7.5E-05	6.3E-05	5.1E-05	3.9E-05	3.1E-05
Tc-99	5.7E+05	6.6E+05	7.3E+05	8.2E+05	9.4E+05	1.0E+06	1.2E+06	1.3E+06	1.5E+06	1.6E+06	1.8E+06	2.0E+06	2.1E+06	2.4E+06	2.8E+06

TABLE 53. CONCENTRATIONS AT THE COMPLIANCE WELL
HORIZONTAL PATHRAE MODEL RESULTS FOR CLASS A SOUTH CELL TOP SLOPE (0.276 CM/YR INFILTRATION, 250 FOOT DISTANCE)

SYMBOL	760	765	770	775	780	785	790	795	800	805	810	815	820	825	830	835
Am-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-242m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-210m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bk-247	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ca-41	1.9E+03	1.8E+03	1.6E+03	1.5E+03	1.6E+03	1.5E+03	1.3E+03	1.3E+03	1.3E+03	1.2E+03	1.1E+03	1.1E+03	1.0E+03	9.4E+02	8.7E+02	8.9E+02
Cl-36	2.0E-08	1.5E-08	1.1E-08	8.5E-09	5.9E-09	4.3E-09	3.4E-09	2.6E-09	1.8E-09	1.3E-09	1.0E-09	7.8E-10	5.6E-10	4.0E-10	3.1E-10	2.4E-10
Fe-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I-129	1.3E+04	1.4E+04	1.6E+04	1.7E+04	2.0E+04	2.2E+04	2.3E+04	2.6E+04	2.9E+04	3.2E+04	3.5E+04	3.8E+04	4.1E+04	4.5E+04	5.1E+04	5.3E+04
K-40	2.9E+04	3.6E+04	4.0E+04	4.7E+04	5.7E+04	6.6E+04	7.3E+04	8.6E+04	1.0E+05	1.2E+05	1.3E+05	1.6E+05	1.8E+05	2.1E+05	2.2E+05	2.6E+05
Nb-91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pd-107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	2.1E+07	2.0E+07	2.3E+07	2.5E+07	2.4E+07	2.2E+07	2.2E+07	2.5E+07	2.6E+07	2.5E+07	2.3E+07	2.4E+07	2.7E+07	2.8E+07	2.5E+07	2.4E+07
Se-79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Si-32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	2.6E-05	2.1E-05	1.6E-05	1.3E-05	1.0E-05	8.2E-06	6.2E-06	5.1E-06	4.1E-06	3.2E-06	2.5E-06	2.0E-06	1.6E-06	1.2E-06	9.5E-07	7.7E-07
Tc-99	2.8E+06	3.2E+06	3.3E+06	3.6E+06	4.1E+06	4.3E+06	4.7E+06	5.2E+06	5.5E+06	6.0E+06	6.5E+06	7.0E+06	7.5E+06	8.2E+06	8.7E+06	9.4E+06

SYMBOL	840	845	850	855	860	865	870	875	880	885	890	895	900	905	910
Am-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-242m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-210m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bk-247	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ca-41	8.5E+02	7.5E+02	7.0E+02	7.2E+02	6.6E+02	6.0E+02	5.6E+02	5.7E+02	5.2E+02	4.6E+02	4.4E+02	4.4E+02	4.0E+02	3.6E+02	3.5E+02
Cl-36	1.8E-10	1.2E-10	9.6E-11	7.3E-11	4.6E-11	3.6E-11	1.7E-11	1.2E-11	0	0	0	0	0	0	0
Fe-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I-129	5.9E+04	6.5E+04	6.9E+04	7.6E+04	8.4E+04	8.8E+04	9.5E+04	1.1E+05	1.1E+05	1.2E+05	1.3E+05	1.4E+05	1.4E+05	1.6E+05	1.7E+05
K-40	3.1E+05	3.3E+05	3.8E+05	4.6E+05	5.1E+05	5.5E+05	6.4E+05	7.4E+05	8.2E+05	8.9E+05	1.0E+06	1.2E+06	1.3E+06	1.4E+06	1.6E+06
Nb-91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pd-107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	2.6E+07	2.8E+07	2.7E+07	2.5E+07	2.4E+07	2.7E+07	2.9E+07	2.7E+07	2.4E+07	2.5E+07	2.7E+07	2.8E+07	2.6E+07	2.3E+07	2.5E+07
Se-79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Si-32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	6.1E-07	4.7E-07	3.6E-07	3.0E-07	2.4E-07	1.8E-07	1.4E-07	1.1E-07	8.8E-08	6.7E-08	5.4E-08	4.4E-08	3.3E-08	2.5E-08	2.0E-08
Tc-99	1.0E+07	1.1E+07	1.1E+07	1.3E+07	1.3E+07	1.4E+07	1.5E+07	1.6E+07	1.7E+07	1.8E+07	1.9E+07	2.0E+07	2.1E+07	2.3E+07	2.6E+07

TABLE 53. CONCENTRATIONS AT THE COMPLIANCE WELL
HORIZONTAL PATHRAE MODEL RESULTS FOR CLASS A SOUTH CELL TOP SLOPE (0.276 CM/YR INFILTRATION, 250 FOOT DISTANCE)

SYMBOL	915	920	925	930	935	940	945	950	955	960	965	970	975	980	985
Am-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-242m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-210m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bk-247	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ca-41	3.5E+02	3.0E+02	2.8E+02	2.6E+02	2.6E+02	2.4E+02	2.2E+02	2.1E+02	2.0E+02	1.8E+02	1.7E+02	1.7E+02	1.5E+02	1.3E+02	1.3E+02
Cl-36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I-129	1.8E+05	1.9E+05	2.1E+05	2.1E+05	2.3E+05	2.5E+05	2.6E+05	2.8E+05	3.0E+05	3.2E+05	3.8E+05	4.7E+05	5.4E+05	5.5E+05	5.2E+05
K-40	1.8E+06	1.9E+06	2.2E+06	2.6E+06	2.7E+06	2.9E+06	3.4E+06	3.7E+06	4.0E+06	4.4E+06	4.9E+06	5.5E+06	5.7E+06	6.4E+06	7.1E+06
Nb-91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pd-107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	2.6E+07	2.6E+07	2.4E+07	2.3E+07	2.5E+07	2.6E+07	2.5E+07	2.2E+07	2.2E+07	2.4E+07	2.5E+07	2.2E+07	2.0E+07	2.1E+07	2.2E+07
Se-79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Si-32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	1.6E-08	1.2E-08	9.3E-09	7.6E-09	6.0E-09	4.5E-09	3.5E-09	2.8E-09	2.2E-09	1.6E-09	1.3E-09	1.0E-09	8.0E-10	5.9E-10	4.7E-10
Tc-99	3.3E+07	3.7E+07	3.7E+07	3.4E+07	3.1E+07	3.2E+07	3.9E+07	4.4E+07	4.4E+07	4.1E+07	3.8E+07	3.9E+07	4.9E+07	5.5E+07	5.5E+07

SYMBOL	990	995	1000	1005	1010	1015	1020	1030	1040	1050	1060	1070	1080	1100
Am-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-242m	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-210m	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bk-247	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ca-41	1.3E+02	1.1E+02	1.0E+02	8.9E+01	8.5E+01	8.3E+01	7.6E+01	7.1E+01	5.8E+01	5.3E+01	4.3E+01	3.9E+01	3.4E+01	2.5E+01
Cl-36	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I-129	4.5E+05	4.6E+05	5.6E+05	6.4E+05	6.8E+05	6.5E+05	5.9E+05	6.7E+05	8.6E+05	7.8E+05	7.9E+05	1.1E+06	1.0E+06	1.3E+06
K-40	7.8E+06	8.1E+06	9.0E+06	1.0E+07	1.1E+07	1.1E+07	1.3E+07	1.5E+07	1.8E+07	2.0E+07	2.4E+07	2.7E+07	3.3E+07	4.1E+07
Nb-91	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pd-107	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	2.2E+07	2.0E+07	1.9E+07	2.0E+07	2.1E+07	2.0E+07	1.8E+07	1.9E+07	1.8E+07	1.6E+07	1.7E+07	1.4E+07	1.5E+07	1.3E+07
Se-79	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Si-32	0	0	0	0	0	0	0	0	0	2.2E-11	6.1E-11	9.1E-11	1.4E-10	7.3E-10
Sr-90	3.8E-10	2.8E-10	2.1E-10	1.6E-10	1.3E-10	9.4E-11	5.6E-11	3.6E-11	1.3E-11	0	0	0	0	0
Tc-99	5.1E+07	4.7E+07	5.1E+07	6.1E+07	6.8E+07	6.8E+07	6.2E+07	6.2E+07	6.2E+07	7.5E+07	7.5E+07	9.7E+07	8.8E+07	1.1E+08

TABLE 54. CONCENTRATIONS AT THE COMPLIANCE WELL
HORIZONTAL PATHRAE MODEL RESULTS FOR CLASS A SOUTH CELL SIDE SLOPE (0.286 CM/YR INFILTRATION, 90 FOOT DISTANCE)

SYMBOL	EXCEEDS	1	10	15	20	25	30	35	40	45	50	55
Am-241	-1	0	0	0	0	0	0	0	0	0	0	0
Am-242m	-1	0	0	0	0	0	0	0	0	0	0	0
Am-243	-1	0	0	0	0	0	0	0	0	0	0	0
Bi-207	-1	0	0	0	0	0	0	0	0	0	0	0
Bi-210m	-1	0	0	0	0	0	0	0	0	0	0	0
Bk-247	-1	0	0	0	0	0	0	0	0	6.4E-11	2.2E-09	3.8E-08
Ca-41	505	0	0	0	0	0	0	0	0	0	0	0
Cl-36	-1	0	0	0	0	0	0	0	2.8E-10	1.8E-08	6.7E-07	1.7E-05
Fe-60	-1	0	0	0	0	0	0	0	0	0	0	0
H-3	-1	0	0	0	0	0	0	0	0	0	0	0
I-129	510	0	0	0	0	0	0	0	0	0	0	0
K-40	600	0	0	0	0	0	0	0	0	0	0	0
Nb-91	-1	0	0	0	0	0	0	0	0	0	0	0
Pd-107	-1	0	0	0	0	0	0	0	0	0	0	0
Pt-193	-1	0	0	0	0	0	0	0	0	0	0	0
Re-187	500	0	0	0	0	0	0	0	0	0	0	0
Se-79	-1	0	0	0	0	0	0	0	0	0	0	0
Si-32	1500	0	0	0	0	0	0	0	0	0	0	0
Sr-90	-1	0	0	0	0	0	0	0	0	0	0	0
Tc-99	510	0	0	0	0	0	0	0	0	0	0	0

SYMBOL	60	65	70	80	90	100	110	120	130	140	150	160	180	190	200	210	220	240	260
Am-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-242m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-210m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bk-247	4.0E-07	3.2E-06	1.6E-05	2.9E-04	2.5E-03	1.3E-02	4.2E-02	1.0E-01	2.0E-01	3.2E-01	4.4E-01	5.3E-01	5.4E-01	5.0E-01	4.2E-01	3.3E-01	2.6E-01	1.4E-01	6.3E-02
Ca-41	0	0	0	0	0	0	3.9E-11	1.9E-09	4.8E-08	7.6E-07	8.1E-06	6.5E-05	1.8E-03	7.6E-03	2.6E-02	7.8E-02	2.1E-01	1.1E+00	4.2E+00
Cl-36	2.7E-04	2.8E-03	2.0E-02	4.4E-01	4.4E+00	2.5E+01	8.6E+01	2.3E+02	4.5E+02	7.7E+02	1.1E+03	1.4E+03	1.8E+03	1.8E+03	1.7E+03	1.4E+03	1.2E+03	6.6E+02	3.4E+02
Fe-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	0	0	0	1.0E-10	5.8E-08	4.7E-06	9.6E-05	8.2E-04	4.1E-03	1.3E-02	3.6E-02	1.2E-01	4.4E-01	5.3E-01	5.0E-01	4.6E-01	5.0E-01	4.4E-01	1.9E-01
I-129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.8E-10
K-40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nb-91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pd-107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	0	0	0	0	0	0	0	0	0	2.1E-11	1.4E-09	3.9E-08	1.7E-06	2.0E-05	2.5E-04	2.2E-03	1.3E-02	1.2E-01	1.3E+00
Se-79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Si-32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	0	0	0	0	0	1.6E-10	1.1E-08	3.7E-07	6.7E-06	7.2E-05	5.4E-04	3.0E-03	4.2E-02	1.2E-01	2.9E-01	6.0E-01	1.1E+00	2.8E+00	5.5E+00
Tc-99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.9E-10	7.4E-09	1.3E-06

NOTE: Year to exceed GWPL reported to next lowest model output year. -1 indicates constituent does not exceed GWPL within the 2,000 years modeled
Radionuclide concentrations are reported in pCi/L

TABLE 54. CONCENTRATIONS AT THE COMPLIANCE WELL
HORIZONTAL PATHRAE MODEL RESULTS FOR CLASS A SOUTH CELL SIDE SLOPE (0.286 CM/YR INFILTRATION, 90 FOOT DISTANCE)

SYMBOL	280	300	305	310	315	320	325	330	335	340
Am-241	0	0	0	0	0	0	0	0	0	0
Am-242m	0	0	0	0	0	0	0	0	0	0
Am-243	0	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	0	0	0
Bi-210m	0	0	0	0	0	0	0	0	0	0
Bk-247	2.7E-02	1.0E-02	8.1E-03	7.2E-03	6.4E-03	3.2E-03	3.4E-03	1.7E-03	2.0E-03	9.9E-04
Ca-41	1.6E+01	5.1E+01	6.8E+01	8.5E+01	9.6E+01	1.3E+02	1.3E+02	2.1E+02	1.8E+02	2.9E+02
Cl-36	1.6E+02	7.6E+01	6.2E+01	5.0E+01	4.0E+01	4.3E+01	2.6E+01	2.0E+01	1.4E+01	1.1E+01
Fe-60	0	0	0	0	0	0	0	0	0	0
H-3	7.4E-02	3.2E-02	1.9E-02	1.7E-02	1.1E-02	8.5E-03	6.8E-03	4.0E-03	3.7E-03	2.1E-03
I-129	1.3E-08	1.5E-07	2.6E-07	1.5E-06	1.6E-06	1.5E-06	1.7E-05	1.3E-05	9.4E-06	6.5E-05
K-40	0	0	1.7E-10	2.4E-10	1.8E-10	1.0E-09	6.1E-09	6.5E-09	4.4E-09	5.1E-08
Nb-91	0	0	0	0	0	0	0	0	0	0
Pd-107	0	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	0	0	0	0	0	0	0
Re-187	1.6E+01	8.0E+01	1.2E+02	1.2E+02	3.0E+02	2.3E+02	5.9E+02	5.9E+02	9.0E+02	1.3E+03
Se-79	0	0	0	0	0	0	0	0	0	0
Si-32	0	0	0	0	0	0	0	0	0	0
Sr-90	9.6E+00	1.5E+01	1.7E+01	1.7E+01	1.7E+01	1.9E+01	1.6E+01	2.0E+01	1.6E+01	2.0E+01
Tc-99	3.4E-05	2.1E-04	1.1E-03	2.1E-03	1.4E-03	6.9E-03	1.2E-02	8.5E-03	3.6E-02	6.0E-07

SYMBOL	345	350	355	360	365	370	375	380	385	390	395
Am-241	0	0	0	0	0	0	0	0	0	0	0
Am-242m	0	0	0	0	0	0	0	0	0	0	0
Am-243	0	0	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	0	0	0	0
Bi-210m	0	0	0	0	0	0	0	0	0	0	0
Bk-247	1.2E-03	5.9E-04	7.2E-04	3.4E-04	4.2E-04	2.0E-04	2.4E-04	1.2E-04	1.4E-04	6.7E-05	8.2E-05
Ca-41	2.4E+02	4.1E+02	3.2E+02	5.3E+02	4.2E+02	6.7E+02	5.7E+02	8.2E+02	7.7E+02	9.8E+02	1.0E+03
Cl-36	9.4E+00	6.4E+00	6.1E+00	3.6E+00	3.9E+00	2.0E+00	2.4E+00	1.1E+00	1.5E+00	6.9E-01	9.2E-01
Fe-60	0	0	0	0	0	0	0	0	0	0	0
H-3	1.7E-03	1.2E-03	7.8E-04	6.1E-04	3.4E-04	2.9E-04	1.7E-04	1.2E-04	8.8E-05	5.0E-05	4.1E-06
I-129	8.8E-05	6.1E-05	3.1E-04	5.1E-04	3.0E-04	1.1E-03	2.3E-03	1.7E-03	3.7E-03	9.7E-03	6.0E-03
K-40	1.3E-07	1.2E-07	9.4E-08	1.2E-06	1.9E-06	1.5E-06	3.0E-06	1.8E-05	2.1E-05	1.4E-05	6.5E-05
Nb-91	0	0	0	0	0	0	0	0	0	0	0
Pd-107	0	0	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	0	0	0	0	0	0	0	0
Re-187	1.2E+03	2.8E+03	2.1E+03	4.5E+03	4.5E+03	6.0E+03	9.2E+03	7.2E+03	1.6E+04	1.2E+04	2.3E+04
Se-79	0	0	0	0	0	0	0	0	0	0	0
Si-32	0	0	0	0	0	0	0	0	0	0	0
Sr-90	1.4E+01	1.8E+01	1.3E+01	1.7E+01	1.2E+01	1.5E+01	1.1E+01	1.3E+01	9.8E+00	1.1E+01	9.0E+00
Tc-99	4.1E-02	1.7E-01	2.6E-01	1.8E-01	6.7E-01	9.9E-01	6.8E-01	2.4E+00	3.5E+00	2.3E+00	7.9E+00

SYMBOL	400	405	410	415	420	425	430	435	440	445
Am-241	0	0	0	0	0	0	0	0	0	0
Am-242m	0	0	0	0	0	0	0	0	0	0
Am-243	0	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	0	0	0
Bi-210m	0	0	0	0	0	0	0	0	0	0
Bk-247	3.9E-05	4.7E-05	2.2E-05	2.7E-05	1.3E-05	1.5E-05	7.5E-06	8.5E-06	4.4E-06	4.7E-06
Ca-41	1.1E+03	1.3E+03	1.2E+03	1.6E+03	1.5E+03	1.9E+03	1.5E+03	2.2E+03	1.6E+03	2.4E+03
Cl-36	4.3E-01	5.6E-01	2.8E-01	3.3E-01	1.7E-01	1.9E-01	1.1E-01	1.1E-01	6.8E-02	5.9E-02
Fe-60	0	0	0	0	0	0	0	0	0	0
H-3	2.3E-05	1.8E-05	1.1E-05	6.9E-06	5.0E-06	2.7E-06	2.1E-06	1.2E-06	8.5E-07	5.6E-07
I-129	1.1E-02	3.5E-02	3.2E-02	2.9E-02	1.1E-01	1.1E-01	8.0E-02	3.1E-01	3.6E-01	2.3E-01
K-40	1.8E-04	1.6E-04	1.1E-04	8.7E-04	1.4E-03	1.1E-03	1.3E-03	7.4E-03	8.7E-03	6.0E-03
Nb-91	0	0	0	0	0	0	0	0	0	0
Pd-107	0	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	0	0	0	0	0	0	0
Re-187	2.4E+04	2.7E+04	4.2E+04	3.0E+04	6.4E+04	4.9E+04	8.5E+04	6.8E+04	9.3E+04	1.4E+05
Se-79	0	0	0	0	0	0	0	0	0	0
Si-32	0	0	0	0	0	0	0	0	0	0
Sr-90	8.5E+00	7.9E+00	6.7E+00	6.7E+00	5.1E+00	5.4E+00	3.9E+00	4.4E+00	2.9E+00	3.4E+00
Tc-99	1.0E+01	7.0E+00	2.3E+01	2.9E+01	1.9E+01	6.4E+01	7.8E+01	5.2E+01	1.7E+02	1.9E+02

TABLE 54. CONCENTRATIONS AT THE COMPLIANCE WELL
HORIZONTAL PATHRAE MODEL RESULTS FOR CLASS A SOUTH CELL SIDE SLOPE (0.286 CM/YR INFILTRATION, 90 FOOT DISTANCE)

SYMBOL	450	455	460	465	470	475	480	485	490	495	500	505	510	515	520	525
Am-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-242m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-210m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bk-247	2.5E-06	2.6E-06	1.4E-06	1.4E-06	8.3E-07	7.9E-07	4.7E-07	4.2E-07	2.6E-07	2.3E-07	1.4E-07	1.2E-07	8.3E-08	6.6E-08	4.7E-08	3.6E-08
Ca-41	1.9E+03	2.6E+03	2.1E+03	2.8E+03	2.3E+03	3.0E+03	2.7E+03	3.1E+03	3.1E+03	3.1E+03	3.2E+03	3.0E+03	3.5E+03	3.0E+03	3.7E+03	2.9E+03
Cl-36	4.2E-02	3.2E-02	2.6E-02	1.7E-02	1.6E-02	9.1E-03	9.4E-03	4.8E-03	5.6E-03	2.7E-03	3.3E-03	1.5E-03	1.9E-03	8.8E-04	1.1E-03	5.3E-04
Fe-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	3.1E-07	2.4E-07	1.3E-07	9.5E-08	5.8E-08	3.5E-08	2.5E-08	1.3E-08	9.8E-09	5.3E-09	3.6E-09	2.3E-09	1.3E-09	9.1E-10	5.2E-10	5.0E-10
I-129	7.7E-01	1.0E+00	7.1E-01	1.7E+00	2.7E+00	2.0E+00	3.4E+00	6.8E+00	5.2E+00	8.4E+00	1.5E+01	1.3E+01	1.2E+01	3.3E+01	3.0E+01	2.1E+01
K-40	1.5E-02	4.6E-02	4.3E-02	2.8E-02	1.3E-01	2.3E-01	1.6E-01	1.6E-01	7.4E-01	9.0E-01	6.3E-01	1.1E+00	3.2E+00	3.1E+00	2.0E+00	6.4E+00
Nb-91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pd-107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	1.0E+05	2.0E+05	1.6E+05	2.4E+05	2.5E+05	2.5E+05	3.8E+05	2.7E+05	4.9E+05	4.0E+05	5.6E+05	6.1E+05	5.4E+05	8.5E+05	5.9E+05	1.1E+06
Se-79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Si-32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	2.2E+00	2.6E+00	1.8E+00	1.9E+00	1.3E+00	1.4E+00	1.1E+00	1.0E+00	8.2E-01	7.2E-01	6.4E-01	4.8E-01	4.7E-01	3.3E-01	3.3E-01	2.3E-01
Tc-99	1.2E+02	3.8E+02	4.3E+02	2.9E+02	8.5E+02	9.2E+02	6.2E+02	1.8E+03	1.9E+03	1.3E+03	3.6E+03	3.7E+03	2.5E+03	6.9E+03	8.8E+03	4.8E+03

SYMBOL	530	535	540	545	550	555	560	565	570	575	580	585	590	595	600
Am-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-242m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-210m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bk-247	2.7E-08	1.9E-08	1.5E-08	1.0E-08	8.3E-09	5.4E-09	4.5E-09	2.8E-09	2.5E-09	1.5E-09	1.4E-09	7.7E-10	7.7E-10	4.1E-10	4.0E-10
Ca-41	3.9E+03	2.9E+03	3.9E+03	2.9E+03	3.8E+03	2.8E+03	3.7E+03	3.0E+03	3.6E+03	4.3E+03	5.8E+03	3.1E+03	1.3E+03	3.9E+03	4.5E+03
Cl-36	6.3E-04	3.3E-04	3.4E-04	2.0E-04	1.9E-04	1.2E-04	1.0E-04	7.0E-05	5.4E-05	4.2E-05	2.8E-05	2.5E-05	1.5E-05	1.5E-05	7.6E-06
Fe-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	7.0E-10	5.2E-11	8.4E-11	5.0E-11	1.7E-11	0	1.2E-11	0	0	0	0	0	0	0	0
I-129	6.2E+01	6.3E+01	4.1E+01	1.1E+02	1.3E+02	8.4E+01	1.8E+02	2.5E+02	1.7E+02	2.9E+02	4.5E+02	3.3E+02	4.2E+02	8.1E+02	8.3E+02
K-40	1.2E+01	9.4E+00	8.8E+00	2.6E+01	3.6E+01	2.6E+01	3.1E+01	9.8E+01	9.6E+01	6.3E+01	1.4E+02	2.9E+02	2.4E+02	1.6E+02	5.3E+02
Nb-91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pd-107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	8.5E+05	1.1E+06	1.2E+06	1.1E+06	1.6E+06	1.1E+06	1.9E+06	1.5E+06	1.9E+06	2.1E+06	1.8E+06	2.7E+06	1.9E+06	3.1E+06	2.6E+06
Se-79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Si-32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	2.4E-01	1.6E-01	1.7E-01	1.1E-01	1.2E-01	7.5E-02	7.9E-02	5.3E-02	5.2E-02	5.0E-02	5.6E-02	2.6E-02	9.3E-03	2.1E-02	2.1E-02
Tc-99	1.3E+04	1.2E+04	8.8E+03	2.3E+04	2.1E+04	1.6E+04	3.8E+04	3.5E+04	2.6E+04	6.3E+04	5.7E+04	4.4E+04	9.9E+04	8.7E+04	6.9E+04

TABLE 54. CONCENTRATIONS AT THE COMPLIANCE WELL
HORIZONTAL PATHRAE MODEL RESULTS FOR CLASS A SOUTH CELL SIDE SLOPE (0.286 CM/YR INFILTRATION, 90 FOOT DISTANCE)

SYMBOL	605	610	615	620	625	630	635	640	645	650	655	660	665	670	675	680
Am-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-242m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-210m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bk-247	2.1E-10	2.2E-10	1.1E-10	1.2E-10	5.3E-11	6.6E-11	2.4E-11	2.9E-11	1.3E-11	1.6E-11	0	0	0	0	0	0
Ca-41	2.3E+03	9.3E+02	4.1E+03	3.6E+03	1.7E+03	9.8E+02	4.0E+03	2.9E+03	1.2E+03	1.4E+03	3.6E+03	2.2E+03	9.1E+02	1.8E+03	2.9E+03	1.5E+03
Cl-36	8.5E-06	4.0E-06	4.8E-06	2.3E-06	2.8E-06	1.3E-06	1.6E-06	7.4E-07	8.7E-07	4.4E-07	4.7E-07	2.6E-07	2.6E-07	1.5E-07	1.4E-07	9.5E-08
Fe-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I-129	6.1E+02	1.4E+03	1.2E+03	8.8E+02	2.1E+03	2.0E+03	1.3E+03	3.2E+03	3.4E+03	2.2E+03	4.6E+03	5.4E+03	3.6E+03	6.0E+03	6.7E+03	5.6E+03
K-40	7.0E+02	5.1E+02	5.1E+02	1.6E+03	1.6E+03	1.0E+03	1.9E+03	3.7E+03	3.2E+03	2.1E+03	5.7E+03	7.9E+03	5.9E+03	5.0E+03	1.5E+04	1.5E+04
Nb-91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pd-107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	3.0E+06	3.4E+06	2.6E+06	4.1E+06	2.8E+06	4.4E+06	3.8E+06	4.1E+06	4.8E+06	3.6E+06	5.6E+06	3.9E+06	5.9E+06	5.1E+06	5.3E+06	6.3E+06
Se-79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Si-32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	9.2E-03	3.4E-03	1.1E-02	8.2E-03	3.4E-03	1.6E-03	5.0E-03	3.1E-03	1.2E-03	1.0E-03	2.1E-03	1.1E-03	4.1E-04	6.2E-04	6.4E-04	4.0E-04
Tc-99	1.5E+05	1.3E+06	1.1E+05	2.3E+05	2.0E+05	1.6E+05	3.3E+05	2.7E+05	2.4E+05	4.9E+05	3.9E+05	3.5E+05	6.8E+05	5.5E+05	5.1E+05	9.5E+05

SYMBOL	685	690	695	700	705	710	715	720	725	730	735	740	745	750	755
Am-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-242m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-210m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bk-247	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ca-41	6.5E+02	2.0E+03	2.3E+03	1.1E+03	4.8E+02	2.1E+03	1.7E+03	7.9E+02	5.0E+02	1.8E+03	1.2E+03	5.3E+02	6.6E+02	1.5E+03	8.8E+02
Cl-36	7.2E-08	5.4E-08	3.7E-08	3.1E-08	1.9E-08	1.8E-08	9.7E-09	1.1E-08	5.0E-09	6.0E-09	2.9E-09	5.1E-09	2.4E-09	7.2E-10	2.2E-10
Fe-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I-129	7.6E+03	1.2E+04	8.9E+03	9.4E+03	1.7E+04	1.4E+04	1.2E+04	2.4E+04	2.1E+04	1.4E+04	3.3E+04	3.1E+04	2.1E+04	4.2E+04	4.5E+04
K-40	1.0E+04	1.5E+04	3.2E+04	2.8E+04	1.8E+04	4.1E+04	6.1E+04	4.5E+04	3.5E+04	9.6E+04	1.1E+05	7.2E+04	8.8E+04	1.9E+05	1.7E+05
Nb-91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pd-107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	4.6E+06	7.2E+06	5.0E+06	7.3E+06	6.4E+06	9.5E+06	1.4E+07	8.7E+06	4.0E+06	1.8E+06	1.2E+07	1.2E+07	7.0E+06	3.1E+06	2.9E+06
Se-79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Si-32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	1.4E-04	3.5E-04	3.2E-04	1.4E-04	5.3E-05	1.7E-04	1.1E-04	4.8E-05	2.5E-05	6.9E-05	4.2E-05	1.6E-05	1.5E-05	2.7E-05	1.5E-05
Tc-99	7.4E+05	7.2E+05	1.3E+06	9.9E+05	9.9E+05	1.7E+06	1.3E+06	1.3E+06	2.2E+06	1.6E+06	1.8E+06	2.8E+06	2.1E+06	2.3E+06	3.6E+06

TABLE 54. CONCENTRATIONS AT THE COMPLIANCE WELL
HORIZONTAL PATHRAE MODEL RESULTS FOR CLASS A SOUTH CELL SIDE SLOPE (0.286 CM/YR INFILTRATION, 90 FOOT DISTANCE)

SYMBOL	760	765	770	775	780	785	790	795	800	805	810	815	820	825	830	835
Am-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-242m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-210m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bk-247	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ca-41	3.7E+02	8.0E+02	1.1E+03	6.1E+02	2.5E+02	8.2E+02	8.3E+02	4.0E+02	1.7E+02	7.4E+02	5.8E+02	2.7E+02	1.9E+02	6.1E+02	4.0E+02	1.7E+02
Cl-36	1.3E-09	7.7E-10	2.5E-10	6.9E-11	3.7E-10	2.7E-10	9.1E-11	2.6E-11	8.0E-11	8.8E-11	3.2E-11	0	1.1E-11	2.2E-11	0	0
Fe-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I-129	2.8E+04	5.1E+04	6.1E+04	4.0E+04	5.9E+04	8.3E+04	5.9E+04	6.8E+04	1.1E+05	8.2E+04	7.5E+04	1.4E+05	1.1E+05	8.6E+04	1.7E+05	1.5E+05
K-40	1.1E+06	2.2E+05	3.2E+05	2.4E+05	1.7E+05	4.5E+05	5.1E+05	3.6E+05	3.7E+05	8.3E+05	7.6E+05	5.0E+05	8.6E+05	1.3E+06	1.1E+06	7.2E+05
Nb-91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pd-107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	1.4E+07	1.1E+07	5.8E+06	2.5E+06	7.0E+06	1.5E+07	9.9E+06	4.7E+06	2.0E+06	1.2E+07	1.4E+07	7.9E+06	3.5E+06	2.5E+06	1.5E+07	1.2E+07
Se-79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Si-32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	5.2E-06	8.2E-06	1.0E-05	4.7E-06	1.7E-06	4.0E-06	3.6E-06	1.6E-06	5.8E-07	1.8E-06	1.3E-06	4.9E-07	2.8E-07	6.9E-07	4.1E-07	1.6E-07
Tc-99	2.6E+06	3.0E+06	4.6E+06	3.2E+06	3.9E+06	5.7E+06	4.1E+06	5.0E+06	7.0E+06	4.9E+06	6.1E+06	8.4E+06	5.8E+06	7.5E+06	9.9E+06	6.7E+06

SYMBOL	840	845	850	855	860	865	870	875	880	885	890	895	900	905	910
Am-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-242m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-210m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bk-247	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ca-41	2.4E+02	4.6E+02	2.7E+02	1.1E+02	2.6E+02	3.3E+02	1.8E+02	7.2E+01	2.5E+02	2.4E+02	1.1E+02	5.3E+01	2.2E+02	1.6E+02	7.2E+01
Cl-36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I-129	1.0E+05	2.1E+05	2.0E+05	1.2E+05	2.3E+05	2.6E+05	1.6E+05	2.7E+05	3.2E+05	2.2E+05	2.8E+05	4.0E+05	2.9E+05	2.9E+05	4.9E+05
K-40	1.7E+06	2.1E+06	1.5E+06	1.3E+06	2.9E+06	2.8E+06	1.8E+06	2.7E+06	4.5E+06	3.7E+06	2.4E+06	5.2E+06	6.4E+06	4.6E+06	3.8E+06
Nb-91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pd-107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	6.3E+06	2.7E+06	6.0E+06	1.4E+07	1.0E+07	4.8E+06	2.0E+06	1.0E+07	1.3E+07	7.6E+06	3.4E+06	2.0E+06	1.3E+07	1.1E+07	5.7E+06
Se-79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Si-32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	1.5E-07	2.6E-07	1.4E-07	4.9E-08	8.2E-08	9.3E-08	4.3E-08	1.6E-08	3.8E-08	3.2E-08	1.3E-08	5.4E-09	1.5E-08	1.0E-08	4.1E-09
Tc-99	9.1E+06	1.2E+07	7.8E+06	1.1E+07	1.4E+07	9.0E+06	1.3E+07	1.5E+07	1.0E+07	1.5E+07	1.8E+07	1.2E+07	3.2E+07	4.1E+07	2.6E+07

TABLE 54. CONCENTRATIONS AT THE COMPLIANCE WELL
HORIZONTAL PATHRAE MODEL RESULTS FOR CLASS A SOUTH CELL SIDE SLOPE (0.286 CM/YR INFILTRATION, 90 FOOT DISTANCE)

SYMBOL	915	920	925	930	935	940	945	950	955	960
Am-241	0	0	0	0	0	0	0	0	0	0
Am-242m	0	0	0	0	0	0	0	0	0	0
Am-243	0	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	0	0	0
Bi-210m	0	0	0	0	0	0	0	0	0	0
Bk-247	0	0	0	0	0	0	0	0	0	0
Ca-41	5.8E+01	1.7E+02	1.0E+02	4.6E+01	6.8E+01	1.3E+02	8.9E+01	2.9E+01	7.1E+01	8.6E+01
Cl-36	0	0	0	0	0	0	0	0	0	0
Fe-60	0	0	0	0	0	0	0	0	0	0
H-3	0	0	0	0	0	0	0	0	0	0
I-129	3.7E+05	3.2E+05	5.8E+05	4.8E+05	3.4E+05	6.6E+05	5.9E+05	4.1E+05	1.4E+06	1.5E+06
K-40	8.8E+06	8.6E+06	5.6E+06	7.7E+06	1.4E+07	1.1E+07	7.0E+06	1.4E+07	1.8E+07	1.3E+07
Nb-91	0	0	0	0	0	0	0	0	0	0
Pd-107	0	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	0	0	0	0	0	0	0
Re-187	2.4E+06	4.3E+06	1.2E+07	8.7E+06	4.2E+06	1.7E+06	7.4E+06	1.0E+07	6.4E+06	2.9E+06
Se-79	0	0	0	0	0	0	0	0	0	0
Si-32	0	0	0	0	0	0	0	0	0	2.7E-11
Sr-90	2.6E-09	5.9E-09	3.3E-09	1.2E-09	1.4E-09	2.1E-09	1.0E-09	3.9E-10	6.9E-10	7.3E-10
Tc-99	1.4E+07	6.4E+06	3.4E+06	3.8E+07	4.9E+07	3.1E+07	1.6E+07	7.5E+06	4.5E+06	4.8E+07

SYMBOL	965	970	975	980	985	990	995	1000	1005	1010
Am-241	0	0	0	0	0	0	0	0	0	0
Am-242m	0	0	0	0	0	0	0	0	0	0
Am-243	0	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	0	0	0
Bi-210m	0	0	0	0	0	0	0	0	0	0
Bk-247	0	0	0	0	0	0	0	0	0	0
Ca-41	4.3E+01	1.8E+01	8.4E+01	5.8E+01	2.8E+01	1.4E+01	5.2E+01	3.8E+01	1.6E+01	1.5E+01
Cl-36	0	0	0	0	0	0	0	0	0	0
Fe-60	0	0	0	0	0	0	0	0	0	0
H-3	0	0	0	0	0	0	0	0	0	0
I-129	9.3E+05	4.8E+05	2.3E+05	1.1E+05	1.1E+06	1.9E+06	1.4E+06	7.5E+05	3.7E+05	1.7E+05
K-40	1.0E+07	2.3E+07	2.3E+07	1.5E+07	1.8E+07	3.2E+07	2.7E+07	1.7E+07	3.1E+07	4.3E+07
Nb-91	0	0	0	0	0	0	0	0	0	0
Pd-107	0	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	0	0	0	0	0	0	0
Re-187	1.5E+06	9.1E+06	8.6E+06	4.6E+06	2.0E-06	2.7E+06	8.8E+06	6.4E+06	3.1E+06	1.3E+06
Se-79	0	0	0	0	0	0	0	0	0	0
Si-32	4.3E-11	4.3E-11	3.5E-11	2.6E-11	1.8E-11	3.4E-11	2.4E-10	4.6E-10	5.1E-10	4.4E-10
Sr-90	3.2E-10	1.1E-10	3.0E-10	2.3E-10	9.5E-11	3.3E-11	1.2E-10	7.2E-11	2.9E-11	1.1E-11
Tc-99	5.9E+07	3.7E+07	1.9E+07	9.0E+06	6.3E+06	6.2E+07	7.1E+07	4.4E+07	2.2E+07	1.0E+07

SYMBOL	1015	1020	1030	1040	1050	1060	1070	1080	1100
Am-241	0	0	0	0	0	0	0	0	0
Am-242m	0	0	0	0	0	0	0	0	0
Am-243	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	0	0
Bi-210m	0	0	0	0	0	0	0	0	0
Bk-247	0	0	0	0	0	0	0	0	0
Ca-41	3.9E+01	2.4E+01	1.7E+01	1.5E+01	1.7E+01	9.6E+00	1.4E+01	5.9E+00	3.6E+00
Cl-36	0	0	0	0	0	0	0	0	0
Fe-60	0	0	0	0	0	0	0	0	0
H-3	0	0	0	0	0	0	0	0	0
I-129	8.1E+05	2.4E+06	1.2E+06	2.8E+05	2.8E+06	1.8E+06	4.3E+05	2.6E+06	6.6E+05
K-40	3.1E+07	2.2E+07	5.2E+07	3.7E+07	6.0E+07	6.3E+07	6.9E+07	1.0E+08	1.3E+08
Nb-91	0	0	0	0	0	0	0	0	0
Pd-107	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	0	0	0	0	0	0
Re-187	4.6E+06	7.5E+06	2.1E+06	5.9E+06	3.3E+06	1.5E+06	4.5E+06	9.4E+05	1.4E+06
Se-79	0	0	0	0	0	0	0	0	0
Si-32	3.3E-10	2.3E-10	1.6E-09	4.8E-09	3.3E-09	1.6E-09	2.9E-08	3.7E-08	3.4E-08
Sr-90	4.0E-11	2.3E-11	0	0	0	0	0	0	0
Tc-99	8.8E+06	7.4E+07	4.8E+07	1.1E+07	8.6E+07	5.2E+07	1.2E+07	1.0E+08	1.3E+07

TABLE 55. CONCENTRATIONS AT THE COMPLIANCE WELL
HORIZONTAL PATHRAE MODEL RESULTS FOR CLASS A SOUTH CELL SIDE SLOPE (0.595 CM/YR INFILTRATION, 90 FOOT DISTANCE)

SYMBOL	EXCEEDS	1	10	15	20	25	30	35	40	45	50	55	60	65	70	80	90	100	110	120	130	140	150	160	180	190	200	210	220	240	260
Am-241	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-242m	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-243	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-210m	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bk-247	-1	0	0	0	0	2.7E-10	6.2E-08	1.9E-05	2.5E-04	1.8E-03	8.2E-03	2.7E-02	7.2E-02	1.5E-01	2.4E-01	4.6E-01	5.4E-01	4.6E-01	3.1E-01	1.8E-01	8.7E-02	3.9E-02	1.6E-02	6.2E-03	8.1E-04	2.7E-04	9.0E-05	3.0E-05	9.2E-06	8.7E-07	7.9E-08
Ca-41	-1	0	0	0	0	0	0	0	0	0	0	2.6E-11	7.6E-09	2.0E-07	2.4E-06	1.8E-04	4.5E-03	6.0E-02	4.8E-01	2.4E+00	9.6E+00	3.0E+01	7.4E+01	1.6E+02	4.6E+02	6.8E+02	9.5E+02	1.2E+03	1.6E+03	2.5E+03	3.2E+03
Cl-36	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-60	-1	0	0	0	1.5E-11	1.4E-07	6.3E-05	1.4E-02	2.2E-01	2.0E+00	1.2E+01	4.8E+01	1.5E+02	3.4E+02	8.2E+02	1.4E+03	1.8E+03	1.7E+03	1.3E+03	7.8E+02	4.1E+02	2.0E+02	9.1E+01	3.8E+01	5.9E+00	2.2E+00	7.9E-01	2.8E-01	9.4E-02	1.0E-02	1.1E-03
H-3	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I-129	-1	0	0	0	0	0	0	3.1E-11	2.5E-08	4.1E-06	2.2E-04	4.4E-02	4.6E-01	6.4E+00	1.3E+01	1.6E+02	1.5E+03	6.7E+03	1.5E+04	2.1E+04	2.1E+04	2.0E+04	1.8E+04	1.5E+04	5.3E+03	2.5E+03	1.2E+03	5.9E+02	2.7E+02	3.9E+01	4.9E+00
K-40	500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.1E-10	4.6E-10	8.8E-08	9.4E-08	1.4E-06	9.2E-06	8.8E-06	2.5E-04	1.8E-03
Nb-91	510	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8.7E-11	4.4E-09	5.9E-09	2.4E-07	1.8E-07	5.3E-06	1.8E-04
Pd-107	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Se-79	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.0E-11	1.5E-08	8.5E-07	1.3E-05	7.0E-05	5.3E-04	5.7E-03	4.1E-02	2.0E-01	1.6E+00	2.8E+00	5.4E+00	1.4E+01	3.4E+01	1.2E+02	1.9E+02
Si-32	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	755	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tc-99	-1	0	0	0	0	0	0	0	0	0	0	2.2E-10	4.8E-08	1.2E-06	1.0E-05	5.1E-04	9.6E-03	8.9E-02	4.9E-01	1.8E+00	5.0E+00	1.1E+01	1.9E+01	2.7E+01	4.0E+01	4.1E+01	3.9E+01	3.6E+01	3.3E+01	2.3E+01	1.4E+01

NOTE: Year to exceed GWPL reported to next lowest model output year. -1 indicates constituent does not exceed GWPL within the 2,000 years modeled
Radionuclide concentrations are reported in pCi/L

TABLE 55. CONCENTRATIONS AT THE COMPLIANCE WELL

HORIZONTAL PATHRAE MODEL RESULTS FOR CLASS A SOUTH CELL SIDE SLOPE (0.595 CM/YR INFILTRATION, 90 FOOT DISTANCE)

SYMBOL	280	300	305	310	315	320	325	330	335	340	345	350	355	360
Am-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-242m	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-210m	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bk-247	8.8E-09	5.5E-10	2.9E-10	1.6E-10	9.1E-11	2.2E-11	1.2E-11	0	0	0	0	0	0	0
Ca-41	3.7E+03	2.7E+03	2.1E+03	2.3E+03	2.0E+03	1.9E+03	1.8E+03	1.6E+03	1.6E+03	1.2E+03	1.3E+03	9.7E+02	1.1E+03	7.8E+02
Cl-36	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-60	1.1E-04	1.1E-05	6.0E-06	3.3E-06	1.9E-06	1.2E-06	5.7E-07	3.0E-07	1.6E-07	8.1E-08	4.6E-08	2.3E-08	1.4E-08	6.6E-09
H-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I-129	6.6E-01	8.1E-02	3.7E-02	1.8E-02	1.2E-02	5.9E-03	3.3E-03	1.9E-03	9.2E-04	5.8E-04	2.8E-04	1.6E-04	8.9E-05	4.3E-05
K-40	5.0E-03	1.9E-02	4.8E-02	4.2E-02	4.1E-02	1.1E-01	1.0E-01	8.3E-02	2.4E-01	2.2E-01	1.6E-01	4.5E-01	4.6E-01	3.1E-01
Nb-91	2.8E-03	2.3E-02	2.7E-02	1.8E-02	5.1E-02	1.2E-01	1.0E-01	7.4E-02	3.4E-01	4.6E-01	3.4E-01	4.4E-01	1.4E+00	1.4E+00
Pd-107	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Se-79	3.3E+02	7.4E+02	5.6E+02	9.7E+02	7.0E+02	1.1E+03	9.7E+02	1.1E+03	1.2E+03	1.0E+03	1.5E+03	1.0E+03	1.6E+03	1.3E+03
Si-32	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tc-99	7.0E+00	2.8E+00	1.9E+00	1.7E+00	1.2E+00	9.8E-01	7.4E-01	5.5E-01	4.5E-01	3.0E-01	2.7E-01	1.7E-01	1.5E-01	9.1E-02

SYMBOL	365	370	375	380	385	390	395	400	405	410	415	420	425	430	435	440	445
Am-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-242m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-210m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bk-247	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ca-41	8.8E+02	6.3E+02	6.9E+02	5.2E+02	5.3E+02	4.3E+02	3.9E+02	3.5E+02	2.9E+02	2.8E+02	2.0E+02	2.1E+02	1.5E+02	1.6E+02	1.1E+02	1.2E+02	8.7E+01
Cl-36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-60	4.4E-09	1.9E-09	1.3E-09	5.6E-10	4.1E-10	1.6E-10	1.2E-10	3.8E-11	3.0E-11	0	0	0	0	0	0	0	0
H-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I-129	2.7E-05	1.3E-05	7.5E-06	3.9E-06	2.0E-06	1.1E-06	5.3E-07	3.2E-07	1.6E-07	8.2E-08	4.6E-08	2.2E-08	1.3E-08	6.0E-09	3.3E-09	1.7E-09	8.2E-10
K-40	7.9E-01	8.7E-01	5.7E-01	1.3E+00	1.5E+00	1.0E+00	2.0E+00	2.6E+00	1.7E+00	2.9E+00	4.0E+00	2.8E+00	4.0E+00	6.0E+00	4.3E+00	5.3E+00	8.6E+00
Nb-91	8.9E-01	2.4E+00	4.7E+00	3.3E+00	2.6E+00	8.8E+00	1.0E+01	7.1E+00	1.1E+01	2.5E+01	2.2E+01	1.4E+01	3.9E+01	5.4E+01	4.0E+01	3.7E+01	9.7E+01
Pd-107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Se-79	1.5E+03	1.6E+03	1.3E+03	1.8E+03	1.2E+03	1.8E+03	1.4E+03	1.7E+03	1.6E+03	1.4E+03	1.7E+03	1.2E+03	1.7E+03	1.2E+03	1.5E+03	1.3E+03	1.2E+03
Si-32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8.6E-11	5.7E-10	9.6E-10
Tc-99	8.4E-02	5.2E-02	4.6E-02	2.9E-02	2.4E-02	1.7E-02	1.3E-02	9.2E-03	6.4E-03	5.1E-03	3.2E-03	2.8E-03	1.6E-03	1.4E-03	8.4E-04	7.4E-04	4.4E-04

TABLE 55. CONCENTRATIONS AT THE COMPLIANCE WELL
HORIZONTAL PATHRAE MODEL RESULTS FOR CLASS A SOUTH CELL SIDE SLOPE (0.595 CM/YR INFILTRATION, 90 FOOT DISTANCE)

SYMBOL	450	455	460	465	470	475	480	485	490	495	500	505	510	515	520
Am-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-242m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-210m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bk-247	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ca-41	8.9E+01	6.7E+01	6.4E+01	5.2E+01	4.4E+01	4.0E+01	3.1E+01	2.9E+01	2.1E+01	2.1E+01	1.4E+01	1.5E+01	1.0E+01	1.1E+01	7.9E+00
Cl-36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I-129	4.8E-10	2.3E-10	1.2E-10	6.1E-11	1.9E-11	0	0	0	0	0	0	0	0	0	0
K-40	6.5E+00	6.8E+00	1.2E+01	9.1E+00	8.2E+00	1.6E+01	1.2E+01	1.0E+01	2.0E+01	1.7E+01	1.2E+01	2.4E+01	2.1E+01	1.5E+01	2.9E+01
Nb-91	9.7E+01	6.4E+01	1.1E+02	1.9E+02	1.6E+02	1.1E+02	2.8E+02	3.3E+02	2.3E+02	2.7E+02	5.5E+02	4.9E+02	3.2E+02	6.4E+02	8.9E+02
Pd-107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Se-79	1.4E+03	9.5E+02	1.3E+03	9.0E+02	1.2E+03	9.5E+02	9.3E+02	9.5E-02	6.9E+02	9.0E+02	6.0E+02	7.9E+02	6.0E+02	6.3E+02	6.1E+02
Si-32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	1.0E-09	8.3E-10	6.2E-10	4.3E-10	9.3E-09	7.6E-08	1.4E-07	1.5E-07	1.2E-07	9.2E-08	6.4E-08	4.6E-07	4.6E-06	9.0E-06	9.9E-06
Tc-99	3.6E-04	2.3E-04	1.8E-04	1.2E-04	8.9E-05	6.5E-05	4.3E-05	3.3E-05	2.1E-05	1.7E-05	1.0E-05	8.7E-06	5.1E-06	4.3E-06	2.5E-06

SYMBOL	525	530	535	540	545	550	555	560	565	570	575	580	585	590	595	600
Am-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-242m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-210m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bk-247	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ca-41	7.6E+00	5.8E+00	5.2E+00	4.3E+00	3.5E+00	3.2E+00	2.4E+00	2.3E+00	1.7E+00	2.4E+00	1.7E+00	7.3E-01	4.7E-01	1.0E+00	6.1E-01	2.6E-01
Cl-36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I-129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
K-40	2.7E+01	1.7E+01	3.3E+01	3.3E+01	2.1E+01	3.6E+01	3.9E+01	2.6E+01	3.9E+01	4.5E+01	3.0E+01	4.2E+01	5.3E+01	3.6E+01	4.4E+01	5.7E+01
Nb-91	6.6E+02	5.3E+02	1.2E+03	1.2E+03	8.3E+02	1.2E+03	1.9E+03	1.6E+03	1.1E+03	2.3E+03	2.8E+03	1.9E+03	1.8E+03	3.8E+03	3.4E+03	2.2E+03
Pd-107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Se-79	4.7E+02	5.7E+02	3.8E+02	4.9E+02	3.6E+02	4.0E+02	3.4E+02	2.8E+02	3.2E+02	2.2E+02	2.8E+02	2.0E+02	2.2E+02	1.9E+02	1.7E+02	1.7E+02
Si-32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	8.5E-06	6.4E-06	4.5E-06	1.4E-05	1.6E-04	3.5E-04	4.0E-04	3.5E-04	2.6E-04	1.9E-04	3.0E-04	3.7E-03	8.5E-03	9.9E-03	8.8E-03	6.7E-03
Tc-99	2.1E-06	1.3E-06	9.7E-07	6.7E-07	4.6E-07	3.3E-07	2.2E-07	1.7E-07	1.0E-07	1.1E-07	6.7E-08	2.6E-08	1.4E-08	2.3E-08	1.2E-08	4.6E-09

TABLE 55. CONCENTRATIONS AT THE COMPLIANCE WELL
HORIZONTAL PATHRAE MODEL RESULTS FOR CLASS A SOUTH CELL SIDE SLOPE (0.595 CM/YR INFILTRATION, 90 FOOT DISTANCE)

SYMBOL	605	610	615	620	625	630	635	640	645	650	655	660	665	670	675
Am-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-242m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-210m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bk-247	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ca-41	3.4E-01	4.7E-01	2.5E-01	1.0E-01	2.3E-01	2.1E-01	1.0E-01	4.7E-02	1.2E-01	9.1E-02	4.1E-02	3.1E-02	6.2E-02	3.7E-02	1.6E-02
Cl-36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I-129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
K-40	4.0E+01	4.3E+01	6.2E+01	4.5E+01	4.3E+01	6.6E+01	5.0E+01	4.3E+01	6.8E+01	5.4E+01	4.1E+01	7.0E+01	5.8E+01	4.0E+01	7.1E+01
Nb-91	3.6E+03	5.1E+03	3.9E+03	2.9E+03	6.1E+03	6.3E+03	4.2E+03	4.9E+03	8.5E+03	7.0E+03	4.5E+03	8.4E+03	1.0E+04	7.3E+03	6.2E+03
Pd-107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Se-79	1.2E+02	1.5E+02	1.0E+02	1.2E+02	9.6E+01	9.1E+01	8.9E+01	6.5E+01	7.8E+01	5.1E+01	6.3E+01	4.7E+01	4.7E+01	4.3E+01	3.3E+01
Si-32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	4.8E-03	4.9E-03	5.6E-02	1.4E-01	1.7E-01	1.6E-01	1.2E-01	8.7E-02	7.0E-02	6.2E-01	1.7E+00	2.2E+00	2.0E+00	1.6E+00	1.1E+00
Tc-99	4.4E-09	5.1E-09	2.4E-09	8.5E-10	1.4E-09	1.1E-09	4.8E-10	1.8E-10	3.7E-10	2.4E-10	8.7E-11	5.2E-11	7.9E-11	4.4E-11	1.7E-11

SYMBOL	680	685	690	695	700	705	710	715	720	725	730	735	740	745	750	755
Am-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-242m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-210m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bk-247	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ca-41	2.2E-02	2.8E-02	1.5E-02	6.0E-03	1.3E-02	1.2E-02	5.7E-03	2.7E-03	7.1E-03	5.0E-03	2.2E-03	1.8E-03	3.5E-03	2.0E-03	8.5E-04	1.3E-03
Cl-36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I-129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
K-40	6.2E+01	4.1E+01	7.0E+01	6.4E+01	4.1E+01	6.7E+01	8.4E+01	4.0E+01	6.3E+01	6.5E+01	4.1E+01	5.8E+01	6.4E+01	4.2E+01	5.3E+01	6.2E+01
Nb-91	1.2E+04	1.1E+04	7.4E+03	1.1E+04	1.5E+04	1.2E+04	8.0E+03	1.6E+04	1.7E+04	1.1E+04	1.2E+04	2.0E+04	1.7E+04	1.1E+04	1.8E+04	2.2E+04
Pd-107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Se-79	3.7E+01	2.4E+01	3.0E+01	2.1E+01	3.3E+01	3.1E+01	1.7E+01	7.6E+00	5.9E+00	1.9E+01	1.4E+01	7.2E+00	3.1E+00	7.2E+00	1.1E+01	6.7E+00
Si-32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	8.1E-01	5.1E+00	1.6E+01	2.1E+01	2.0E+01	1.6E+01	1.1E+01	7.8E+00	3.4E+01	1.1E+02	1.6E+02	1.5E+02	1.2E+02	8.9E+01	6.1E+01	1.8E+02
Tc-99	1.2E-11	1.7E-11	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 55. CONCENTRATIONS AT THE COMPLIANCE WELL
HORIZONTAL PATHRAE MODEL RESULTS FOR CLASS A SOUTH CELL SIDE SLOPE (0.595 CM/YR INFILTRATION, 90 FOOT DISTANCE)

SYMBOL	760	765	770	775	780	785	790	795	800	805	810	815	820	825	830	835	840	845	850	855	860	865	870	875	880	885	890	895	900	905	910
Am-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-242m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-210m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bk-247	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ca-41	1.5E-03	8.0E-04	3.3E-04	7.6E-04	6.7E-04	3.1E-04	1.6E-04	3.9E-04	2.7E-04	1.2E-04	1.0E-04	1.9E-04	1.1E-04	4.4E-06	7.1E-05	8.1E-05	4.1E-05	1.7E-05	4.0E-05	3.3E-05	1.6E-05	8.2E-06	2.0E-05	1.3E-05	5.7E-06	5.5E-06	8.9E-06	5.0E-06	2.1E-06	3.6E-06	3.9E-06
Cl-36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I-129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
K-40	4.1E+01	4.7E+01	5.9E+01	4.0E+01	4.1E+01	5.8E+01	4.0E+01	3.5E+01	5.2E+01	3.8E+01	3.1E+01	4.7E+01	3.7E+01	2.8E+01	4.3E+01	3.5E+01	2.4E+01	3.9E+01	3.3E+01	2.2E+01	3.5E+01	3.2E+01	2.0E+01	3.1E+01	3.0E+01	1.9E+01	2.7E+01	2.6E+01	1.7E+01	2.3E+01	2.4E+01
Nb-91	1.0E+04	1.3E+04	2.4E+04	2.2E+04	1.5E+04	1.9E+04	2.7E+04	2.2E+04	1.4E+04	2.8E+04	2.9E+04	2.0E+04	1.8E+04	3.2E+04	2.7E+04	1.8E+04	2.6E+04	3.4E+04	2.4E+04	1.8E+04	3.3E+04	3.2E+04	2.1E+04	2.4E+04	3.6E+04	2.9E+04	1.8E+04	3.1E+04	3.5E+04	2.4E+04	2.1E+04
Pd-107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Se-79	3.1E+00	1.5E+00	6.1E+00	5.6E+00	2.9E+00	1.2E+00	1.7E+00	4.0E+00	2.7E+00	1.3E+00	5.4E-01	1.8E+00	2.2E+00	1.2E+00	5.4E-01	3.6E-01	1.3E+00	1.0E+00	5.2E-01	2.3E-01	4.5E-01	7.6E-01	4.7E-01	2.2E-01	9.8E-02	3.9E-01	3.7E-01	2.0E-01	8.8E-02	9.5E-02	2.4E-01
Si-32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	6.7E+02	9.7E+02	9.5E+02	7.7E+02	5.5E+02	3.8E+02	7.8E+02	3.1E+03	4.7E+03	4.8E+03	3.8E+03	2.8E+03	1.9E+03	3.1E+03	1.3E+04	2.2E+04	2.1E+04	1.8E+04	1.3E+04	9.2E+03	1.1E+04	4.6E+04	7.9E+04	8.3E+04	7.0E+04	5.2E+04	3.6E+04	3.5E+04	1.5E+05	2.6E+05	2.9E+05
Tc-99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 55. CONCENTRATIONS AT THE COMPLIANCE WELL
HORIZONTAL PATHRAE MODEL RESULTS FOR CLASS A SOUTH CELL SIDE SLOPE (0.595 CM/YR INFILTRATION, 90 FOOT DISTANCE)

SYMBOL	915	920	925	930	935	940	945	950	955	960	965	970	975	980
Am-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-242m	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-210m	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bk-247	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ca-41	1.9E-06	8.0E-07	2.0E-06	1.6E-06	7.3E-07	4.2E-07	9.8E-07	8.3E-07	2.7E-07	2.8E-07	4.5E-07	2.4E-07	9.9E-08	1.8E-07
Cl-36	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I-129	0	0	0	0	0	0	0	0	0	0	0	0	0	0
K-40	1.6E+01	1.9E+01	2.2E+01	1.5E+01	2.4E+01	3.4E+01	2.4E+01	1.3E+01	6.2E+00	2.9E+00	9.7E+00	2.3E+01	1.8E+01	1.0E+01
Nb-91	3.5E+04	3.1E+04	2.0E+04	2.8E+04	3.6E+04	2.7E+04	1.8E+04	3.3E+04	3.3E+04	2.2E+04	2.3E+04	3.5E+04	2.9E+04	1.8E+04
Pd-107	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-187	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Se-79	1.8E-01	8.3E-02	3.5E-02	1.0E-01	1.4E-01	7.5E-02	3.4E-02	2.0E-02	7.5E-02	6.1E-02	3.1E-02	1.3E-02	2.3E-02	4.3E-02
Si-32	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	2.4E+05	1.8E+05	1.3E+05	1.1E+05	4.1E+05	7.9E+05	8.8E+05	7.6E+05	5.8E+05	4.1E+05	3.1E+05	1.0E+06	2.1E+06	2.5E+06
Tc-99	0	0	0	0	0	0	0	0	0	0	0	0	0	0

SYMBOL	985	990	995	1000	1005	1010	1015	1020	1030	1040	1050	1060	1070	1080	1100
Am-241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-242m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Am-243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi-210m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bk-247	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ca-41	1.8E-07	9.1E-08	3.8E-08	9.7E-08	7.4E-08	3.4E-08	2.1E-08	4.7E-08	1.3E-08	2.1E-08	4.5E-09	8.8E-09	1.8E-09	3.4E-09	1.4E-09
Cl-36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I-129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
K-40	5.2E+00	2.4E+00	4.8E+00	1.6E+01	1.4E+01	6.7E+00	4.3E+00	2.0E+00	1.1E+01	7.2E+00	1.7E+00	7.4E+00	5.7E+00	1.4E+00	4.4E+00
Nb-91	3.0E+04	3.4E+04	2.3E+04	1.9E+04	3.3E+04	3.0E+04	1.9E+04	2.4E+04	2.5E+04	2.8E+04	1.9E+04	2.9E+04	1.5E+04	2.6E+04	4.1E+04
Pd-107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pt-193	0	0	0	0	0	0	0	0	0	0	0	0	0	1.2E-11	1.3E-11
Re-187	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Se-79	2.8E-02	1.2E-02	5.5E-03	2.1E-02	2.2E-02	1.1E-02	5.1E-03	4.6E-03	9.8E-03	2.0E-03	7.2E-03	1.9E-03	3.8E-03	1.7E-03	1.4E-03
Si-32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-90	2.1E+06	1.6E+06	1.1E+06	8.5E+05	2.3E+06	5.1E+06	6.2E+06	5.5E+06	3.1E+06	4.9E+06	1.5E+07	1.0E+07	5.0E+06	2.5E+07	1.7E+07
Tc-99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Whetstone Associates

ATTACHMENT 1
ENERGY*SOLUTIONS*
CLASS A SOUTH CELL
HELP INFILTRATION MODEL
OUTPUT FILES

Prepared for

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Document 4101L.071207

December 2007

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**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**              HELP MODEL VERSION 3.06   (17 AUGUST 1996)                  **
**              DEVELOPED BY ENVIRONMENTAL LABORATORY                       **
**              USAE WATERWAYS EXPERIMENT STATION                           **
**              FOR USEPA RISK REDUCTION ENGINEERING LABORATORY             **
**                                                                          **
**                                                                          **
******************************************************************************
******************************************************************************
PRECIPITATION DATA FILE:     C:\PROJECTS\4101L\LLRW2007\HELP07\M100.D4
TEMPERATURE DATA FILE:       C:\PROJECTS\4101L\LLRW2007\HELP07\M100.D7
SOLAR RADIATION DATA FILE:   C:\PROJECTS\4101L\LLRW2007\HELP07\M100.D13
EVAPOTRANSPIRATION DATA:     C:\PROJECTS\4101L\LLRW2007\HELP07\M100.D11
SOIL AND DESIGN DATA FILE:   C:\PROJECTS\4101L\LLRW2007\HELP07\T6\11E2-T6.D10
OUTPUT DATA FILE:            C:\PROJECTS\4101L\LLRW2007\HELP07\T6\11E2-T6.OUT
TIME: 13: 4     DATE: 11/26/2007
******************************************************************************
     TITLE: 11.e(2) Cell Top Slope, 6 in Filter below Sacrificial Soil
******************************************************************************
     NOTE: INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
           WERE SPECIFIED BY THE USER.

                              LAYER 1
                              --------
               TYPE 1 - VERTICAL PERCOLATION LAYER
                   MATERIAL TEXTURE NUMBER 0
     THICKNESS                  =     18.00   INCHES
     POROSITY                   =      0.1900 VOL/VOL
     FIELD CAPACITY             =      0.0240 VOL/VOL
     WILTING POINT              =      0.0070 VOL/VOL
     INITIAL SOIL WATER CONTENT =      0.0146 VOL/VOL
     EFFECTIVE SAT. HYD. COND.  =   42.0000000000      CM/SEC

                              LAYER 2
                              --------
                TYPE 2 - LATERAL DRAINAGE LAYER
                   MATERIAL TEXTURE NUMBER 0
     THICKNESS                  =      6.00   INCHES
     POROSITY                   =      0.1900 VOL/VOL
     FIELD CAPACITY             =      0.0240 VOL/VOL
     WILTING POINT              =      0.0070 VOL/VOL
     INITIAL SOIL WATER CONTENT =      0.0240 VOL/VOL
     EFFECTIVE SAT. HYD. COND.  =   42.0000000000      CM/SEC
     SLOPE                      =      2.10   PERCENT
     DRAINAGE LENGTH            =    740.0    FEET

                              LAYER 3
                              --------
                 TYPE 3 - BARRIER SOIL LINER
                   MATERIAL TEXTURE NUMBER 0
     THICKNESS                  =     12.00   INCHES
     POROSITY                   =      0.3100 VOL/VOL
     FIELD CAPACITY             =      0.2000 VOL/VOL
     WILTING POINT              =      0.0250 VOL/VOL
     INITIAL SOIL WATER CONTENT =      0.3100 VOL/VOL
     EFFECTIVE SAT. HYD. COND.  =  0.400000019000E-02 CM/SEC

                              LAYER 4
                              --------
                TYPE 2 - LATERAL DRAINAGE LAYER
                   MATERIAL TEXTURE NUMBER 0
     THICKNESS                  =      6.00   INCHES
     POROSITY                   =      0.2800 VOL/VOL
     FIELD CAPACITY             =      0.0320 VOL/VOL
     WILTING POINT              =      0.0130 VOL/VOL
     INITIAL SOIL WATER CONTENT =      0.0320 VOL/VOL
     EFFECTIVE SAT. HYD. COND.  =    3.50000000000     CM/SEC
     SLOPE                      =      2.10   PERCENT
     DRAINAGE LENGTH            =    740.0    FEET

                              LAYER 5
                              --------
                 TYPE 3 - BARRIER SOIL LINER
                   MATERIAL TEXTURE NUMBER 0
     THICKNESS                  =     12.00   INCHES
     POROSITY                   =      0.4300 VOL/VOL
     FIELD CAPACITY             =      0.3900 VOL/VOL
     WILTING POINT              =      0.2800 VOL/VOL
     INITIAL SOIL WATER CONTENT =      0.4300 VOL/VOL
     EFFECTIVE SAT. HYD. COND.  =  0.500000006000E-07 CM/SEC

                              LAYER 6
                              --------
               TYPE 1 - VERTICAL PERCOLATION LAYER
```

```
                 MATERIAL TEXTURE NUMBER   0
    THICKNESS                   =     12.00   INCHES
    POROSITY                    =      0.4300 VOL/VOL
    FIELD CAPACITY              =      0.3900 VOL/VOL
    WILTING POINT               =      0.2800 VOL/VOL
    INITIAL SOIL WATER CONTENT  =      0.3900 VOL/VOL
    EFFECTIVE SAT. HYD. COND.   =  0.999999997000E-06 CM/SEC

                             LAYER  7
                             --------
               TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   0
    THICKNESS                   =    100.00   INCHES
    POROSITY                    =      0.4370 VOL/VOL
    FIELD CAPACITY              =      0.0620 VOL/VOL
    WILTING POINT               =      0.0240 VOL/VOL
    INITIAL SOIL WATER CONTENT  =      0.1106 VOL/VOL
    EFFECTIVE SAT. HYD. COND.   =  0.500000024000E-03 CM/SEC

                             LAYER  8
                             --------
                 TYPE 3 - BARRIER SOIL LINER
                 MATERIAL TEXTURE NUMBER   0
    THICKNESS                   =     24.00   INCHES
    POROSITY                    =      0.4300 VOL/VOL
    FIELD CAPACITY              =      0.3900 VOL/VOL
    WILTING POINT               =      0.2800 VOL/VOL
    INITIAL SOIL WATER CONTENT  =      0.4300 VOL/VOL
    EFFECTIVE SAT. HYD. COND.   =  0.999999997000E-06 CM/SEC

              GENERAL DESIGN AND EVAPORATIVE ZONE DATA
              ----------------------------------------
   NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
          SOIL DATA BASE USING SOIL TEXTURE #21 WITH BARE
          GROUND CONDITIONS, A SURFACE SLOPE OF  2.% AND
          A SLOPE LENGTH OF  740. FEET.
  SCS RUNOFF CURVE NUMBER               =     68.10
  FRACTION OF AREA ALLOWING RUNOFF      =    100.0    PERCENT
  AREA PROJECTED ON HORIZONTAL PLANE    =      1.699  ACRES
  EVAPORATIVE ZONE DEPTH                =     18.0    INCHES
  INITIAL WATER IN EVAPORATIVE ZONE     =      0.263  INCHES
  UPPER LIMIT OF EVAPORATIVE STORAGE    =      3.420  INCHES
  LOWER LIMIT OF EVAPORATIVE STORAGE    =      0.126  INCHES
  INITIAL SNOW WATER                    =      0.000  INCHES
  INITIAL WATER IN LAYER MATERIALS      =     35.539  INCHES
  TOTAL INITIAL WATER                   =     35.539  INCHES
  TOTAL SUBSURFACE INFLOW               =      0.00   INCHES/YEAR
               EVAPOTRANSPIRATION AND WEATHER DATA
               -----------------------------------
   NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
          SALT LAKE CITY        UTAH
       STATION LATITUDE                         =  40.69 DEGREES
       MAXIMUM LEAF AREA INDEX                  =   0.00
       START OF GROWING SEASON (JULIAN DATE)    =   117
       END OF GROWING SEASON (JULIAN DATE)      =   289
       EVAPORATIVE ZONE DEPTH                   =  18.0  INCHES
       AVERAGE ANNUAL WIND SPEED                =   5.75 MPH
       AVERAGE 1ST QUARTER RELATIVE HUMIDITY    =  50.50 %
       AVERAGE 2ND QUARTER RELATIVE HUMIDITY    =  28.60 %
       AVERAGE 3RD QUARTER RELATIVE HUMIDITY    =  22.70 %
       AVERAGE 4TH QUARTER RELATIVE HUMIDITY    =  47.90 %
   NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
          COEFFICIENTS FOR    SALT LAKE CITY       UTAH
          NORMAL MEAN MONTHLY PRECIPITATION (INCHES)
JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
-------     -------     -------     -------     -------     -------
  0.79        0.92        0.85        1.25        0.94        0.90
  0.34        0.32        0.34        0.75        0.58        0.60
   NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
          COEFFICIENTS FOR    SALT LAKE CITY       UTAH
       NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)
JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
-------     -------     -------     -------     -------     -------
 30.40       32.00       41.70       49.10       60.10       69.60
 78.40       77.00       65.50       50.90       36.70       28.90
   NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
          COEFFICIENTS FOR    SALT LAKE CITY       UTAH
            AND STATION LATITUDE  =  40.69 DEGREES

*******************************************************************************
      AVERAGE MONTHLY VALUES IN INCHES FOR YEARS     1 THROUGH  100
-------------------------------------------------------------------------------

                         JAN/JUL  FEB/AUG  MAR/SEP  APR/OCT  MAY/NOV  JUN/DEC
                         -------  -------  -------  -------  -------  -------
  PRECIPITATION
    -------
   TOTALS                  0.73     0.97     0.90     1.17     0.93     1.03
```

```
                          0.32     0.32     0.33     0.81     0.58     0.63

  STD. DEVIATIONS         0.37     0.45     0.42     0.49     0.54     0.73
                          0.27     0.26     0.27     0.58     0.32     0.26

RUNOFF
------
  TOTALS                  0.007    0.034    0.011    0.000    0.000    0.000
                          0.000    0.000    0.000    0.000    0.000    0.000

  STD. DEVIATIONS         0.023    0.082    0.039    0.000    0.000    0.000
                          0.000    0.000    0.000    0.000    0.000    0.002

EVAPOTRANSPIRATION
------------------
  TOTALS                  0.428    0.550    0.616    0.687    0.514    0.561
                          0.203    0.203    0.202    0.351    0.376    0.452

  STD. DEVIATIONS         0.168    0.206    0.240    0.266    0.293    0.369
                          0.117    0.130    0.152    0.234    0.167    0.153

LATERAL DRAINAGE COLLECTED FROM LAYER  2
----------------------------------------
  TOTALS                  0.0017   0.0111   0.0228   0.0016   0.0014   0.0016
                          0.0003   0.0002   0.0002   0.0016   0.0003   0.0001

  STD. DEVIATIONS         0.0063   0.0299   0.0408   0.0019   0.0018   0.0022
                          0.0007   0.0005   0.0005   0.0023   0.0006   0.0002

PERCOLATION/LEAKAGE THROUGH LAYER  3
------------------------------------
  TOTALS                  0.1059   0.2922   0.6439   0.5006   0.3915   0.4818
                          0.1287   0.1124   0.1225   0.4646   0.1826   0.0562

  STD. DEVIATIONS         0.2249   0.4293   0.4397   0.3027   0.3182   0.4083
                          0.1722   0.1471   0.1513   0.4097   0.2013   0.0970

LATERAL DRAINAGE COLLECTED FROM LAYER  4
----------------------------------------
  TOTALS                  0.0994   0.2872   0.6305   0.4879   0.3769   0.4684
                          0.1280   0.1037   0.1129   0.4521   0.1752   0.0522

  STD. DEVIATIONS         0.2105   0.4260   0.4279   0.2958   0.3126   0.4007
                          0.1679   0.1404   0.1445   0.4036   0.1972   0.0920

PERCOLATION/LEAKAGE THROUGH LAYER  5
------------------------------------
  TOTALS                  0.0024   0.0039   0.0113   0.0157   0.0126   0.0137
                          0.0060   0.0076   0.0080   0.0124   0.0096   0.0052

  STD. DEVIATIONS         0.0044   0.0052   0.0053   0.0051   0.0063   0.0068
                          0.0056   0.0071   0.0074   0.0076   0.0074   0.0071

PERCOLATION/LEAKAGE THROUGH LAYER  8
------------------------------------
  TOTALS                  0.0129   0.0074   0.0100   0.0106   0.0096   0.0092
                          0.0073   0.0082   0.0082   0.0093   0.0084   0.0074

  STD. DEVIATIONS         0.0578   0.0021   0.0021   0.0020 . 0.0025   0.0024
                          0.0024   0.0026   0.0025   0.0024   0.0024   0.0023

-------------------------------------------------------------------------------
             AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)
-------------------------------------------------------------------------------

DAILY AVERAGE HEAD ON TOP OF LAYER  3
-------------------------------------
  AVERAGES                0.0002   0.0008   0.0016   0.0013   0.0011   0.0013
                          0.0003   0.0003   0.0003   0.0012   0.0004   0.0001

  STD. DEVIATIONS         0.0005   0.0013   0.0013   0.0009   0.0010   0.0011
                          0.0005   0.0004   0.0004   0.0012   0.0005   0.0002

DAILY AVERAGE HEAD ON TOP OF LAYER  5
-------------------------------------
  AVERAGES                0.0057   0.0181   0.0361   0.0289   0.0216   0.0277
                          0.0073   0.0059   0.0067   0.0259   0.0104   0.0030

  STD. DEVIATIONS         0.0121   0.0267   0.0245   0.0175   0.0179   0.0237
                          0.0096   0.0081   0.0086   0.0231   0.0117   0.0053

DAILY AVERAGE HEAD ON TOP OF LAYER  8
-------------------------------------
  AVERAGES                0.0043   0.0001   0.0001   0.0001   0.0001   0.0001
                          0.0001   0.0001   0.0001   0.0001   0.0001   0.0001

  STD. DEVIATIONS         0.0418   0.0000   0.0000   0.0000   0.0000   0.0000
                          0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
```

****
****

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 100

	INCHES		CU. FEET	PERCENT
PRECIPITATION	8.72	(1.548)	53776.4	100.00
RUNOFF	0.052	(0.1033)	320.48	0.596
EVAPOTRANSPIRATION	5.142	(0.7760)	31712.11	58.970
LATERAL DRAINAGE COLLECTED FROM LAYER 2	0.04270	(0.04713)	263.370	0.48975
PERCOLATION/LEAKAGE THROUGH LAYER 3	3.48291	(0.92390)	21480.375	39.94387
AVERAGE HEAD ON TOP OF LAYER 3	0.001	(0.000)		
LATERAL DRAINAGE COLLECTED FROM LAYER 4	3.37429	(0.91561)	20810.504	38.69821
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.10862	(0.01924)	669.873	1.24566
AVERAGE HEAD ON TOP OF LAYER 5	0.016	(0.005)		
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.10866	(0.05436)	670.118	1.24612
AVERAGE HEAD ON TOP OF LAYER 8	0.000	(0.003)		
CHANGE IN WATER STORAGE	0.000	(0.2561)	-0.20	0.000

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 100

	(INCHES)	(CU. FT.)
PRECIPITATION	1.16	7154.149
RUNOFF	0.277	1706.2565
DRAINAGE COLLECTED FROM LAYER 2	0.24876	1534.22034
PERCOLATION/LEAKAGE THROUGH LAYER 3	1.645048	10145.61720
AVERAGE HEAD ON TOP OF LAYER 3	0.164	
MAXIMUM HEAD ON TOP OF LAYER 3	0.074	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	0.0 FEET	
DRAINAGE COLLECTED FROM LAYER 4	0.94491	5827.62305
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.001880	11.59433
AVERAGE HEAD ON TOP OF LAYER 5	1.679	
MAXIMUM HEAD ON TOP OF LAYER 5	3.171	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	40.9 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.036168	223.06197
AVERAGE HEAD ON TOP OF LAYER 8	1.519	
SNOW WATER	1.19	7366.7827
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.1176	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0070	

*** Maximum heads are computed using McEnroe's equations. ***
Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 100

LAYER	(INCHES)	(VOL/VOL)
1	0.2636	0.0146
2	0.1440	0.0240
3	3.7200	0.3100
4	0.1920	0.0320
5	5.1600	0.4300
6	4.6800	0.3900
7	11.0560	0.1106
8	10.3200	0.4300
SNOW WATER	0.000	

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****

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******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**               HELP MODEL VERSION 3.06   (17 AUGUST 1996)                 **
**                 DEVELOPED BY ENVIRONMENTAL LABORATORY                    **
**                   USAE WATERWAYS EXPERIMENT STATION                      **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
******************************************************************************
******************************************************************************
PRECIPITATION DATA FILE:     C:\PROJECTS\4101L\LLRW2007\HELP07\M100.D4
TEMPERATURE DATA FILE:       C:\PROJECTS\4101L\LLRW2007\HELP07\M100.D7
SOLAR RADIATION DATA FILE:   C:\PROJECTS\4101L\LLRW2007\HELP07\M100.D13
EVAPOTRANSPIRATION DATA:     C:\PROJECTS\4101L\LLRW2007\HELP07\M100.D11
SOIL AND DESIGN DATA FILE:   C:\PROJECTS\4101L\LLRW2007\HELP07\S6\11E2S12.D10
OUTPUT DATA FILE:            C:\PROJECTS\4101L\LLRW2007\HELP07\S6\11E2S12.OUT
TIME:  17:40     DATE:  11/26/2007

******************************************************************************
     TITLE:  11.e(2) - Side Slope,12"Filter below S.Soil, No Run On
******************************************************************************
     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.

                                  LAYER  1
                                  --------
                   TYPE 1 - VERTICAL PERCOLATION LAYER
                       MATERIAL TEXTURE NUMBER   0
          THICKNESS                   =     18.00    INCHES
          POROSITY                    =      0.1700 VOL/VOL
          FIELD CAPACITY              =      0.0070 VOL/VOL
          WILTING POINT               =      0.0030 VOL/VOL
          INITIAL SOIL WATER CONTENT  =      0.0120 VOL/VOL
          EFFECTIVE SAT. HYD. COND.   =   80.0000000000      CM/SEC

                                  LAYER  2
                                  --------
                     TYPE 2 - LATERAL DRAINAGE LAYER
                       MATERIAL TEXTURE NUMBER   0
          THICKNESS                   =      6.00    INCHES
          POROSITY                    =      0.1900 VOL/VOL
          FIELD CAPACITY              =      0.0240 VOL/VOL
          WILTING POINT               =      0.0070 VOL/VOL
          INITIAL SOIL WATER CONTENT  =      0.0240 VOL/VOL
          EFFECTIVE SAT. HYD. COND.   =   42.0000000000      CM/SEC
          SLOPE                       =     20.00    PERCENT
          DRAINAGE LENGTH             =    150.0     FEET

                                  LAYER  3
                                  --------
                       TYPE 3 - BARRIER SOIL LINER
                       MATERIAL TEXTURE NUMBER   0
          THICKNESS                   =     12.00    INCHES
          POROSITY                    =      0.3100 VOL/VOL
          FIELD CAPACITY              =      0.2000 VOL/VOL
          WILTING POINT               =      0.0250 VOL/VOL
          INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
          EFFECTIVE SAT. HYD. COND.   =  0.400000019000E-02 CM/SEC

                                  LAYER  4
                                  --------
                     TYPE 2 - LATERAL DRAINAGE LAYER
                       MATERIAL TEXTURE NUMBER   0
          THICKNESS                   =     12.00    INCHES
          POROSITY                    =      0.2800 VOL/VOL
          FIELD CAPACITY              =      0.0320 VOL/VOL
          WILTING POINT               =      0.0130 VOL/VOL
          INITIAL SOIL WATER CONTENT  =      0.0320 VOL/VOL
          EFFECTIVE SAT. HYD. COND.   =   3.50000000000      CM/SEC
          SLOPE                       =     20.00    PERCENT
          DRAINAGE LENGTH             =    150.0     FEET

                                  LAYER  5
                                  --------
                       TYPE 3 - BARRIER SOIL LINER
                       MATERIAL TEXTURE NUMBER   0
          THICKNESS                   =     12.00    INCHES
          POROSITY                    =      0.4300 VOL/VOL
          FIELD CAPACITY              =      0.3900 VOL/VOL
          WILTING POINT               =      0.2800 VOL/VOL
          INITIAL SOIL WATER CONTENT  =      0.4300 VOL/VOL
          EFFECTIVE SAT. HYD. COND.   =  0.500000006000E-07 CM/SEC

                                  LAYER  6
                                  --------
```

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              TYPE 1 - VERTICAL PERCOLATION LAYER
                  MATERIAL TEXTURE NUMBER   0
    THICKNESS                    =      12.00   INCHES
    POROSITY                     =       0.4300 VOL/VOL
    FIELD CAPACITY               =       0.3900 VOL/VOL
    WILTING POINT                =       0.2800 VOL/VOL
    INITIAL SOIL WATER CONTENT   =       0.3900 VOL/VOL
    EFFECTIVE SAT. HYD. COND.    =  0.999999997000E-06 CM/SEC

                           LAYER  7
                           --------
              TYPE 1 - VERTICAL PERCOLATION LAYER
                  MATERIAL TEXTURE NUMBER   0
    THICKNESS                    =     100.00   INCHES
    POROSITY                     =       0.4370 VOL/VOL
    FIELD CAPACITY               =       0.0620 VOL/VOL
    WILTING POINT                =       0.0240 VOL/VOL
    INITIAL SOIL WATER CONTENT   =       0.1040 VOL/VOL
    EFFECTIVE SAT. HYD. COND.    =  0.500000024000E-03 CM/SEC

                           LAYER  8
                           --------
                  TYPE 3 - BARRIER SOIL LINER
                  MATERIAL TEXTURE NUMBER   0
    THICKNESS                    =      24.00   INCHES
    POROSITY                     =       0.4300 VOL/VOL
    FIELD CAPACITY               =       0.3900 VOL/VOL
    WILTING POINT                =       0.2800 VOL/VOL
    INITIAL SOIL WATER CONTENT   =       0.4300 VOL/VOL
    EFFECTIVE SAT. HYD. COND.    =  0.999999997000E-06 CM/SEC

             GENERAL DESIGN AND EVAPORATIVE ZONE DATA
             ------------------------------------------
  NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
           SOIL DATA BASE USING SOIL TEXTURE #21 WITH BARE
           GROUND CONDITIONS, A SURFACE SLOPE OF 20.% AND
           A SLOPE LENGTH OF  150. FEET.
 SCS RUNOFF CURVE NUMBER              =     73.10
 FRACTION OF AREA ALLOWING RUNOFF     =    100.0    PERCENT
 AREA PROJECTED ON HORIZONTAL PLANE   =      0.344  ACRES
 EVAPORATIVE ZONE DEPTH               =     18.0    INCHES
 INITIAL WATER IN EVAPORATIVE ZONE    =      0.216  INCHES
 UPPER LIMIT OF EVAPORATIVE STORAGE   =      3.060  INCHES
 LOWER LIMIT OF EVAPORATIVE STORAGE   =      0.054  INCHES
 INITIAL SNOW WATER                   =      0.000  INCHES
 INITIAL WATER IN LAYER MATERIALS     =     35.024  INCHES
 TOTAL INITIAL WATER                  =     35.024  INCHES
 TOTAL SUBSURFACE INFLOW              =      0.00   INCHES/YEAR
              EVAPOTRANSPIRATION AND WEATHER DATA
              -----------------------------------
  NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
           SALT LAKE CITY          UTAH
      STATION LATITUDE                         =  40.69 DEGREES
      MAXIMUM LEAF AREA INDEX                  =   0.00
      START OF GROWING SEASON (JULIAN DATE)    =   117
      END OF GROWING SEASON (JULIAN DATE)      =   289
      EVAPORATIVE ZONE DEPTH                   =  18.0  INCHES
      AVERAGE ANNUAL WIND SPEED                =   5.75 MPH
      AVERAGE 1ST QUARTER RELATIVE HUMIDITY    =  50.50 %
      AVERAGE 2ND QUARTER RELATIVE HUMIDITY    =  28.60 %
      AVERAGE 3RD QUARTER RELATIVE HUMIDITY    =  22.70 %
      AVERAGE 4TH QUARTER RELATIVE HUMIDITY    =  47.90 %
  NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
           COEFFICIENTS FOR     SALT LAKE CITY        UTAH
           NORMAL MEAN MONTHLY PRECIPITATION (INCHES)
JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
-------     -------     -------     -------     -------     -------
  0.79        0.92        0.85        1.25        0.94        0.90
  0.34        0.32        0.34        0.75        0.58        0.60
  NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
           COEFFICIENTS FOR     SALT LAKE CITY        UTAH
      NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)
JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
-------     -------     -------     -------     -------     -------
 30.40       32.00       41.70       49.10       60.10       69.60
 78.40       77.00       65.50       50.90       36.70       28.90
  NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
           COEFFICIENTS FOR     SALT LAKE CITY        UTAH
             AND STATION LATITUDE  =  40.69 DEGREES

*******************************************************************************

      AVERAGE MONTHLY VALUES IN INCHES FOR YEARS     1 THROUGH  100
-------------------------------------------------------------------------------

                         JAN/JUL  FEB/AUG  MAR/SEP  APR/OCT  MAY/NOV  JUN/DEC
                         -------  -------  -------  -------  -------  -------
  PRECIPITATION
```

TOTALS	0.73	0.97	0.90	1.17	0.93	1.03
	0.32	0.32	0.33	0.81	0.58	0.63
STD. DEVIATIONS	0.37	0.45	0.42	0.49	0.54	0.73
	0.27	0.26	0.27	0.58	0.32	0.26

RUNOFF

TOTALS	0.008	0.038	0.012	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.025	0.090	0.042	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.002

EVAPOTRANSPIRATION

TOTALS	0.419	0.525	0.546	0.705	0.537	0.589
	0.206	0.194	0.193	0.343	0.363	0.437
STD. DEVIATIONS	0.166	0.193	0.243	0.291	0.316	0.406
	0.130	0.146	0.154	0.234	0.170	0.148

LATERAL DRAINAGE COLLECTED FROM LAYER 2

TOTALS	0.0490	0.1244	0.2286	0.0356	0.0289	0.0404
	0.0067	0.0042	0.0044	0.0429	0.0096	0.0027
STD. DEVIATIONS	0.1416	0.2584	0.3009	0.0416	0.0400	0.0613
	0.0144	0.0093	0.0108	0.0627	0.0203	0.0165

PERCOLATION/LEAKAGE THROUGH LAYER 3

TOTALS	0.0705	0.1995	0.4743	0.4500	0.3441	0.4111
	0.1259	0.1162	0.1256	0.4273	0.1999	0.0813
STD. DEVIATIONS	0.1435	0.3066	0.3479	0.2479	0.2604	0.3174
	0.1335	0.1184	0.1390	0.3499	0.1775	0.0968

LATERAL DRAINAGE COLLECTED FROM LAYER 4

TOTALS	0.0694	0.1979	0.4689	0.4424	0.3376	0.4046
	0.1204	0.1096	0.1194	0.4211	0.1938	0.0776
STD. DEVIATIONS	0.1428	0.3054	0.3482	0.2476	0.2595	0.3167
	0.1323	0.1169	0.1378	0.3493	0.1769	0.0944

PERCOLATION/LEAKAGE THROUGH LAYER 5

TOTALS	0.0010	0.0016	0.0054	0.0076	0.0065	0.0065
	0.0055	0.0066	0.0062	0.0062	0.0061	0.0036
STD. DEVIATIONS	0.0019	0.0021	0.0026	0.0024	0.0028	0.0028
	0.0030	0.0030	0.0029	0.0028	0.0028	0.0032

PERCOLATION/LEAKAGE THROUGH LAYER 8

TOTALS	0.0074	0.0028	0.0054	0.0064	0.0056	0.0055
	0.0049	0.0056	0.0052	0.0053	0.0052	0.0037
STD. DEVIATIONS	0.0502	0.0016	0.0015	0.0015	0.0016	0.0015
	0.0016	0.0017	0.0015	0.0018	0.0015	0.0019

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 3

AVERAGES	0.0003	0.0008	0.0014	0.0012	0.0009	0.0011
	0.0003	0.0003	0.0003	0.0011	0.0005	0.0002
STD. DEVIATIONS	0.0008	0.0014	0.0013	0.0007	0.0007	0.0009
	0.0004	0.0003	0.0004	0.0010	0.0005	0.0003

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0004	0.0012	0.0025	0.0025	0.0018	0.0023
	0.0007	0.0006	0.0007	0.0023	0.0011	0.0004
STD. DEVIATIONS	0.0008	0.0018	0.0019	0.0014	0.0014	0.0018
	0.0007	0.0006	0.0008	0.0019	0.0010	0.0005

DAILY AVERAGE HEAD ON TOP OF LAYER 8

AVERAGES	0.0032	0.0000	0.0001	0.0001	0.0001	0.0001
	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000

```
STD. DEVIATIONS        0.0315   0.0000   0.0000   0.0000   0.0000   0.0000
                       0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

*******************************************************************************
*******************************************************************************
     AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS    1 THROUGH  100
-------------------------------------------------------------------------------
                                      INCHES            CU. FEET     PERCENT
                                 -------------------  -------------  ---------
PRECIPITATION                      8.72   (  1.548)     10900.9      100.00
RUNOFF                             0.058  ( 0.1140)        72.68       0.667
EVAPOTRANSPIRATION                 5.058  ( 0.8082)      6323.94      58.013
LATERAL DRAINAGE COLLECTED         0.57740 ( 0.36167)     721.845      6.62190
  FROM LAYER  2
PERCOLATION/LEAKAGE THROUGH        3.02551 ( 0.82101)    3782.407     34.69818
  LAYER  3
AVERAGE HEAD ON TOP                0.001 (  0.000)
  OF LAYER  3
LATERAL DRAINAGE COLLECTED         2.96269 ( 0.81994)    3703.875     33.97776
  FROM LAYER  4
PERCOLATION/LEAKAGE THROUGH        0.06282 ( 0.00820)      78.532      0.72041
  LAYER  5
AVERAGE HEAD ON TOP                0.001 (  0.000)
  OF LAYER  5
PERCOLATION/LEAKAGE THROUGH        0.06283 ( 0.04960)      78.542      0.72051
  LAYER  8
AVERAGE HEAD ON TOP                0.000 (  0.003)
  OF LAYER  8
CHANGE IN WATER STORAGE            0.000  ( 0.2321)         0.00       0.000

*******************************************************************************
*******************************************************************************
             PEAK DAILY VALUES FOR YEARS    1 THROUGH  100
   ----------------------------------------------------------------------------
                                                  (INCHES)      (CU. FT.)
                                                 ----------   -------------
     PRECIPITATION                                  1.16         1450.199
     RUNOFF                                         0.298         372.4357
     DRAINAGE COLLECTED FROM LAYER  2               1.61500      2019.02710
     PERCOLATION/LEAKAGE THROUGH LAYER  3           1.371039     1714.03430
     AVERAGE HEAD ON TOP OF LAYER  3                0.153
     MAXIMUM HEAD ON TOP OF LAYER  3                0.010
     LOCATION OF MAXIMUM HEAD IN LAYER  2
            (DISTANCE FROM DRAIN)                   0.0 FEET
     DRAINAGE COLLECTED FROM LAYER  4               1.37083      1713.77600
     PERCOLATION/LEAKAGE THROUGH LAYER  5           0.001432        1.79010
     AVERAGE HEAD ON TOP OF LAYER  5                0.230
     MAXIMUM HEAD ON TOP OF LAYER  5                0.100
     LOCATION OF MAXIMUM HEAD IN LAYER  4
            (DISTANCE FROM DRAIN)                   4.8 FEET
     PERCOLATION/LEAKAGE THROUGH LAYER  8           0.035869       44.84264
     AVERAGE HEAD ON TOP OF LAYER  8                1.308
     SNOW WATER                                     1.19         1493.3019
     MAXIMUM VEG. SOIL WATER (VOL/VOL)                      0.1063
     MINIMUM VEG. SOIL WATER (VOL/VOL)                      0.0030

      ***  Maximum heads are computed using McEnroe's equations.  ***
           Reference:  Maximum Saturated Depth over Landfill Liner
                       by Bruce M. McEnroe, University of Kansas
                       ASCE Journal of Environmental Engineering
                       Vol. 119, No. 2, March 1993, pp. 262-270.

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*******************************************************************************

                FINAL WATER STORAGE AT END OF YEAR  100
    ----------------------------------------------------------------------
                LAYER        (INCHES)        (VOL/VOL)
                -----        --------        ---------
                  1           0.2168          0.0120
                  2           0.1440          0.0240
                  3           3.7200          0.3100
                  4           0.3840          0.0320
                  5           5.1600          0.4300
                  6           4.6800          0.3900
                  7          10.3991          0.1040
                  8          10.3200          0.4300
               SNOW WATER     0.000

*******************************************************************************
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```

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******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**               HELP MODEL VERSION 3.06   (17 AUGUST 1996)                 **
**                DEVELOPED BY ENVIRONMENTAL LABORATORY                     **
**                  USAE WATERWAYS EXPERIMENT STATION                       **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
******************************************************************************
******************************************************************************
PRECIPITATION DATA FILE:     C:\PROJECTS\4101L\LLRW2007\HELP07\M100.D4
TEMPERATURE DATA FILE:       C:\PROJECTS\4101L\LLRW2007\HELP07\M100.D7
SOLAR RADIATION DATA FILE:   C:\PROJECTS\4101L\LLRW2007\HELP07\M100.D13
EVAPOTRANSPIRATION DATA:     C:\PROJECTS\4101L\LLRW2007\HELP07\M100.D11
SOIL AND DESIGN DATA FILE:   C:\PROJECTS\4101L\LLRW2007\HELP07\S6\11E2S12d.D10
OUTPUT DATA FILE:            C:\PROJECTS\4101L\LLRW2007\HELP07\S6\11E2S12d.OUT
TIME:  18:14     DATE:  11/26/2007

******************************************************************************
     TITLE:  11.e(2) - Side Slope,12"Filter below S.Soil,Run On, 4th Iter
******************************************************************************
     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
            WERE SPECIFIED BY THE USER.

                                  LAYER  1
                                  --------
                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                      =      18.00    INCHES
          POROSITY                       =       0.1700 VOL/VOL
          FIELD CAPACITY                 =       0.0070 VOL/VOL
          WILTING POINT                  =       0.0030 VOL/VOL
          INITIAL SOIL WATER CONTENT     =       0.0120 VOL/VOL
          EFFECTIVE SAT. HYD. COND.      =    80.0000000000      CM/SEC

                                  LAYER  2
                                  --------
                      TYPE 2 - LATERAL DRAINAGE LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                      =       6.00    INCHES
          POROSITY                       =       0.1900 VOL/VOL
          FIELD CAPACITY                 =       0.0240 VOL/VOL
          WILTING POINT                  =       0.0070 VOL/VOL
          INITIAL SOIL WATER CONTENT     =       0.0240 VOL/VOL
          EFFECTIVE SAT. HYD. COND.      =    42.0000000000      CM/SEC
          SLOPE                          =      20.00    PERCENT
          DRAINAGE LENGTH                =     953.0     FEET

                                  LAYER  3
                                  --------
                        TYPE 3 - BARRIER SOIL LINER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                      =      12.00    INCHES
          POROSITY                       =       0.3100 VOL/VOL
          FIELD CAPACITY                 =       0.2000 VOL/VOL
          WILTING POINT                  =       0.0250 VOL/VOL
          INITIAL SOIL WATER CONTENT     =       0.3100 VOL/VOL
          EFFECTIVE SAT. HYD. COND.      =   0.400000019000E-02 CM/SEC

                                  LAYER  4
                                  --------
                      TYPE 2 - LATERAL DRAINAGE LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                      =      12.00    INCHES
          POROSITY                       =       0.2800 VOL/VOL
          FIELD CAPACITY                 =       0.0320 VOL/VOL
          WILTING POINT                  =       0.0130 VOL/VOL
          INITIAL SOIL WATER CONTENT     =       0.0320 VOL/VOL
          EFFECTIVE SAT. HYD. COND.      =     3.50000000000      CM/SEC
          SLOPE                          =      20.00    PERCENT
          DRAINAGE LENGTH                =     953.0     FEET

                                  LAYER  5
                                  --------
                        TYPE 3 - BARRIER SOIL LINER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                      =      12.00    INCHES
          POROSITY                       =       0.4300 VOL/VOL
          FIELD CAPACITY                 =       0.3900 VOL/VOL
          WILTING POINT                  =       0.2800 VOL/VOL
          INITIAL SOIL WATER CONTENT     =       0.4300 VOL/VOL
          EFFECTIVE SAT. HYD. COND.      =   0.500000006000E-07 CM/SEC

                                  LAYER  6
```

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                       --------
           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
    THICKNESS                    =     12.00   INCHES
    POROSITY                     =      0.4300 VOL/VOL
    FIELD CAPACITY               =      0.3900 VOL/VOL
    WILTING POINT                =      0.2800 VOL/VOL
    INITIAL SOIL WATER CONTENT   =      0.3900 VOL/VOL
    EFFECTIVE SAT. HYD. COND.    =  0.999999997000E-06 CM/SEC

                       LAYER  7
                       --------
           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
    THICKNESS                    =    100.00   INCHES
    POROSITY                     =      0.4370 VOL/VOL
    FIELD CAPACITY               =      0.0620 VOL/VOL
    WILTING POINT                =      0.0240 VOL/VOL
    INITIAL SOIL WATER CONTENT   =      0.1204 VOL/VOL
    EFFECTIVE SAT. HYD. COND.    =  0.500000024000E-03 CM/SEC

                       LAYER  8
                       --------
               TYPE 3 - BARRIER SOIL LINER
               MATERIAL TEXTURE NUMBER   0
    THICKNESS                    =     24.00   INCHES
    POROSITY                     =      0.4300 VOL/VOL
    FIELD CAPACITY               =      0.3900 VOL/VOL
    WILTING POINT                =      0.2800 VOL/VOL
    INITIAL SOIL WATER CONTENT   =      0.4300 VOL/VOL
    EFFECTIVE SAT. HYD. COND.    =  0.999999997000E-06 CM/SEC

          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ----------------------------------------
  NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
         SOIL DATA BASE USING SOIL TEXTURE #21 WITH BARE
         GROUND CONDITIONS, A SURFACE SLOPE OF 20.% AND
         A SLOPE LENGTH OF  150. FEET.
 SCS RUNOFF CURVE NUMBER              =     73.10
 FRACTION OF AREA ALLOWING RUNOFF     =    100.0    PERCENT
 AREA PROJECTED ON HORIZONTAL PLANE   =      0.344  ACRES
 EVAPORATIVE ZONE DEPTH               =     18.0    INCHES
 INITIAL WATER IN EVAPORATIVE ZONE    =      0.216  INCHES
 UPPER LIMIT OF EVAPORATIVE STORAGE   =      3.060  INCHES
 LOWER LIMIT OF EVAPORATIVE STORAGE   =      0.054  INCHES
 INITIAL SNOW WATER                   =      0.000  INCHES
 INITIAL WATER IN LAYER MATERIALS     =     36.664  INCHES
 TOTAL INITIAL WATER                  =     36.664  INCHES
 TOTAL SUBSURFACE INFLOW              -      0.00   INCHES/YEAR
           EVAPOTRANSPIRATION AND WEATHER DATA
           -----------------------------------
  NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
         SALT LAKE CITY        UTAH
      STATION LATITUDE                          =  40.69 DEGREES
      MAXIMUM LEAF AREA INDEX                   =   0.00
      START OF GROWING SEASON (JULIAN DATE)     =   117
      END OF GROWING SEASON (JULIAN DATE)       =   289
      EVAPORATIVE ZONE DEPTH                    =  18.0  INCHES
      AVERAGE ANNUAL WIND SPEED                 =   5.75 MPH
      AVERAGE 1ST QUARTER RELATIVE HUMIDITY     =  50.50 %
      AVERAGE 2ND QUARTER RELATIVE HUMIDITY     =  28.60 %
      AVERAGE 3RD QUARTER RELATIVE HUMIDITY     =  22.70 %
      AVERAGE 4TH QUARTER RELATIVE HUMIDITY     =  47.90 %
  NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
         COEFFICIENTS FOR    SALT LAKE CITY       UTAH
         NORMAL MEAN MONTHLY PRECIPITATION (INCHES)
JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
-------     -------     -------     -------     -------     -------
  0.79        0.92        0.85        1.25        0.94        0.90
  0.34        0.32        0.34        0.75        0.58        0.60
  NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
         COEFFICIENTS FOR    SALT LAKE CITY       UTAH
      NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)
JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
-------     -------     -------     -------     -------     -------
 30.40       32.00       41.70       49.10       60.10       69.60
 78.40       77.00       65.50       50.90       36.70       28.90
  NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
         COEFFICIENTS FOR    SALT LAKE CITY       UTAH
           AND STATION LATITUDE  =  40.69 DEGREES

*******************************************************************************

      AVERAGE MONTHLY VALUES IN INCHES FOR YEARS     1 THROUGH  100
-------------------------------------------------------------------------------

                      JAN/JUL  FEB/AUG  MAR/SEP  APR/OCT  MAY/NOV  JUN/DEC
```

PRECIPITATION

TOTALS	0.73	0.97	0.90	1.17	0.93	1.03
	0.32	0.32	0.33	0.81	0.58	0.63
STD. DEVIATIONS	0.37	0.45	0.42	0.49	0.54	0.73
	0.27	0.26	0.27	0.58	0.32	0.26

RUNOFF

TOTALS	0.008	0.038	0.012	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.025	0.090	0.042	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.002

EVAPOTRANSPIRATION

TOTALS	0.419	0.525	0.546	0.705	0.537	0.589
	0.206	0.194	0.193	0.343	0.363	0.437
STD. DEVIATIONS	0.166	0.193	0.243	0.291	0.316	0.406
	0.130	0.146	0.154	0.234	0.170	0.148

LATERAL DRAINAGE COLLECTED FROM LAYER 2

TOTALS	0.0230	0.0605	0.1048	0.0065	0.0053	0.0076
	0.0012	0.0007	0.0008	0.0080	0.0017	0.0008
STD. DEVIATIONS	0.0785	0.1418	0.1681	0.0080	0.0076	0.0121
	0.0027	0.0017	0.0019	0.0124	0.0038	0.0057

PERCOLATION/LEAKAGE THROUGH LAYER 3

TOTALS	0.0965	0.2633	0.5981	0.4791	0.3677	0.4440
	0.1313	0.1196	0.1292	0.4621	0.2078	0.0833
STD. DEVIATIONS	0.1901	0.3766	0.3962	0.2771	0.2889	0.3622
	0.1430	0.1250	0.1469	0.3938	0.1917	0.1001

LATERAL DRAINAGE COLLECTED FROM LAYER 4

TOTALS	0.0920	0.2565	0.5777	0.4500	0.3438	0.4196
	0.1126	0.0969	0.1078	0.4377	0.1838	0.0693
STD. DEVIATIONS	0.1860	0.3717	0.3958	0.2763	0.2859	0.3603
	0.1393	0.1202	0.1413	0.3896	0.1892	0.0913

PERCOLATION/LEAKAGE THROUGH LAYER 5

TOTALS	0.0041	0.0064	0.0203	0.0293	0.0239	0.0244
	0.0192	0.0227	0.0212	0.0243	0.0242	0.0142
STD. DEVIATIONS	0.0070	0.0083	0.0083	0.0072	0.0090	0.0086
	0.0096	0.0092	0.0096	0.0107	0.0092	0.0114

PERCOLATION/LEAKAGE THROUGH LAYER 8

TOTALS	0.0161	0.0132	0.0239	0.0267	0.0223	0.0214
	0.0180	0.0206	0.0189	0.0205	0.0197	0.0128
STD. DEVIATIONS	0.0696	0.0063	0.0054	0.0057	0.0060	0.0061
	0.0065	0.0061	0.0064	0.0077	0.0064	0.0077

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 3

AVERAGES	0.0003	0.0008	0.0014	0.0012	0.0009	0.0011
	0.0003	0.0003	0.0003	0.0011	0.0005	0.0002
STD. DEVIATIONS	0.0008	0.0014	0.0013	0.0007	0.0007	0.0009
	0.0004	0.0003	0.0004	0.0010	0.0005	0.0003

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0008	0.0023	0.0047	0.0038	0.0028	0.0035
	0.0009	0.0008	0.0009	0.0035	0.0015	0.0006
STD. DEVIATIONS	0.0015	0.0033	0.0032	0.0023	0.0023	0.0030
	0.0011	0.0010	0.0012	0.0032	0.0016	0.0007

DAILY AVERAGE HEAD ON TOP OF LAYER 8

AVERAGES	0.0061	0.0002	0.0003	0.0003	0.0002	0.0002
	0.0002	0.0002	0.0002	0.0002	0.0002	0.0001
STD. DEVIATIONS	0.0598	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 100

	INCHES		CU. FEET	PERCENT
PRECIPITATION	8.72	(1.548)	10900.9	100.00
RUNOFF	0.058	(0.1140)	72.68	0.667
EVAPOTRANSPIRATION	5.058	(0.8082)	6323.94	58.013
LATERAL DRAINAGE COLLECTED FROM LAYER 2	0.22096	(0.20421)	276.244	2.53415
PERCOLATION/LEAKAGE THROUGH LAYER 3	3.38194	(0.88125)	4228.007	38.78593
AVERAGE HEAD ON TOP OF LAYER 3	0.001	(0.000)		
LATERAL DRAINAGE COLLECTED FROM LAYER 4	3.14772	(0.87490)	3935.190	36.09975
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.23422	(0.02764)	292.818	2.68618
AVERAGE HEAD ON TOP OF LAYER 5	0.002	(0.001)		
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.23418	(0.06667)	292.767	2.68572
AVERAGE HEAD ON TOP OF LAYER 8	0.001	(0.005)		
CHANGE IN WATER STORAGE	0.000	(0.2390)	0.06	0.001

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 100

	(INCHES)	(CU. FT.)
PRECIPITATION	1.16	1450.199
RUNOFF	0.298	372.4357
DRAINAGE COLLECTED FROM LAYER 2	0.97104	1213.97290
PERCOLATION/LEAKAGE THROUGH LAYER 3	1.433739	1792.42053
AVERAGE HEAD ON TOP OF LAYER 3	0.153	
MAXIMUM HEAD ON TOP OF LAYER 3	0.056	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	0.0 FEET	
DRAINAGE COLLECTED FROM LAYER 4	1.34344	1679.52881
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.001732	2.16551
AVERAGE HEAD ON TOP OF LAYER 5	0.336	
MAXIMUM HEAD ON TOP OF LAYER 5	0.722	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	0.0 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.036612	45.77120
AVERAGE HEAD ON TOP OF LAYER 8	1.832	
SNOW WATER	1.19	1493.3019
MAXIMUM VEG. SOIL WATER (VOL/VOL)		0.1063
MINIMUM VEG. SOIL WATER (VOL/VOL)		0.0030

*** Maximum heads are computed using McEnroe's equations. ***
Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 100

LAYER	(INCHES)	(VOL/VOL)
1	0.2168	0.0120
2	0.1440	0.0240
3	3.7200	0.3100
4	0.3840	0.0320
5	5.1600	0.4300
6	4.6800	0.3900
7	12.0440	0.1204
8	10.3200	0.4300
SNOW WATER	0.000	

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**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                 HELP MODEL VERSION 3.06   (17 AUGUST 1996)               **
**                 DEVELOPED BY ENVIRONMENTAL LABORATORY                    **
**                   USAE WATERWAYS EXPERIMENT STATION                      **
**              FOR USEPA RISK REDUCTION ENGINEERING LABORATORY             **
**                                                                          **
**                                                                          **
******************************************************************************
******************************************************************************
PRECIPITATION DATA FILE:     C:\PROJECTS\4101L\LLRW2007\HELP07\M100.D4
TEMPERATURE DATA FILE:       C:\PROJECTS\4101L\LLRW2007\HELP07\M100.D7
SOLAR RADIATION DATA FILE:   C:\PROJECTS\4101L\LLRW2007\HELP07\M100.D13
EVAPOTRANSPIRATION DATA:     C:\PROJECTS\4101L\LLRW2007\HELP07\M100.D11
SOIL AND DESIGN DATA FILE:   C:\PROJECTS\4101L\LLRW2007\HELP07\S6\11E2S18.D10
OUTPUT DATA FILE:            C:\PROJECTS\4101L\LLRW2007\HELP07\S6\11E2S18.OUT
TIME:  18:39     DATE:  11/26/2007

******************************************************************************
     TITLE:  11.e(2) - Side Slope, 18"Filter below S.Soil, No Run On
******************************************************************************
     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
            WERE SPECIFIED BY THE USER.

                                 LAYER  1
                                 --------
                  TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =     18.00   INCHES
           POROSITY                   =      0.1700 VOL/VOL
           FIELD CAPACITY             =      0.0070 VOL/VOL
           WILTING POINT              =      0.0030 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.0120 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =   80.0000000000     CM/SEC

                                 LAYER  2
                                 --------
                   TYPE 2 - LATERAL DRAINAGE LAYER
                    MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =      6.00   INCHES
           POROSITY                   =      0.1900 VOL/VOL
           FIELD CAPACITY             =      0.0240 VOL/VOL
           WILTING POINT              =      0.0070 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.0240 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =   42.0000000000     CM/SEC
           SLOPE                      =     20.00   PERCENT
           DRAINAGE LENGTH            =    150.0    FEET

                                 LAYER  3
                                 --------
                    TYPE 3 - BARRIER SOIL LINER
                    MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =     12.00   INCHES
           POROSITY                   =      0.3100 VOL/VOL
           FIELD CAPACITY             =      0.2000 VOL/VOL
           WILTING POINT              =      0.0250 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.3100 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.400000019000E-02 CM/SEC

                                 LAYER  4
                                 --------
                   TYPE 2 - LATERAL DRAINAGE LAYER
                    MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =     18.00   INCHES
           POROSITY                   =      0.2800 VOL/VOL
           FIELD CAPACITY             =      0.0320 VOL/VOL
           WILTING POINT              =      0.0130 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.0320 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =   3.50000000000     CM/SEC
           SLOPE                      =     20.00   PERCENT
           DRAINAGE LENGTH            =    150.0    FEET

                                 LAYER  5
                                 --------
                    TYPE 3 - BARRIER SOIL LINER
                    MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =     12.00   INCHES
           POROSITY                   =      0.4300 VOL/VOL
           FIELD CAPACITY             =      0.3900 VOL/VOL
           WILTING POINT              =      0.2800 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.4300 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.500000006000E-07 CM/SEC

                                 LAYER  6
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                   --------
        TYPE 1 - VERTICAL PERCOLATION LAYER
           MATERIAL TEXTURE NUMBER   0
THICKNESS                  =     12.00   INCHES
POROSITY                   =      0.4300 VOL/VOL
FIELD CAPACITY             =      0.3900 VOL/VOL
WILTING POINT              =      0.2800 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.3900 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.999999997000E-06 CM/SEC

                   LAYER  7
                   --------
        TYPE 1 - VERTICAL PERCOLATION LAYER
           MATERIAL TEXTURE NUMBER   0
THICKNESS                  =    100.00   INCHES
POROSITY                   =      0.4370 VOL/VOL
FIELD CAPACITY             =      0.0620 VOL/VOL
WILTING POINT              =      0.0240 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0941 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.500000024000E-03 CM/SEC

                   LAYER  8
                   --------
           TYPE 3 - BARRIER SOIL LINER
           MATERIAL TEXTURE NUMBER   0
THICKNESS                  =     24.00   INCHES
POROSITY                   =      0.4300 VOL/VOL
FIELD CAPACITY             =      0.3900 VOL/VOL
WILTING POINT              =      0.2800 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.4300 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.999999997000E-06 CM/SEC

          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ----------------------------------------
 NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
        SOIL DATA BASE USING SOIL TEXTURE #21 WITH BARE
        GROUND CONDITIONS, A SURFACE SLOPE OF 20.% AND
        A SLOPE LENGTH OF  150. FEET.
SCS RUNOFF CURVE NUMBER            =     73.10
FRACTION OF AREA ALLOWING RUNOFF   =    100.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE =      0.344  ACRES
EVAPORATIVE ZONE DEPTH             =     18.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE  =      0.216  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE =      3.060  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE =      0.054  INCHES
INITIAL SNOW WATER                 =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS   =     34.226  INCHES
TOTAL INITIAL WATER                =     34.226  INCHES
TOTAL SUBSURFACE INFLOW            =      0.00   INCHES/YEAR
         EVAPOTRANSPIRATION AND WEATHER DATA
         -----------------------------------
 NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
        SALT LAKE CITY       UTAH
     STATION LATITUDE                    =  40.69 DEGREES
     MAXIMUM LEAF AREA INDEX             =   0.00
     START OF GROWING SEASON (JULIAN DATE) =  117
     END OF GROWING SEASON (JULIAN DATE)   =  289
     EVAPORATIVE ZONE DEPTH              =  18.0  INCHES
     AVERAGE ANNUAL WIND SPEED           =   5.75 MPH
     AVERAGE 1ST QUARTER RELATIVE HUMIDITY =  50.50 %
     AVERAGE 2ND QUARTER RELATIVE HUMIDITY =  28.60 %
     AVERAGE 3RD QUARTER RELATIVE HUMIDITY =  22.70 %
     AVERAGE 4TH QUARTER RELATIVE HUMIDITY =  47.90 %
 NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
        COEFFICIENTS FOR    SALT LAKE CITY       UTAH
        NORMAL MEAN MONTHLY PRECIPITATION (INCHES)
JAN/JUL    FEB/AUG    MAR/SEP    APR/OCT    MAY/NOV    JUN/DEC
-------    -------    -------    -------    -------    -------
 0.79       0.92       0.85       1.25       0.94       0.90
 0.34       0.32       0.34       0.75       0.58       0.60
 NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
        COEFFICIENTS FOR    SALT LAKE CITY       UTAH
    NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)
JAN/JUL    FEB/AUG    MAR/SEP    APR/OCT    MAY/NOV    JUN/DEC
-------    -------    -------    -------    -------    -------
30.40      32.00      41.70      49.10      60.10      69.60
78.40      77.00      65.50      50.90      36.70      28.90
 NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
        COEFFICIENTS FOR    SALT LAKE CITY       UTAH
          AND STATION LATITUDE  =  40.69 DEGREES

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   AVERAGE MONTHLY VALUES IN INCHES FOR YEARS    1 THROUGH  100
   -------------------------------------------------------------
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	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	0.73	0.97	0.90	1.17	0.93	1.03
	0.32	0.32	0.33	0.81	0.58	0.63
STD. DEVIATIONS	0.37	0.45	0.42	0.49	0.54	0.73
	0.27	0.26	0.27	0.58	0.32	0.26
RUNOFF						
TOTALS	0.008	0.038	0.012	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.025	0.090	0.042	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.002
EVAPOTRANSPIRATION						
TOTALS	0.419	0.525	0.546	0.705	0.537	0.589
	0.206	0.194	0.193	0.343	0.363	0.437
STD. DEVIATIONS	0.166	0.193	0.243	0.291	0.316	0.406
	0.130	0.146	0.154	0.234	0.170	0.148
LATERAL DRAINAGE COLLECTED FROM LAYER 2						
TOTALS	0.0490	0.1244	0.2286	0.0356	0.0289	0.0404
	0.0067	0.0042	0.0044	0.0429	0.0096	0.0027
STD. DEVIATIONS	0.1416	0.2584	0.3009	0.0416	0.0400	0.0613
	0.0144	0.0093	0.0108	0.0627	0.0203	0.0165
PERCOLATION/LEAKAGE THROUGH LAYER 3						
TOTALS	0.0705	0.1995	0.4743	0.4500	0.3441	0.4111
	0.1259	0.1162	0.1256	0.4273	0.1999	0.0813
STD. DEVIATIONS	0.1435	0.3066	0.3479	0.2479	0.2604	0.3174
	0.1335	0.1184	0.1390	0.3499	0.1775	0.0968
LATERAL DRAINAGE COLLECTED FROM LAYER 4						
TOTALS	0.0701	0.1989	0.4723	0.4473	0.3418	0.4088
	0.1239	0.1137	0.1233	0.4249	0.1975	0.0799
STD. DEVIATIONS	0.1432	0.3061	0.3480	0.2481	0.2602	0.3173
	0.1332	0.1180	0.1386	0.3497	0.1773	0.0960
PERCOLATION/LEAKAGE THROUGH LAYER 5						
TOTALS	0.0004	0.0006	0.0020	0.0027	0.0022	0.0023
	0.0020	0.0024	0.0023	0.0024	0.0024	0.0014
STD. DEVIATIONS	0.0007	0.0008	0.0008	0.0006	0.0007	0.0007
	0.0009	0.0009	0.0009	0.0009	0.0009	0.0011
PERCOLATION/LEAKAGE THROUGH LAYER 8						
TOTALS	0.0042	0.0005	0.0016	0.0023	0.0019	0.0019
	0.0016	0.0021	0.0019	0.0019	0.0019	0.0012
STD. DEVIATIONS	0.0385	0.0007	0.0007	0.0006	0.0007	0.0007
	0.0007	0.0008	0.0008	0.0008	0.0007	0.0009

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
DAILY AVERAGE HEAD ON TOP OF LAYER 3						
AVERAGES	0.0003	0.0008	0.0014	0.0012	0.0009	0.0011
	0.0003	0.0003	0.0003	0.0011	0.0005	0.0002
STD. DEVIATIONS	0.0008	0.0014	0.0013	0.0007	0.0007	0.0009
	0.0004	0.0003	0.0004	0.0010	0.0005	0.0003
DAILY AVERAGE HEAD ON TOP OF LAYER 5						
AVERAGES	0.0006	0.0018	0.0039	0.0038	0.0028	0.0035
	0.0010	0.0009	0.0011	0.0035	0.0017	0.0007
STD. DEVIATIONS	0.0012	0.0027	0.0028	0.0021	0.0021	0.0027
	0.0011	0.0010	0.0012	0.0028	0.0015	0.0008
DAILY AVERAGE HEAD ON TOP OF LAYER 8						
AVERAGES	0.0019	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0187	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 100

	INCHES		CU. FEET	PERCENT
PRECIPITATION	8.72	(1.548)	10900.9	100.00
RUNOFF	0.058	(0.1140)	72.68	0.667
EVAPOTRANSPIRATION	5.058	(0.8082)	6323.94	58.013
LATERAL DRAINAGE COLLECTED FROM LAYER 2	0.57740	(0.36167)	721.845	6.62190
PERCOLATION/LEAKAGE THROUGH LAYER 3	3.02551	(0.82101)	3782.407	34.69818
AVERAGE HEAD ON TOP OF LAYER 3	0.001	(0.000)		
LATERAL DRAINAGE COLLECTED FROM LAYER 4	3.00244	(0.82074)	3753.563	34.43359
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.02307	(0.00265)	28.844	0.26460
AVERAGE HEAD ON TOP OF LAYER 5	0.002	(0.001)		
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.02307	(0.03860)	28.837	0.26454
AVERAGE HEAD ON TOP OF LAYER 8	0.000	(0.002)		
CHANGE IN WATER STORAGE	0.000	(0.2301)	0.02	0.000

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 100

	(INCHES)	(CU. FT.)
PRECIPITATION	1.16	1450.199
RUNOFF	0.298	372.4357
DRAINAGE COLLECTED FROM LAYER 2	1.61500	2019.02710
PERCOLATION/LEAKAGE THROUGH LAYER 3	1.371039	1714.03430
AVERAGE HEAD ON TOP OF LAYER 3	0.153	
MAXIMUM HEAD ON TOP OF LAYER 3	0.010	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	0.0 FEET	
DRAINAGE COLLECTED FROM LAYER 4	1.37090	1713.85889
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.001166	1.45824
AVERAGE HEAD ON TOP OF LAYER 5	0.346	
MAXIMUM HEAD ON TOP OF LAYER 5	0.110	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	0.0 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.035421	44.28211
AVERAGE HEAD ON TOP OF LAYER 8	0.992	
SNOW WATER	1.19	1493.3019
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.1063	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0030	

*** Maximum heads are computed using McEnroe's equations. ***
Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 100

LAYER	(INCHES)	(VOL/VOL)
1	0.2168	0.0120
2	0.1440	0.0240
3	3.7200	0.3100
4	0.5760	0.0320
5	5.1600	0.4300
6	4.6800	0.3900
7	9.4105	0.0941
8	10.3200	0.4300
SNOW WATER	0.000	

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**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**              HELP MODEL VERSION 3.06   (17 AUGUST 1996)                  **
**              DEVELOPED BY ENVIRONMENTAL LABORATORY                       **
**              USAE WATERWAYS EXPERIMENT STATION                           **
**              FOR USEPA RISK REDUCTION ENGINEERING LABORATORY             **
**                                                                          **
**                                                                          **
******************************************************************************
******************************************************************************
PRECIPITATION DATA FILE:     C:\PROJECTS\4101L\LLRW2007\HELP07\M100.D4
TEMPERATURE DATA FILE:       C:\PROJECTS\4101L\LLRW2007\HELP07\M100.D7
SOLAR RADIATION DATA FILE:   C:\PROJECTS\4101L\LLRW2007\HELP07\M100.D13
EVAPOTRANSPIRATION DATA:     C:\PROJECTS\4101L\LLRW2007\HELP07\M100.D11
SOIL AND DESIGN DATA FILE:   C:\PROJECTS\4101L\LLRW2007\HELP07\S6\11E2S18c.D10
OUTPUT DATA FILE:            C:\PROJECTS\4101L\LLRW2007\HELP07\S6\11E2S18c.OUT
TIME: 19:14     DATE: 11/26/2007

******************************************************************************
     TITLE: 11.e(2) -Side Slope, 18"Filter below S.Soil,Run On, 3rd Iter
******************************************************************************
     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
            WERE SPECIFIED BY THE USER.

                              LAYER  1
                              --------
                  TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   0
          THICKNESS                  =     18.00   INCHES
          POROSITY                   =      0.1700 VOL/VOL
          FIELD CAPACITY             =      0.0070 VOL/VOL
          WILTING POINT              =      0.0030 VOL/VOL
          INITIAL SOIL WATER CONTENT =      0.0120 VOL/VOL
          EFFECTIVE SAT. HYD. COND.  =   80.0000000000      CM/SEC

                              LAYER  2
                              --------
                  TYPE 2 - LATERAL DRAINAGE LAYER
                    MATERIAL TEXTURE NUMBER   0
          THICKNESS                  =      6.00   INCHES
          POROSITY                   =      0.1900 VOL/VOL
          FIELD CAPACITY             =      0.0240 VOL/VOL
          WILTING POINT              =      0.0070 VOL/VOL
          INITIAL SOIL WATER CONTENT =      0.0240 VOL/VOL
          EFFECTIVE SAT. HYD. COND.  =   42.0000000000      CM/SEC
          SLOPE                      =     20.00   PERCENT
          DRAINAGE LENGTH            =    924.0    FEET

                              LAYER  3
                              --------
                    TYPE 3 - BARRIER SOIL LINER
                    MATERIAL TEXTURE NUMBER   0
          THICKNESS                  =     12.00   INCHES
          POROSITY                   =      0.3100 VOL/VOL
          FIELD CAPACITY             =      0.2000 VOL/VOL
          WILTING POINT              =      0.0250 VOL/VOL
          INITIAL SOIL WATER CONTENT =      0.3100 VOL/VOL
          EFFECTIVE SAT. HYD. COND.  =  0.400000019000E-02 CM/SEC

                              LAYER  4
                              --------
                  TYPE 2 - LATERAL DRAINAGE LAYER
                    MATERIAL TEXTURE NUMBER   0
          THICKNESS                  =     18.00   INCHES
          POROSITY                   =      0.2800 VOL/VOL
          FIELD CAPACITY             =      0.0320 VOL/VOL
          WILTING POINT              =      0.0130 VOL/VOL
          INITIAL SOIL WATER CONTENT =      0.0320 VOL/VOL
          EFFECTIVE SAT. HYD. COND.  =    3.50000000000     CM/SEC
          SLOPE                      =     20.00   PERCENT
          DRAINAGE LENGTH            =    924.0    FEET

                              LAYER  5
                              --------
                    TYPE 3 - BARRIER SOIL LINER
                    MATERIAL TEXTURE NUMBER   0
          THICKNESS                  =     12.00   INCHES
          POROSITY                   =      0.4300 VOL/VOL
          FIELD CAPACITY             =      0.3900 VOL/VOL
          WILTING POINT              =      0.2800 VOL/VOL
          INITIAL SOIL WATER CONTENT =      0.4300 VOL/VOL
          EFFECTIVE SAT. HYD. COND.  =  0.500000006000E-07 CM/SEC

                              LAYER  6
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                      --------
              TYPE 1 - VERTICAL PERCOLATION LAYER
                  MATERIAL TEXTURE NUMBER   0
     THICKNESS                       =      12.00    INCHES
     POROSITY                        =        0.4300 VOL/VOL
     FIELD CAPACITY                  =        0.3900 VOL/VOL
     WILTING POINT                   =        0.2800 VOL/VOL
     INITIAL SOIL WATER CONTENT      =        0.3900 VOL/VOL
     EFFECTIVE SAT. HYD. COND.       =    0.999999997000E-06 CM/SEC

                             LAYER  7
                             --------
              TYPE 1 - VERTICAL PERCOLATION LAYER
                  MATERIAL TEXTURE NUMBER   0
     THICKNESS                       =     100.00    INCHES
     POROSITY                        =        0.4370 VOL/VOL
     FIELD CAPACITY                  =        0.0620 VOL/VOL
     WILTING POINT                   =        0.0240 VOL/VOL
     INITIAL SOIL WATER CONTENT      =        0.1114 VOL/VOL
     EFFECTIVE SAT. HYD. COND.       =    0.500000024000E-03 CM/SEC

                             LAYER  8
                             --------
                  TYPE 3   BARRIER SOIL LINER
                  MATERIAL TEXTURE NUMBER   0
     THICKNESS                       =      24.00    INCHES
     POROSITY                        =        0.4300 VOL/VOL
     FIELD CAPACITY                  =        0.3900 VOL/VOL
     WILTING POINT                   =        0.2800 VOL/VOL
     INITIAL SOIL WATER CONTENT      =        0.4300 VOL/VOL
     EFFECTIVE SAT. HYD. COND.       =    0.999999997000E-06 CM/SEC

            GENERAL DESIGN AND EVAPORATIVE ZONE DATA
            ---- ----------------------------------
   NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
          SOIL DATA BASE USING SOIL TEXTURE #21 WITH BARE
          GROUND CONDITIONS, A SURFACE SLOPE OF 20.% AND
          A SLOPE LENGTH OF  150. FEET.
  SCS RUNOFF CURVE NUMBER                =      73.10
  FRACTION OF AREA ALLOWING RUNOFF       =     100.0     PERCENT
  AREA PROJECTED ON HORIZONTAL PLANE     =       0.344   ACRES
  EVAPORATIVE ZONE DEPTH                 =      18.0     INCHES
  INITIAL WATER IN EVAPORATIVE ZONE      =       0.216   INCHES
  UPPER LIMIT OF EVAPORATIVE STORAGE     =       3.060   INCHES
  LOWER LIMIT OF EVAPORATIVE STORAGE     =       0.054   INCHES
  INITIAL SNOW WATER                     =       0.000   INCHES
  INITIAL WATER IN LAYER MATERIALS       =      35.956   INCHES
  TOTAL INITIAL WATER                    =      35.956   INCHES
  TOTAL SUBSURFACE INFLOW                =       0.00    INCHES/YEAR
             EVAPOTRANSPIRATION AND WEATHER DATA
             -----------------------------------
   NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
          SALT LAKE CITY         UTAH
       STATION LATITUDE                        =  40.69 DEGREES
       MAXIMUM LEAF AREA INDEX                 =   0.00
       START OF GROWING SEASON (JULIAN DATE)   =    117
       END OF GROWING SEASON (JULIAN DATE)     =    289
       EVAPORATIVE ZONE DEPTH                  =  18.0  INCHES
       AVERAGE ANNUAL WIND SPEED               =   5.75 MPH
       AVERAGE 1ST QUARTER RELATIVE HUMIDITY   =  50.50 %
       AVERAGE 2ND QUARTER RELATIVE HUMIDITY   =  28.60 %
       AVERAGE 3RD QUARTER RELATIVE HUMIDITY   =  22.70 %
       AVERAGE 4TH QUARTER RELATIVE HUMIDITY   =  47.90 %
   NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
          COEFFICIENTS FOR     SALT LAKE CITY       UTAH
          NORMAL MEAN MONTHLY PRECIPITATION (INCHES)
 JAN/JUL      FEB/AUG      MAR/SEP      APR/OCT      MAY/NOV      JUN/DEC
 -------      -------      -------      -------      -------      -------
  0.79         0.92         0.85         1.25         0.94         0.90
  0.34         0.32         0.34         0.75         0.58         0.60
   NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
          COEFFICIENTS FOR     SALT LAKE CITY       UTAH
       NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)
 JAN/JUL      FEB/AUG      MAR/SEP      APR/OCT      MAY/NOV      JUN/DEC
 -------      -------      -------      -------      -------      -------
  30.40        32.00        41.70        49.10        60.10        69.60
  78.40        77.00        65.50        50.90        36.70        28.90
   NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
          COEFFICIENTS FOR     SALT LAKE CITY       UTAH
            AND STATION LATITUDE  =  40.69 DEGREES

*******************************************************************************

       AVERAGE MONTHLY VALUES IN INCHES FOR YEARS    1 THROUGH  100
-------------------------------------------------------------------------------

                         JAN/JUL  FEB/AUG  MAR/SEP  APR/OCT  MAY/NOV  JUN/DEC
```

PRECIPITATION						
TOTALS	0.73	0.97	0.90	1.17	0.93	1.03
	0.32	0.32	0.33	0.81	0.58	0.63
STD. DEVIATIONS	0.37	0.45	0.42	0.49	0.54	0.73
	0.27	0.26	0.27	0.58	0.32	0.26
RUNOFF						
TOTALS	0.008	0.038	0.012	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.025	0.090	0.042	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.002
EVAPOTRANSPIRATION						
TOTALS	0.419	0.525	0.546	0.705	0.537	0.589
	0.206	0.194	0.193	0.343	0.363	0.437
STD. DEVIATIONS	0.166	0.193	0.243	0.291	0.316	0.406
	0.130	0.146	0.154	0.234	0.170	0.148
LATERAL DRAINAGE COLLECTED FROM LAYER 2						
TOTALS	0.0234	0.0616	0.1067	0.0067	0.0055	0.0078
	0.0012	0.0008	0.0008	0.0083	0.0018	0.0008
STD. DEVIATIONS	0.0797	0.1441	0.1707	0.0082	0.0079	0.0125
	0.0028	0.0017	0.0020	0.0127	0.0039	0.0058
PERCOLATION/LEAKAGE THROUGH LAYER 3						
TOTALS	0.0961	0.2623	0.5961	0.4789	0.3675	0.4437
	0.1313	0.1196	0.1292	0.4619	0.2078	0.0832
STD. DEVIATIONS	0.1892	0.3753	0.3953	0.2769	0.2886	0.3619
	0.1429	0.1250	0.1468	0.3935	0.1916	0.1000
LATERAL DRAINAGE COLLECTED FROM LAYER 4						
TOTALS	0.0941	0.2591	0.5864	0.4652	0.3562	0.4321
	0.1220	0.1084	0.1187	0.4501	0.1962	0.0765
STD. DEVIATIONS	0.1877	0.3730	0.3957	0.2767	0.2873	0.3611
	0.1413	0.1228	0.1445	0.3919	0.1905	0.0960
PERCOLATION/LEAKAGE THROUGH LAYER 5						
TOTALS	0.0019	0.0031	0.0098	0.0137	0.0113	0.0116
	0.0093	0.0112	0.0105	0.0118	0.0116	0.0068
STD. DEVIATIONS	0.0033	0.0040	0.0038	0.0031	0.0040	0.0037
	0.0043	0.0042	0.0044	0.0046	0.0042	0.0052
PERCOLATION/LEAKAGE THROUGH LAYER 8						
TOTALS	0.0089	0.0046	0.0102	0.0125	0.0105	0.0104
	0.0090	0.0106	0.0097	0.0102	0.0099	0.0061
STD. DEVIATIONS	0.0591	0.0034	0.0030	0.0030	0.0033	0.0031
	0.0035	0.0035	0.0034	0.0039	0.0034	0.0042

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 3						
AVERAGES	0.0003	0.0008	0.0014	0.0012	0.0009	0.0011
	0.0003	0.0003	0.0003	0.0011	0.0005	0.0002
STD. DEVIATIONS	0.0008	0.0014	0.0013	0.0007	0.0007	0.0009
	0.0004	0.0003	0.0004	0.0010	0.0005	0.0003
DAILY AVERAGE HEAD ON TOP OF LAYER 5						
AVERAGES	0.0008	0.0023	0.0048	0.0040	0.0030	0.0037
	0.0011	0.0010	0.0011	0.0038	0.0017	0.0007
STD. DEVIATIONS	0.0015	0.0033	0.0032	0.0023	0.0023	0.0030
	0.0012	0.0010	0.0012	0.0032	0.0016	0.0008
DAILY AVERAGE HEAD ON TOP OF LAYER 8						
AVERAGES	0.0044	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
STD. DEVIATIONS	0.0432	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 100

	INCHES		CU. FEET	PERCENT
PRECIPITATION	8.72	(1.548)	10900.9	100.00
RUNOFF	0.058	(0.1140)	72.68	0.667
EVAPOTRANSPIRATION	5.058	(0.8082)	6323.94	58.013
LATERAL DRAINAGE COLLECTED FROM LAYER 2	0.22533	(0.20729)	281.707	2.58426
PERCOLATION/LEAKAGE THROUGH LAYER 3	3.37757	(0.88080)	4222.544	38.73581
AVERAGE HEAD ON TOP OF LAYER 3	0.001	(0.000)		
LATERAL DRAINAGE COLLECTED FROM LAYER 4	3.26493	(0.87838)	4081.719	37.44394
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.11265	(0.01263)	140.826	1.29188
AVERAGE HEAD ON TOP OF LAYER 5	0.002	(0.001)		
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.11269	(0.05837)	140.879	1.29236
AVERAGE HEAD ON TOP OF LAYER 8	0.000	(0.004)		
CHANGE IN WATER STORAGE	0.000	(0.2344)	-0.04	0.000

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 100

	(INCHES)	(CU. FT.)
PRECIPITATION	1.16	1450.199
RUNOFF	0.298	372.4357
DRAINAGE COLLECTED FROM LAYER 2	0.98523	1231.70959
PERCOLATION/LEAKAGE THROUGH LAYER 3	1.431567	1789.70496
AVERAGE HEAD ON TOP OF LAYER 3	0.153	
MAXIMUM HEAD ON TOP OF LAYER 3	0.228	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	0.0 FEET	
DRAINAGE COLLECTED FROM LAYER 4	1.43070	1788.62268
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.001701	2.12659
AVERAGE HEAD ON TOP OF LAYER 5	0.361	
MAXIMUM HEAD ON TOP OF LAYER 5	0.650	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	22.1 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.036204	45.26162
AVERAGE HEAD ON TOP OF LAYER 8	1.545	
SNOW WATER	1.19	1493.3019
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.1063	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0030	

*** Maximum heads are computed using McEnroe's equations. ***
Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 100

LAYER	(INCHES)	(VOL/VOL)
1	0.2168	0.0120
2	0.1440	0.0240
3	3.7200	0.3100
4	0.5760	0.0320
5	5.1600	0.4300
6	4.6800	0.3900
7	11.1358	0.1114
8	10.3200	0.4300
SNOW WATER	0.000	

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Whetstone Associates

ATTACHMENT 2
ENERGY*SOLUTIONS*
CLASS A SOUTH CELL
UNSAT-H MODEL INPUT & OUTPUT FILES

Prepared for

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December 2007

UNSAT-H INPUT FILES

CAS-T27e.lis.doc	Class A South Cell Top Slope, 0.276 cm/yr
CAS-S28c.lis.doc	Class A South Cell Side Slope, 0.286 cm/yr
CAS-S59c.lis.doc	Class A South Cell Side Slope, 0.595 cm/yr

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                              Program DATAINH
                               Version2.05
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 Input Filename: C:\Projects\4101L\CAS2007\Unsat07\CAS-T27e.inp
 Date Processed: 06 Dec 2007
 Time Processed: 12:10:38.32

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 Title:
 CAS-T27e.INP: Class A South disposal cell Unsat flow, frost-prot. top slope, 0.2
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 Options chosen include:

 IPLANT =   0        LOWER  =   2        NGRAV  =    1        ISWDIF =   1
 IHEAT  =   0        UPPERH =   0        LOWERH =    0
 NPRINT =   0        DAYEND = 365        NDAYS  = 365        NYEARS =  50
 IRAIN  =   0        ICONVH =   0
 NSURPE =   0        NFHOUR =   2        ITOPBC =    0        ET_OPT =   0
 ICLOUD =   0
 KOPT   =   4        KEST   =   3        IVAPOR =    0        SH_OPT =   0
 INMAX  =   3        INHMAX =   2
 HIRRI  =   0.00     HDRY   =  1.000E+04 HTOP   =   0.00     DHMAX  =   0.00
 DMAXBA = 5.000E-04 DELMAX =  0.150      DELMIN =  1.500E-08 STOPHR =  24.0
 OUTTIM = 0.150
 TORT   = 0.660      TSOIL  =   288.     VAPDIF =  0.240     QHTOP  =   0.00
 TGRAD  =   0.00     TSMEAN =   288.     TSAMP  =   10.0     QHLEAK =   0.00
 WTF    = 0.500      RFACT  =   1.05     RAINIF =  1.000E-05 DHFACT =   0.00
 MATN   =   5        NPT    = 137

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 KOPT = 4:  van Genuchten functions for soil hydraulic properties

 THETA vs H, MAT   1,   Radon Barrier2 Moisture Characteristics
      AIRINT =   0.0000                           THET =  0.43200
        THTR =  0.10000                          ALPHA =  3.00000E-03
           N =   1.1720                              M =  0.14676
     K vs H, MAT   1,   Radon Barrier2 Hydraulic Conductivity
      AIRINK =   0.0000                             SK =  1.80000E-04
           A =  3.00000E-03                          N =   1.1720
           M =  0.14676                         KMODEL =   2.0000
        EPIT =   4.5000

 THETA vs H, MAT   2,   Radon Barrier2 Moisture Characteristics
      AIRINT =   0.0000                           THET =  0.43200
        THTR =  0.10000                          ALPHA =  3.00000E-03
           N =   1.1720                              M =  0.14676
     K vs H, MAT   2,   Radon Barrier2 Hydraulic Conductivity
      AIRINK =   0.0000                             SK -  3.60000E-03
           A =  3.00000E-03                          N =   1.1720
           M =  0.14676                         KMODEL =   2.0000
        EPIT =   4.5000

 THETA vs H, MAT   3,   Waste Moisture Characteristics
      AIRINT =   0.0000                           THET =  0.35000
        THTR =  2.00000E-02                      ALPHA =  0.11500
           N =   2.0130                              M =  0.50323
     K vs H, MAT   3,   Waste Hydraulic Conductivity
      AIRINK =   0.0000                             SK =   1.8000
           A =  0.11500                              N =   2.0130
           M =  0.50323                         KMODEL =   2.0000
        EPIT =  0.50000

 THETA vs H, MAT   4,   Clay Liner Moisture Characteristics
      AIRINT =   0.0000                           THET =  0.43200
        THTR =  0.10000                          ALPHA =  3.00000E-03
           N =   1.1720                              M =  0.14676
     K vs H, MAT   4,   Clay Liner Hydraulic Conductivity
      AIRINK =   0.0000                             SK =  3.60000E-03
           A =  3.00000E-03                          N =   1.1720
           M =  0.14676                         KMODEL =   2.0000
        EPIT =   4.5000

 THETA vs H, MAT   5,   Unit 3 Silty Sand Moisture Characteristics
      AIRINT =   0.0000                           THET =  0.34000
        THTR =  2.00000E-02                      ALPHA =  5.50000E-02
           N =   2.5180                              M =  0.60286
     K vs H, MAT   5,   Unit 3 Silty Sand Hydraulic Conductivity
      AIRINK =   0.0000                             SK =   2.1920
           A =  5.50000E-02                          N =   2.5180
           M =  0.60286                         KMODEL =   2.0000
        EPIT =  0.50000

 Surface node hydraulic properties

 HIRRI =       0.0     , THETA = 0.4320, K =   1.8000E-04, C =  -1.9786E-08
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HDRY = 1.00E+04, THETA = 0.2845, K = 9.2973E-11, C = -3.1149E-06
NDAY = 0

NODE	Z	MAT	HEAD	CONDUCTIVITY	CAPACITY	THETA	TEMP
1	0.00	1	4.2000E+01	1.6187E-05	-1.0888E-04	0.4279	288.1
2	0.10	1	4.2100E+01	1.6157E-05	-1.0889E-04	0.4279	288.1
3	0.30	1	4.2300E+01	1.6098E-05	-1.0893E-04	0.4279	288.1
4	0.60	1	4.2600E+01	1.6010E-05	-1.0897E-04	0.4278	288.1
5	1.10	1	4.3100E+01	1.5865E-05	-1.0905E-04	0.4278	288.1
6	2.00	1	4.3900E+01	1.5638E-05	-1.0917E-04	0.4277	288.1
7	3.30	1	4.5300E+01	1.5253E-05	-1.0936E-04	0.4275	288.1
8	5.60	1	4.7800E+01	1.4603E-05	-1.0966E-04	0.4273	288.1
9	6.90	1	4.9300E+01	1.4235E-05	-1.0981E-04	0.4271	288.1
10	7.80	1	5.0400E+01	1.3974E-05	-1.0991E-04	0.4270	288.1
11	8.30	1	5.1000E+01	1.3836E-05	-1.0996E-04	0.4269	288.1
12	8.60	1	5.1400E+01	1.3744E-05	-1.0999E-04	0.4269	288.1
13	8.80	1	5.1700E+01	1.3676E-05	-1.1001E-04	0.4268	288.1
14	8.90	1	5.1800E+01	1.3654E-05	-1.1002E-04	0.4268	288.1
15	9.00	1	5.1900E+01	1.3631E-05	-1.1003E-04	0.4268	288.1
16	9.20	1	5.2200E+01	1.3564E-05	-1.1005E-04	0.4268	288.1
17	9.50	1	5.2600E+01	1.3476E-05	-1.1008E-04	0.4267	288.1
18	10.00	1	5.3200E+01	1.3345E-05	-1.1012E-04	0.4267	288.1
19	10.90	1	5.4500E+01	1.3068E-05	-1.1020E-04	0.4265	288.1
20	13.10	1	5.7600E+01	1.2443E-05	-1.1035E-04	0.4262	288.1
21	16.40	1	6.3000E+01	1.1461E-05	-1.1047E-04	0.4256	288.1
22	21.50	1	7.2800E+01	9.9590E-06	-1.1034E-04	0.4245	288.1
23	24.80	1	8.0400E+01	8.9897E-06	-1.1000E-04	0.4237	288.1
24	27.00	1	8.6100E+01	8.3519E-06	-1.0963E-04	0.4231	288.1
25	28.50	1	9.0400E+01	7.9137E-06	-1.0930E-04	0.4226	288.1
26	29.40	1	9.3100E+01	7.6555E-06	-1.0908E-04	0.4223	288.1
27	29.90	1	9.4700E+01	7.5083E-06	-1.0894E-04	0.4221	288.1
28	30.20	1	9.5600E+01	7.4272E-06	-1.0885E-04	0.4220	288.1
29	30.40	1	9.6300E+01	7.3651E-06	-1.0879E-04	0.4219	288.1
30	30.50	1	9.6600E+01	7.3386E-06	-1.0876E-04	0.4219	288.1
31	30.60	2	9.6600E+01	1.4677E-04	-1.0876E-04	0.4219	288.1
32	30.80	2	9.6400E+01	1.4712E-04	-1.0878E-04	0.4219	288.1
33	31.10	2	9.6200E+01	1.4748E-04	-1.0880E-04	0.4219	288.1
34	31.60	2	9.5800E+01	1.4819E-04	-1.0884E-04	0.4220	288.1
35	32.30	2	9.5300E+01	1.4908E-04	-1.0888E-04	0.4220	288.1
36	33.30	2	9.4500E+01	1.5053E-04	-1.0895E-04	0.4221	288.1
37	34.80	2	9.3300E+01	1.5274E-04	-1.0906E-04	0.4223	288.1
38	37.00	2	9.1500E+01	1.5614E-04	-1.0921E-04	0.4225	288.1
39	39.70	2	8.9400E+01	1.6025E-04	-1.0938E-04	0.4227	288.1
40	42.70	2	8.6900E+01	1.6535E-04	-1.0958E-04	0.4230	288.1
41	45.70	2	8.4500E+01	1.7048E-04	-1.0975E-04	0.4232	288.1
42	48.70	2	8.2000E+01	1.7607E-04	-1.0991E-04	0.4235	288.1
43	51.70	2	7.9600E+01	1.8170E-04	-1.1005E-04	0.4238	288.1
44	54.50	2	7.7200E+01	1.8760E-04	-1.1017E-04	0.4240	288.1
45	56.70	2	7.5400E+01	1.9221E-04	-1.1025E-04	0.4242	288.1
46	58.20	2	7.4100E+01	1.9565E-04	-1.1030E-04	0.4244	288.1
47	59.20	2	7.3300E+01	1.9781E-04	-1.1033E-04	0.4245	288.1
48	59.90	2	7.2700E+01	1.9945E-04	-1.1035E-04	0.4245	288.1
49	60.40	2	7.2300E+01	2.0056E-04	-1.1036E-04	0.4246	288.1
50	60.70	2	7.2000E+01	2.0140E-04	-1.1037E-04	0.4246	288.1
51	60.90	2	7.1900E+01	2.0168E-04	-1.1037E-04	0.4246	288.1
52	61.00	2	7.1800E+01	2.0196E-04	-1.1037E-04	0.4246	288.1
53	61.10	3	7.1700E+01	3.1276E-05	-5.3852E-04	0.0587	288.1
54	61.30	3	7.1700E+01	3.1276E-05	-5.3852E-04	0.0587	288.1
55	61.60	3	7.1700E+01	3.1276E-05	-5.3852E-04	0.0587	288.1
56	62.10	3	7.1700E+01	3.1276E-05	-5.3852E-04	0.0587	288.1
57	63.00	3	7.1700E+01	3.1276E-05	-5.3852E-04	0.0587	288.1
58	64.50	3	7.1700E+01	3.1276E-05	-5.3852E-04	0.0587	288.1
59	67.50	3	7.1700E+01	3.1276E-05	-5.3852E-04	0.0587	288.1
60	72.50	3	7.1700E+01	3.1276E-05	-5.3852E-04	0.0587	288.1
61	82.50	3	7.1700E+01	3.1276E-05	-5.3852E-04	0.0587	288.1
62	102.50	3	7.1700E+01	3.1276E-05	-5.3852E-04	0.0587	288.1
63	132.50	3	7.1700E+01	3.1276E-05	-5.3852E-04	0.0587	288.1
64	177.50	3	7.1700E+01	3.1276E-05	-5.3852E-04	0.0587	288.1
65	242.50	3	7.1700E+01	3.1276E-05	-5.3852E-04	0.0587	288.1
66	342.50	3	7.1700E+01	3.1276E-05	-5.3852E-04	0.0587	288.1
67	502.50	3	7.1700E+01	3.1276E-05	-5.3852E-04	0.0587	288.1
68	746.80	3	7.1700E+01	3.1276E-05	-5.3852E-04	0.0587	288.1
69	991.10	3	7.1700E+01	3.1276E-05	-5.3852E-04	0.0587	288.1
70	1151.10	3	7.1700E+01	3.1276E-05	-5.3852E-04	0.0587	288.1
71	1251.10	3	7.1700E+01	3.1276E-05	-5.3852E-04	0.0587	288.1
72	1316.10	3	7.1700E+01	3.1276E-05	-5.3852E-04	0.0587	288.1
73	1361.10	3	7.1700E+01	3.1276E-05	-5.3852E-04	0.0587	288.1
74	1391.10	3	7.2900E+01	2.9033E-05	-5.2119E-04	0.0580	288.1
75	1411.10	3	7.8100E+01	2.1312E-05	-4.5490E-04	0.0555	288.1
76	1421.10	3	8.6600E+01	1.3396E-05	-3.7073E-04	0.0520	288.1
77	1426.10	3	9.6500E+01	8.2290E-06	-2.9900E-04	0.0487	288.1
78	1429.10	3	1.0800E+02	4.9537E-06	-2.3893E-04	0.0456	288.1
79	1430.60	3	1.1900E+02	3.1978E-06	-1.9688E-04	0.0432	288.1
80	1431.50	3	1.2800E+02	2.3008E-06	-1.7018E-04	0.0416	288.1
81	1432.00	3	1.3500E+02	1.8089E-06	-1.5299E-04	0.0405	288.1
82	1432.30	3	1.4000E+02	1.5347E-06	-1.4225E-04	0.0397	288.1
83	1432.50	3	1.4500E+02	1.3096E-06	-1.3260E-04	0.0390	288.1

84	1432.60	3	1.4700E+02	1.2310E-06	-1.2901E-04	0.0388	288.1
85	1432.70	4	1.4700E+02	8.5697E-05	-1.0259E-04	0.4166	288.1
86	1432.90	4	1.4700E+02	8.5697E-05	-1.0259E-04	0.4166	288.1
87	1433.20	4	1.4700E+02	8.5697E-05	-1.0259E-04	0.4166	288.1
88	1433.70	4	1.4600E+02	8.6527E-05	-1.0273E-04	0.4167	288.1
89	1434.40	4	1.4600E+02	8.6527E-05	-1.0273E-04	0.4167	288.1
90	1435.40	4	1.4500E+02	8.7368E-05	-1.0287E-04	0.4168	288.1
91	1436.90	4	1.4400E+02	8.8220E-05	-1.0301E-04	0.4169	288.1
92	1439.10	4	1.4300E+02	8.9084E-05	-1.0315E-04	0.4170	288.1
93	1443.10	4	1.4000E+02	9.1746E-05	-1.0356E-04	0.4173	288.1
94	1450.10	4	1.3600E+02	9.5470E-05	-1.0410E-04	0.4177	288.1
95	1463.10	4	1.2700E+02	1.0465E-04	-1.0529E-04	0.4186	288.1
96	1476.10	4	1.1700E+02	1.1637E-04	-1.0655E-04	0.4197	288.1
97	1483.10	4	1.1200E+02	1.2293E-04	-1.0714E-04	0.4202	288.1
98	1487.10	4	1.0900E+02	1.2712E-04	-1.0748E-04	0.4206	288.1
99	1489.30	4	1.0800E+02	1.2856E-04	-1.0759E-04	0.4207	288.1
100	1490.80	4	1.0600E+02	1.3151E-04	-1.0781E-04	0.4209	288.1
101	1491.80	4	1.0600E+02	1.3151E-04	-1.0781E-04	0.4209	288.1
102	1492.50	4	1.0500E+02	1.3302E-04	-1.0792E-04	0.4210	288.1
103	1493.00	4	1.0500E+02	1.3302E-04	-1.0792E-04	0.4210	288.1
104	1493.30	4	1.0500E+02	1.3302E-04	-1.0792E-04	0.4210	288.1
105	1493.50	4	1.0400E+02	1.3456E-04	-1.0802E-04	0.4211	288.1
106	1493.60	4	1.0400E+02	1.3456E-04	-1.0802E-04	0.4211	288.1
107	1493.70	5	1.0400E+02	3.1767E-05	-3.2441E-04	0.0425	288.1
108	1493.90	5	1.0400E+02	3.1767E-05	-3.2441E-04	0.0425	288.1
109	1494.20	5	1.0400E+02	3.1767E-05	-3.2441E-04	0.0425	288.1
110	1494.70	5	1.0400E+02	3.1767E-05	-3.2441E-04	0.0425	288.1
111	1495.40	5	1.0400E+02	3.1767E-05	-3.2441E-04	0.0425	288.1
112	1496.40	5	1.0400E+02	3.1767E-05	-3.2441E-04	0.0425	288.1
113	1497.90	5	1.0400E+02	3.1767E-05	-3.2441E-04	0.0425	288.1
114	1499.70	5	1.0400E+02	3.1767E-05	-3.2441E-04	0.0425	288.1
115	1503.70	5	1.0400E+02	3.1767E-05	-3.2441E-04	0.0425	288.1
116	1509.70	5	1.0400E+02	3.1767E-05	-3.2441E-04	0.0425	288.1
117	1519.70	5	1.0400E+02	3.1767E-05	-3.2441E-04	0.0425	288.1
118	1533.70	5	1.0400E+02	3.1767E-05	-3.2441E-04	0.0425	288.1
119	1553.70	5	1.0400E+02	3.1767E-05	-3.2441E-04	0.0425	288.1
120	1582.70	5	1.0400E+02	3.1767E-05	-3.2441E-04	0.0425	288.1
121	1625.70	5	1.0400E+02	3.1767E-05	-3.2441E-04	0.0425	288.1
122	1690.70	5	1.0400E+02	3.1767E-05	-3.2441E-04	0.0425	288.1
123	1733.70	5	8.5400E+01	9.8042E-05	-5.2617E-04	0.0502	288.1
124	1762.70	5	5.9800E+01	7.3209E-04	-1.2329E-03	0.0710	288.1
125	1782.70	5	4.0100E+01	6.3749E-03	-2.9702E-03	0.1092	288.1
126	1796.70	5	2.6100E+01	5.1182E-02	-6.2522E-03	0.1708	288.1
127	1806.70	5	1.6100E+01	3.0268E-01	-9.1739E-03	0.2495	288.1
128	1812.70	5	1.0100E+01	8.3868E-01	-7.8793E-03	0.3028	288.1
129	1816.70	5	6.1000E+00	1.4341E+00	-4.6094E-03	0.3283	288.1
130	1818.50	5	4.3000E+00	1.7214E+00	-2.8711E-03	0.3350	288.1
131	1820.00	5	2.8000E+00	1.9394E+00	-1.5389E-03	0.3383	288.1
132	1821.00	5	1.8000E+00	2.0614E+00	-7.9452E-04	0.3394	288.1
133	1821.70	5	1.1000E+00	2.1299E+00	-3.7748E-04	0.3398	288.1
134	1822.20	5	6.0000E-01	2.1672E+00	-1.5058E-04	0.3400	288.1
135	1822.50	5	3.0000E-01	2.1834E+00	-5.2590E-05	0.3400	288.1
136	1822.70	5	1.0000E-01	2.1904E+00	-9.9232E-06	0.3400	288.1
137	1822.80	5	0.0000E+00	2.1920E+00	-1.5572E-08	0.3400	288.1

Total Initial Storage = 154.6400 cm

NSURPE = 0: There will be no surface evaporation

IRAIN = 0
NWATER (number of days of rain/irrigation) =365

Rainfall/Irrigation Details

Day	Time (hr)	Amount (cm)	Application Type	Efficiency	Changes In Rate/Head
1	0.000	0.0008	1	1.000	2
	24.000	0.0000			
2	0.000	0.0008	1	1.000	2
	24.000	0.0000			
3	0.000	0.0008	1	1.000	2
	24.000	0.0000			
•					
•					
•					
362	0.000	0.0008	1	1.000	2
	24.000	0.0000			
363	0.000	0.0008	1	1.000	2
	24.000	0.0000			
364	0.000	0.0008	1	1.000	2
	24.000	0.0000			
365	0.000	0.0008	1	1.000	2
	24.000	0.0000			

Total Water Applied = 0.2737 cm

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-------------------------------------------------------------------------------
                              Program DATAINH
                                Version2.05
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 Input Filename: C:\Projects\4101L\CAS2007\Unsat07\CAS-28c.inp
 Date Processed: 06 Dec 2007
 Time Processed: 12:42:17.76

-------------------------------------------------------------------------------
 Title:
 CAS-28c.INP: Class A South cell Unsat flow, frost-protected side slope, 0.286 cm
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 Options chosen include:

 IPLANT =    0        LOWER  =    2       NGRAV  =    1       ISWDIF =    1
 IHEAT  =    0        UPPERH =    0       LOWERH =    0
 NPRINT =    0        DAYEND =  365       NDAYS  =  365       NYEARS =   50
 IRAIN  =    0        ICONVH =    0
 NSURPE =    0        NFHOUR =    2       ITOPBC =    0       ET_OPT =    0
 ICLOUD =    0
 KOPT   =    4        KEST   =    3       IVAPOR =    0       SH_OPT =    0
 INMAX  =    3        INHMAX =    2
 HIRRI  =   0.00      HDRY   = 1.000E+04  HTOP   =   0.00     DHMAX  =   0.00
 DMAXBA = 5.000E-04   DELMAX =  0.150     DELMIN = 1.500E-08  STOPHR =   24.0
 OUTTIM =  0.150
 TORT   =  0.660      TSOIL  =   288.     VAPDIF =  0.240     QHTOP  =   0.00
 TGRAD  =   0.00      TSMEAN =   288.     TSAMP  =   10.0     QHLEAK =   0.00
 WTF    =  0.500      RFACT  =   1.05     RAINIF = 1.000E-05  DHFACT =   0.00
 MATN   =    5        NPT    =  132

-------------------------------------------------------------------------------
 KOPT = 4:  van Genuchten functions for soil hydraulic properties

 THETA vs H, MAT   1,   Radon Barrier2 Moisture Characteristics
      AIRINT =   0.0000                             THET =  0.43200
        THTR =  0.10000                            ALPHA =  3.00000E-03
           N =   1.1720                                M =  0.14676
    K vs H, MAT    1,   Radon Barrier2 Hydraulic Conductivity
      AIRINK =   0.0000                               SK =  1.80000E-04
           A =  3.00000E-03                            N =   1.1720
           M =  0.14676                           KMODEL =   2.0000
        EPIT =   4.5000

 THETA vs H, MAT   2,   Radon Barrier2 Moisture Characteristics
      AIRINT =   0.0000                             THET =  0.43200
        THTR =  0.10000                            ALPHA =  3.00000E-03
           N =   1.1720                                M =  0.14676
    K vs H, MAT    2,   Radon Barrier2 Hydraulic Conductivity
      AIRINK =   0.0000                               SK =  3.60000E-03
           A =  3.00000E-03                            N =   1.1720
           M =  0.14676                           KMODEL =   2.0000
        EPIT =   4.5000

 THETA vs H, MAT   3,   Waste Moisture Characteristics
      AIRINT =   0.0000                             THET =  0.35000
        THTR =  2.00000E-02                        ALPHA =  0.11500
           N =   2.0130                                M =  0.50323
    K vs H, MAT    3,   Waste Hydraulic Conductivity
      AIRINK =   0.0000                               SK =   1.8000
           A =  0.11500                                N =   2.0130
           M =  0.50323                           KMODEL =   2.0000
        EPIT =  0.50000

 THETA vs H, MAT   4,   Clay Liner Moisture Characteristics
      AIRINT =   0.0000                             THET =  0.43200
        THTR =  0.10000                            ALPHA =  3.00000E-03
           N =   1.1720                                M =  0.14676
    K vs H, MAT    4,   Clay Liner Hydraulic Conductivity
      AIRINK =   0.0000                               SK =  3.60000E 03
           A =  3.00000E-03                            N =   1.1720
           M =  0.14676                           KMODEL =   2.0000
        EPIT =   4.5000

 THETA vs H, MAT   5,   Unit 3 Silty Sand Moisture Characteristics
      AIRINT =   0.0000                             THET =  0.34000
        THTR =  2.00000E-02                        ALPHA =  5.50000E-02
           N =   2.5180                                M =  0.60286
    K vs H, MAT    5,   Unit 3 Silty Sand Hydraulic Conductivity
      AIRINK =   0.0000                               SK =   2.1920
           A =  5.50000E-02                            N =   2.5180
           M =  0.60286                           KMODEL =   2.0000
        EPIT =  0.50000

 Surface node hydraulic properties
```

HIRRI =   0.0   , THETA = 0.4320, K =   1.8000E-04, C = -1.9786E-08
HDRY =   1.00E+04, THETA = 0.2845, K =   9.2973E-11, C = -3.1149E-06
NDAY =   0

NODE	Z	MAT	HEAD	CONDUCTIVITY	CAPACITY	THETA	TEMP
1	0.00	1	4.0000E+01	1.6801E-05	-1.0853E-04	0.4281	288.1
2	0.10	1	4.0100E+01	1.6769E-05	-1.0855E-04	0.4281	288.1
3	0.30	1	4.0200E+01	1.6738E-05	-1.0857E-04	0.4281	288.1
4	0.60	1	4.0500E+01	1.6644E-05	-1.0862E-04	0.4281	288.1
5	1.10	1	4.1000E+01	1.6489E-05	-1.0871E-04	0.4280	288.1
6	2.00	1	4.1900E+01	1.6217E-05	-1.0886E-04	0.4279	288.1
7	3.30	1	4.3200E+01	1.5836E-05	-1.0907E-04	0.4278	288.1
8	5.60	1	4.5800E+01	1.5119E-05	-1.0942E-04	0.4275	288.1
9	6.90	1	4.7300E+01	1.4730E-05	-1.0960E-04	0.4273	288.1
10	7.80	1	4.8400E+01	1.4454E-05	-1.0972E-04	0.4272	288.1
11	8.30	1	4.9000E+01	1.4307E-05	-1.0978E-04	0.4271	288.1
12	8.60	1	4.9400E+01	1.4211E-05	-1.0982E-04	0.4271	288.1
13	8.80	1	4.9700E+01	1.4139E-05	-1.0985E-04	0.4271	288.1
14	8.90	1	4.9800E+01	1.4116E-05	-1.0986E-04	0.4271	288.1
15	9.00	1	4.9900E+01	1.4092E-05	-1.0986E-04	0.4270	288.1
16	9.20	1	5.0200E+01	1.4021E-05	-1.0989E-04	0.4270	288.1
17	9.50	1	5.0600E+01	1.3928E-05	-1.0993E-04	0.4270	288.1
18	10.00	1	5.1300E+01	1.3767E-05	-1.0998E-04	0.4269	288.1
19	10.90	1	5.2500E+01	1.3498E-05	-1.1007E-04	0.4268	288.1
20	13.10	1	5.5800E+01	1.2800E-05	-1.1027E-04	0.4264	288.1
21	16.40	1	6.1200E+01	1.1774E-05	-1.1045E-04	0.4258	288.1
22	21.50	1	7.1200E+01	1.0183E-05	-1.1039E-04	0.4247	288.1
23	24.80	1	7.9000E+01	9.1574E-06	-1.1008E-04	0.4238	288.1
24	27.00	1	8.5000E+01	8.4697E-06	-1.0971E-04	0.4232	288.1
25	28.50	1	8.9400E+01	8.0126E-06	-1.0938E-04	0.4227	288.1
26	29.40	1	9.2200E+01	7.7402E-06	-1.0915E-04	0.4224	288.1
27	29.90	1	9.3800E+01	7.5906E-06	-1.0902E-04	0.4222	288.1
28	30.20	1	9.4800E+01	7.4992E-06	-1.0893E-04	0.4221	288.1
29	30.40	1	9.5500E+01	7.4362E-06	-1.0886E-04	0.4220	288.1
30	30.50	1	9.5800E+01	7.4094E-06	-1.0884E-04	0.4220	288.1
31	30.60	2	9.5800E+01	1.4819E-04	-1.0884E-04	0.4220	288.1
32	30.80	2	9.5600E+01	1.4854E-04	-1.0885E-04	0.4220	288.1
33	31.10	2	9.5400E+01	1.4890E-04	-1.0887E-04	0.4220	288.1
34	31.60	2	9.5000E+01	1.4962E-04	-1.0891E-04	0.4221	288.1
35	32.30	2	9.4500E+01	1.5053E-04	-1.0895E-04	0.4221	288.1
36	33.30	2	9.3700E+01	1.5200E-04	-1.0902E-04	0.4222	288.1
37	34.80	2	9.2500E+01	1.5424E-04	-1.0913E-04	0.4224	288.1
38	37.00	2	9.0800E+01	1.5749E-04	-1.0927E-04	0.4225	288.1
39	39.70	2	8.8600E+01	1.6186E-04	-1.0945E-04	0.4228	288.1
40	42.70	2	8.6200E+01	1.6683E-04	-1.0963E-04	0.4230	288.1
41	45.70	2	8.3800E+01	1.7202E-04	-1.0979E-04	0.4233	288.1
42	48.70	2	8.1300E+01	1.7769E-04	-1.0995E-04	0.4236	288.1
43	51.70	2	7.8900E+01	1.8339E-04	-1.1008E-04	0.4238	288.1
44	54.50	2	7.6600E+01	1.8912E-04	-1.1020E-04	0.4241	288.1
45	56.70	2	7.4700E+01	1.9405E-04	-1.1028E-04	0.4243	288.1
46	58.20	2	7.3500E+01	1.9727E-04	-1.1032E-04	0.4244	288.1
47	59.20	2	7.2700E+01	1.9945E-04	-1.1035E-04	0.4245	288.1
48	59.90	2	7.2100E+01	2.0112E-04	-1.1037E-04	0.4246	288.1
49	60.40	2	7.1700E+01	2.0224E-04	-1.1038E-04	0.4246	288.1
50	60.70	2	7.1400E+01	2.0309E-04	-1.1039E-04	0.4247	288.1
51	60.90	2	7.1200E+01	2.0366E-04	-1.1039E-04	0.4247	288.1
52	61.00	2	7.1100E+01	2.0394E-04	-1.1039E-04	0.4247	288.1
53	61.10	3	7.1100E+01	3.2477E-05	-5.4751E-04	0.0590	288.1
54	61.30	3	7.1100E+01	3.2477E-05	-5.4751E-04	0.0590	288.1
55	61.60	3	7.1100E+01	3.2477E-05	-5.4751E-04	0.0590	288.1
56	62.10	3	7.1100E+01	3.2477E-05	-5.4751E-04	0.0590	288.1
57	63.00	3	7.1100E+01	3.2477E-05	-5.4751E-04	0.0590	288.1
58	64.50	3	7.1100E+01	3.2477E-05	-5.4751E-04	0.0590	288.1
59	67.50	3	7.1100E+01	3.2477E-05	-5.4751E-04	0.0590	288.1
60	72.50	3	7.1100E+01	3.2477E-05	-5.4751E-04	0.0590	288.1
61	82.50	3	7.1100E+01	3.2477E-05	-5.4751E-04	0.0590	288.1
62	102.50	3	7.1100E+01	3.2477E-05	-5.4751E-04	0.0590	288.1
63	132.50	3	7.1100E+01	3.2477E-05	-5.4751E-04	0.0590	288.1
64	182.50	3	7.1100E+01	3.2477E-05	-5.4751E-04	0.0590	288.1
65	272.50	3	7.1100E+01	3.2477E-05	-5.4751E-04	0.0590	288.1
66	413.40	3	7.1100E+01	3.2477E-05	-5.4751E-04	0.0590	288.1
67	503.40	3	7.1100E+01	3.2477E-05	-5.4751E-04	0.0590	288.1
68	553.40	3	7.1100E+01	3.2477E-05	-5.4751E-04	0.0590	288.1
69	583.40	3	7.2300E+01	3.0129E-05	-5.2975E-04	0.0583	288.1
70	603.40	3	7.7300E+01	2.2320E-05	-4.6425E-04	0.0559	288.1
71	613.40	3	8.5700E+01	1.4040E-05	-3.7849E-04	0.0523	288.1
72	618.40	3	9.5500E+01	8.6243E-06	-3.0526E-04	0.0490	288.1
73	621.40	3	1.0700E+02	5.1660E-06	-2.4340E-04	0.0459	288.1
74	622.90	3	1.1700E+02	3.4521E-06	-2.0366E-04	0.0436	288.1
75	623.80	3	1.2700E+02	2.3837E-06	-1.7287E-04	0.0418	288.1
76	624.30	3	1.3400E+02	1.8707E-06	-1.5528E-04	0.0406	288.1
77	624.60	3	1.3900E+02	1.5853E-06	-1.4431E-04	0.0399	288.1
78	624.80	3	1.4300E+02	1.3945E-06	-1.3634E-04	0.0393	288.1
79	624.90	3	1.4600E+02	1.2696E-06	-1.3079E-04	0.0389	288.1
80	625.00	4	1.4600E+02	8.6527E-05	-1.0273E-04	0.4167	288.1
81	625.20	4	1.4600E+02	8.6527E-05	-1.0273E-04	0.4167	288.1

82	625.50	4	1.4600E+02	8.6527E-05	-1.0273E-04	0.4167	288.1
83	626.00	4	1.4500E+02	8.7368E-05	-1.0287E-04	0.4168	288.1
84	626.70	4	1.4500E+02	8.7368E-05	-1.0287E-04	0.4168	288.1
85	627.70	4	1.4400E+02	8.8220E-05	-1.0301E-04	0.4169	288.1
86	629.20	4	1.4300E+02	8.9084E-05	-1.0315E-04	0.4170	288.1
87	631.40	4	1.4200E+02	8.9959E-05	-1.0329E-04	0.4171	288.1
88	635.40	4	1.3900E+02	9.2658E-05	-1.0370E-04	0.4174	288.1
89	642.40	4	1.3500E+02	9.6434E-05	-1.0424E-04	0.4178	288.1
90	655.40	4	1.2600E+02	1.0575E-04	-1.0542E-04	0.4188	288.1
91	668.40	4	1.1700E+02	1.1637E-04	-1.0655E-04	0.4197	288.1
92	675.40	4	1.1200E+02	1.2293E-04	-1.0714E-04	0.4202	288.1
93	679.40	4	1.0900E+02	1.2712E-04	-1.0748E-04	0.4206	288.1
94	681.60	4	1.0700E+02	1.3002E-04	-1.0770E-04	0.4208	288.1
95	683.10	4	1.0600E+02	1.3151E-04	-1.0781E-04	0.4209	288.1
96	684.10	4	1.0500E+02	1.3302E-04	-1.0792E-04	0.4210	288.1
97	684.80	4	1.0400E+02	1.3456E-04	-1.0802E-04	0.4211	288.1
98	685.30	4	1.0400E+02	1.3456E-04	-1.0802E-04	0.4211	288.1
99	685.60	4	1.0400E+02	1.3456E-04	-1.0802E-04	0.4211	288.1
100	685.80	4	1.0400E+02	1.3456E-04	-1.0802E-04	0.4211	288.1
101	685.90	4	1.0400E+02	1.3456E-04	-1.0802E-04	0.4211	288.1
102	686.00	5	1.0400E+02	3.1767E-05	-3.2441E-04	0.0425	288.1
103	686.20	5	1.0400E+02	3.1767E-05	-3.2441E-04	0.0425	288.1
104	686.50	5	1.0400E+02	3.1767E-05	-3.2441E-04	0.0425	288.1
105	687.00	5	1.0400E+02	3.1767E-05	-3.2441E-04	0.0425	288.1
106	687.70	5	1.0400E+02	3.1767E-05	-3.2441E-04	0.0425	288.1
107	688.70	5	1.0400E+02	3.1767E-05	-3.2441E-04	0.0425	288.1
108	690.20	5	1.0400E+02	3.1767E-05	-3.2441E-04	0.0425	288.1
109	692.00	5	1.0400E+02	3.1767E-05	-3.2441E-04	0.0425	288.1
110	696.00	5	1.0400E+02	3.1767E-05	-3.2441E-04	0.0425	288.1
111	702.00	5	1.0400E+02	3.1767E-05	-3.2441E-04	0.0425	288.1
112	712.00	5	1.0400E+02	3.1767E-05	-3.2441E-04	0.0425	288.1
113	726.00	5	1.0400E+02	3.1767E-05	-3.2441E-04	0.0425	288.1
114	746.00	5	1.0400E+02	3.1767E-05	-3.2441E-04	0.0425	288.1
115	775.00	5	1.0400E+02	3.1767E-05	-3.2441E-04	0.0425	288.1
116	818.00	5	1.0400E+02	3.1767E-05	-3.2441E-04	0.0425	288.1
117	883.00	5	1.0400E+02	3.1767E-05	-3.2441E-04	0.0425	288.1
118	926.00	5	8.5300E+01	9.8698E-05	-5.2767E-04	0.0503	288.1
119	955.00	5	5.9800E+01	7.3209E-04	-1.2329E-03	0.0710	288.1
120	975.00	5	4.0100E+01	6.3749E-03	-2.9702E-03	0.1092	288.1
121	989.00	5	2.6100E+01	5.1182E-02	-6.2522E-03	0.1708	288.1
122	999.00	5	1.6100E+01	3.0268E-01	-9.1739E-03	0.2495	288.1
123	1005.00	5	1.0100E+01	8.3868E-01	-7.8793E-03	0.3028	288.1
124	1009.00	5	6.1000E+00	1.4341E+00	-4.6094E-03	0.3283	288.1
125	1010.80	5	4.3000E+00	1.7214E+00	-2.8711E-03	0.3350	288.1
126	1012.30	5	2.8000E+00	1.9394E+00	-1.5389E-03	0.3383	288.1
127	1013.30	5	1.8000E+00	2.0614E+00	-7.9452E-04	0.3394	288.1
128	1014.00	5	1.1000E+00	2.1299E+00	-3.7748E-04	0.3398	288.1
129	1014.50	5	6.0000E-01	2.1672E+00	-1.5058E-04	0.3400	288.1
130	1014.80	5	3.0000E-01	2.1834E+00	-5.2590E-05	0.3400	288.1
131	1015.00	5	1.0000E-01	2.1904E+00	-9.9232E-06	0.3400	288.1
132	1015.10	5	0.0000E+00	2.1920E+00	-1.5572E-08	0.3400	288.1

Total Initial Storage = 107.4569 cm

NSURPE = 0: There will be no surface evaporation
IRAIN = 0
NWATER (number of days of rain/irrigation) =365

Rainfall/Irrigation Details

Day	Time (hr)	Amount (cm)	Application Type	Efficiency	Changes In Rate/Head
1	0.000	0.0008	1	1.000	2
	24.000	0.0000			
2	0.000	0.0008	1	1.000	2
	24.000	0.0000			
3	0.000	0.0008	1	1.000	2
	24.000	0.0000			
•					
•					
•					
361	0.000	0.0008	1	1.000	2
	24.000	0.0000			
362	0.000	0.0008	1	1.000	2
	24.000	0.0000			
363	0.000	0.0008	1	1.000	2
	24.000	0.0000			
364	0.000	0.0008	1	1.000	2
	24.000	0.0000			
365	0.000	0.0008	1	1.000	2
	24.000	0.0000			

Total Water Applied - 0.2847 cm

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                              Program DATAINH
                               Version2.05
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Input Filename: C:\Projects\4101L\CAS2007\Unsat07\CAS-59c.inp
Date Processed: 06 Dec 2007
Time Processed: 12:44:53.68

--- ------------------------------- --------- ---------------------------------
Title:
CAS-59c.INP: Class A South cell Unsat flow, frost-prot. side slope, 12"filter, 0
--- --------- --------- --------- ------------------ --------------------------
Options chosen include:
IPLANT =    0        LOWER  =   2        NGRAV  =    1        ISWDIF =    1
IHEAT  =    0        UPPERH =   0        LOWERH =    0
NPRINT =    0        DAYEND = 365        NDAYS  = 365        NYEARS =   50
IRAIN  =    0        ICONVH =   0
NSURPE =    0        NFHOUR =   2        ITOPBC =    0        ET_OPT =    0
ICLOUD =    0
KOPT   =    4        KEST   =   3        IVAPOR =    0        SH_OPT =    0
INMAX  =    3        INHMAX =   2
HIRRI  =   0.00      HDRY   =  1.000E+04 HTOP   =   0.00     DHMAX  =   0.00
DMAXBA = 5.000E-04 DELMAX =  0.150      DELMIN =  1.500E-08 STOPHR =   24.0
OUTTIM = 0.150
TORT   = 0.660       TSOIL  =   288.     VAPDIF =  0.240     QHTOP  =   0.00
TGRAD  =   0.00      TSMEAN =   288.     TSAMP  =   10.0     QHLEAK =   0.00
WTF    = 0.500       RFACT  =   1.05     RAINIF =  1.000E-05 DHFACT =   0.00
MATN   =    5        NPT    = 132

-------------------------------------------------------------------------------
KOPT = 4:  van Genuchten functions for soil hydraulic properties

THETA vs H, MAT   1,   Radon Barrier2 Moisture Characteristics
     AIRINT =   0.0000                            THET =  0.43200
       THTR =  0.10000                           ALPHA =  3.00000E-03
          N =   1.1720                               M =  0.14676
    K vs H, MAT   1,   Radon Barrier2 Hydraulic Conductivity
     AIRINK =   0.0000                              SK =  1.80000E-04
          A =  3.00000E-03                           N =   1.1720
          M =  0.14676                          KMODEL =   2.0000
       EPIT =   4.5000

THETA vs H, MAT   2,   Radon Barrier2 Moisture Characteristics
     AIRINT =   0.0000                            THET =  0.43200
       THTR =  0.10000                           ALPHA =  3.00000E-03
          N =   1.1720                               M =  0.14676
    K vs H, MAT   2,   Radon Barrier2 Hydraulic Conductivity
     AIRINK =   0.0000                              SK =  3.60000E-03
          A =  3.00000E-03                           N =   1.1720
          M =  0.14676                          KMODEL =   2.0000
       EPIT =   4.5000

THETA vs H, MAT   3,   Waste Moisture Characteristics
     AIRINT =   0.0000                            THET =  0.35000
       THTR =  2.00000E-02                       ALPHA =  0.11500
          N =   2.0130                               M =  0.50323
    K vs H, MAT   3,   Waste Hydraulic Conductivity
     AIRINK =   0.0000                              SK =   1.8000
          A =  0.11500                               N =   2.0130
          M =  0.50323                          KMODEL =   2.0000
       EPIT =  0.50000

THETA vs H, MAT   4,   Clay Liner Moisture Characteristics
     AIRINT =   0.0000                            THET =  0.43200
       THTR =  0.10000                           ALPHA =  3.00000E-03
          N =   1.1720                               M =  0.14676
    K vs H, MAT   4,   Clay Liner Hydraulic Conductivity
     AIRINK =   0.0000                              SK =  3.60000E-03
          A =  3.00000E-03                           N =   1.1720
          M =  0.14676                          KMODEL =   2.0000
       EPIT =   4.5000

THETA vs H, MAT   5,   Unit 3 Silty Sand Moisture Characteristics
     AIRINT =   0.0000                            THET =  0.34000
       THTR =  2.00000E-02                       ALPHA =  5.50000E-02
          N =   2.5180                               M =  0.60286
    K vs H, MAT   5,   Unit 3 Silty Sand Hydraulic Conductivity
     AIRINK =   0.0000                              SK =   2.1920
          A =  5.50000E-02                           N =   2.5180
          M =  0.60286                          KMODEL =   2.0000
       EPIT =  0.50000

Surface node hydraulic properties

HIRRI  =      0.0    , THETA = 0.4320, K =   1.8000E-04, C =  -1.9786E-08
HDRY   =     1.00E+04, THETA = 0.2845, K =   9.2973E-11, C =  -3.1149E-06
```

NDAY - 0

NODE	Z	MAT	HEAD	CONDUCTIVITY	CAPACITY	THETA	TEMP
1	0.00	1	7.0600E+00	4.2128E-05	-8.7185E-05	0.4315	288.1
2	0.10	1	7.1200E+00	4.1997E-05	-8.7301E-05	0.4315	288.1
3	0.30	1	7.2400E+00	4.1737E-05	-8.7531E-05	0.4315	288.1
4	0.60	1	7.4300E+00	4.1335E-05	-8.7887E-05	0.4314	288.1
5	1.10	1	7.7600E+00	4.0660E-05	-8.8486E-05	0.4314	288.1
6	2.00	1	8.3900E+00	3.9450E-05	-8.9563E-05	0.4314	288.1
7	3.30	1	9.3800E+00	3.7725E-05	-9.1106E-05	0.4313	288.1
8	5.60	1	1.1400E+01	3.4726E-05	-9.3799E-05	0.4311	288.1
9	6.90	1	1.2700E+01	3.3079E-05	-9.5281E-05	0.4310	288.1
10	7.80	1	1.3700E+01	3.1929E-05	-9.6313E-05	0.4309	288.1
11	8.30	1	1.4200E+01	3.1388E-05	-9.6798E-05	0.4308	288.1
12	8.60	1	1.4600E+01	3.0970E-05	-9.7173E-05	0.4308	288.1
13	8.80	1	1.4800E+01	3.0765E-05	-9.7356E-05	0.4308	288.1
14	8.90	1	1.5000E+01	3.0563E-05	-9.7536E-05	0.4307	288.1
15	9.00	1	1.5100E+01	3.0464E-05	-9.7625E-05	0.4307	288.1
16	9.20	1	1.5300E+01	3.0266E-05	-9.7801E-05	0.4307	288.1
17	9.50	1	1.5700E+01	2.9880E-05	-9.8145E-05	0.4307	288.1
18	10.00	1	1.6400E+01	2.9229E-05	-9.8723E-05	0.4306	288.1
19	10.90	1	1.7600E+01	2.8182E-05	-9.9649E-05	0.4305	288.1
20	13.10	1	2.0900E+01	2.5668E-05	-1.0183E-04	0.4301	288.1
21	16.40	1	2.7100E+01	2.1982E-05	-1.0488E-04	0.4295	288.1
22	21.50	1	4.0000E+01	1.6801E-05	-1.0853E-04	0.4281	288.1
23	24.80	1	5.1500E+01	1.3722E-05	-1.1000E-04	0.4269	288.1
24	27.00	1	6.1000E+01	1.1810E-05	-1.1044E-04	0.4258	288.1
25	28.50	1	6.8600E+01	1.0564E-05	-1.1045E-04	0.4250	288.1
26	29.40	1	7.3700E+01	9.8362E-06	-1.1031E-04	0.4244	288.1
27	29.90	1	7.6700E+01	9.4431E-06	-1.1019E-04	0.4241	288.1
28	30.20	1	7.8600E+01	9.2061E-06	-1.1010E-04	0.4239	288.1
29	30.40	1	7.9900E+01	9.0490E-06	-1.1003E-04	0.4237	288.1
30	30.50	1	8.0600E+01	8.9661E-06	-1.0999E-04	0.4237	288.1
31	30.60	2	8.0600E+01	1.7932E-04	-1.0999E-04	0.4237	288.1
32	30.80	2	8.0500E+01	1.7956E-04	-1.1000E-04	0.4237	288.1
33	31.10	2	8.0300E+01	1.8003E-04	-1.1001E-04	0.4237	288.1
34	31.60	2	8.0090E+01	1.8074E-04	-1.1002E-04	0.4237	288.1
35	32.30	2	7.9600E+01	1.8170E-04	-1.1005E-04	0.4238	288.1
36	33.30	2	7.9000E+01	1.8315E-04	-1.1008E-04	0.4238	288.1
37	34.80	2	7.8000E+01	1.8560E-04	-1.1013E-04	0.4239	288.1
38	37.00	2	7.6600E+01	1.8912E-04	-1.1020E-04	0.4241	288.1
39	39.70	2	7.4900E+01	1.9352E-04	-1.1027E-04	0.4243	288.1
40	42.70	2	7.2900E+01	1.9890E-04	-1.1034E-04	0.4245	288.1
41	45.70	2	7.0900E+01	2.0452E-04	-1.1040E-04	0.4247	288.1
42	48.70	2	6.8900E+01	2.1037E-04	-1.1044E-04	0.4249	288.1
43	51.70	2	6.6900E+01	2.1648E-04	-1.1047E-04	0.4252	288.1
44	54.50	2	6.4900E+01	2.2287E-04	-1.1049E-04	0.4254	288.1
45	56.70	2	6.3400E+01	2.2786E-04	-1.1047E-04	0.4256	288.1
46	58.20	2	6.2300E+01	2.3162E-04	-1.1046E-04	0.4257	288.1
47	59.20	2	6.1600E+01	2.3407E-04	-1.1045E-04	0.4258	288.1
48	59.90	2	6.1100E+01	2.3584E-04	-1.1045E-04	0.4258	288.1
49	60.40	2	6.0800E+01	2.3692E-04	-1.1044E-04	0.4258	288.1
50	60.70	2	6.0500E+01	2.3800E-04	-1.1043E-04	0.4259	288.1
51	60.90	2	6.0400E+01	2.3836E-04	-1.1043E-04	0.4259	288.1
52	61.00	2	6.0300E+01	2.3872E-04	-1.1043E-04	0.4259	288.1
53	61.10	3	6.0300E+01	6.7857E-05	-7.5640E-04	0.0659	288.1
54	61.30	3	6.0300E+01	6.7857E-05	-7.5640E-04	0.0659	288.1
55	61.60	3	6.0300E+01	6.7857E-05	-7.5640E-04	0.0659	288.1
56	62.10	3	6.0300E+01	6.7857E-05	-7.5640E-04	0.0659	288.1
57	63.00	3	6.0300E+01	6.7857E-05	-7.5640E-04	0.0659	288.1
58	64.50	3	6.0300E+01	6.7857E-05	-7.5640E-04	0.0659	288.1
59	67.50	3	6.0300E+01	6.7857E-05	-7.5640E-04	0.0659	288.1
60	72.50	3	6.0300E+01	6.7857E-05	-7.5640E-04	0.0659	288.1
61	82.50	3	6.0300E+01	6.7857E-05	-7.5640E-04	0.0659	288.1
62	102.50	3	6.0300E+01	6.7857E-05	-7.5640E-04	0.0659	288.1
63	132.50	3	6.0300E+01	6.7857E-05	-7.5640E-04	0.0659	288.1
64	182.50	3	6.0300E+01	6.7857E-05	-7.5640E-04	0.0659	288.1
65	272.50	3	6.0300E+01	6.7857E-05	-7.5640E-04	0.0659	288.1
66	413.40	3	6.0300E+01	6.7857E-05	-7.5640E-04	0.0659	288.1
67	503.40	3	6.0300E+01	6.7857E-05	-7.5640E-04	0.0659	288.1
68	553.40	3	6.0300E+01	6.7857E-05	-7.5640E-04	0.0659	288.1
69	583.40	3	6.0800E+01	6.5401E-05	-7.4430E-04	0.0656	288.1
70	603.40	3	6.4200E+01	5.1289E-05	-6.6912E-04	0.0632	288.1
71	613.40	3	7.0500E+01	3.3734E-05	-5.5672E-04	0.0593	288.1
72	618.40	3	7.8200E+01	2.1190E-05	-4.5375E-04	0.0554	288.1
73	621.40	3	8.7700E+01	1.2656E-05	-3.6156E-04	0.0516	288.1
74	622.90	3	9.6000E+01	8.4238E-06	-3.0210E-04	0.0489	288.1
75	623.80	3	1.0400E+02	5.8728E-06	-2.5760E-04	0.0466	288.1
76	624.30	3	1.1000E+02	4.5602E-06	-2.3034E-04	0.0452	288.1
77	624.60	3	1.1400E+02	3.8814E-06	-2.1450E-04	0.0443	288.1
78	624.80	3	1.1800E+02	3.3220E-06	-2.0023E-04	0.0434	288.1
79	624.90	3	1.2000E+02	3.0792E-06	-1.9362E-04	0.0431	288.1
80	625.00	4	1.2000E+02	1.1267E-04	-1.0618E-04	0.4194	288.1
81	625.20	4	1.2000E+02	1.1267E-04	-1.0618E-04	0.4194	288.1
82	625.50	4	1.2000E+02	1.1267E-04	-1.0618E-04	0.4194	288.1
83	626.00	4	1.2000E+02	1.1267E-04	-1.0618E-04	0.4194	288.1

84	626.70	4	1.2000E+02	1.1267E-04	-1.0618E-04	0.4194	288.1
85	627.70	4	1.1900E+02	1.1388E-04	-1.0630E-04	0.4195	288.1
86	629.20	4	1.1900E+02	1.1388E-04	-1.0630E-04	0.4195	288.1
87	631.40	4	1.1800E+02	1.1512E-04	-1.0643E-04	0.4196	288.1
88	635.40	4	1.1600E+02	1.1764E 04	-1.0667E 04	0.4198	288.1
89	642.40	4	1.1300E+02	1.2157E-04	-1.0702E-04	0.4201	288.1
90	655.40	4	1.0700E+02	1.3002E-04	-1.0770E-04	0.4208	288.1
91	668.40	4	1.0100E+02	1.3933E 04	-1.0833E 04	0.4214	288.1
92	675.40	4	9.6900E+01	1.4625E-04	-1.0873E-04	0.4219	288.1
93	679.40	4	9.4700E+01	1.5017E-04	-1.0894E-04	0.4221	288.1
94	681.60	4	9.3500E+01	1.5237E-04	-1.0904E-04	0.4222	288.1
95	683.10	4	9.2700E+01	1.5386E-04	-1.0911E-04	0.4223	288.1
96	684.10	4	9.2100E+01	1.5499E-04	-1.0916E-04	0.4224	288.1
97	684.80	4	9.1700E+01	1.5576E-04	-1.0920E-04	0.4224	288.1
98	685.30	4	9.1400E+01	1.5633E-04	-1.0922E-04	0.4225	288.1
99	685.60	4	9.1300E+01	1.5653E-04	-1.0923E-04	0.4225	288.1
100	685.80	4	9.1200E+01	1.5672E-04	-1.0924E-04	0.4225	288.1
101	685.90	4	9.1100E+01	1.5691E-04	-1.0925E-04	0.4225	288.1
102	686.00	5	9.1100E+01	6.7808E-05	-4.4932E-04	0.0474	288.1
103	686.20	5	9.1100E+01	6.7808E-05	-4.4932E-04	0.0474	288.1
104	686.50	5	9.1100E+01	6.7808E-05	-4.4932E-04	0.0474	288.1
105	687.00	5	9.1100E+01	6.7808E-05	-4.4932E-04	0.0474	288.1
106	687.70	5	9.1100E+01	6.7808E-05	-4.4932E-04	0.0474	288.1
107	688.70	5	9.1100E+01	6.7808E-05	-4.4932E-04	0.0474	288.1
108	690.20	5	9.1100E+01	6.7808E-05	-4.4932E-04	0.0474	288.1
109	692.00	5	9.1100E+01	6.7808E-05	-4.4932E-04	0.0474	288.1
110	696.00	5	9.1100E+01	6.7808E-05	-4.4932E-04	0.0474	288.1
111	702.00	5	9.1100E+01	6.7808E-05	-4.4932E-04	0.0474	288.1
112	712.00	5	9.1100E+01	6.7808E-05	-4.4932E-04	0.0474	288.1
113	726.00	5	9.1100E+01	6.7808E-05	-4.4932E-04	0.0474	288.1
114	746.00	5	9.1100E+01	6.7808E 05	-4.4932E 04	0.0474	288.1
115	775.00	5	9.1100E+01	6.7808E-05	-4.4932E-04	0.0474	288.1
116	818.00	5	9.0700E+01	6.9534E 05	-4.5419E-04	0.0476	288.1
117	883.00	5	9.2100E+01	6.3707E-05	-4.3746E-04	0.0470	288.1
118	926.00	5	8.2000E+01	1.2356E 04	-5.8084E-04	0.0521	288.1
119	955.00	5	5.9400E+01	7.5995E-04	-1.2523E-03	0.0715	288.1
120	975.00	5	4.0000E+01	6.4584E-03	-2.9853E-03	0.1095	288.1
121	989.00	5	2.6100E+01	5.1182E-02	-6.2522E-03	0.1708	288.1
122	999.00	5	1.6100E+01	3.0268E-01	-9.1739E-03	0.2495	288.1
123	1005.00	5	1.0100E+01	8.3868E-01	-7.8793E-03	0.3028	288.1
124	1009.00	5	6.1000E+00	1.4341E+00	-4.6094E-03	0.3283	288.1
125	1010.80	5	4.3000E+00	1.7214E+00	-2.8711E-03	0.3350	288.1
126	1012.30	5	2.8000E+00	1.9394E+00	-1.5389E-03	0.3383	288.1
127	1013.30	5	1.8000E+00	2.0614E+00	-7.9452E-04	0.3394	288.1
128	1014.00	5	1.1000E+00	2.1299E+00	-3.7748E-04	0.3398	288.1
129	1014.50	5	6.0000E-01	2.1672E+00	-1.5058E-04	0.3400	288.1
130	1014.80	5	3.0000E-01	2.1834E+00	-5.2590E-05	0.3400	288.1
131	1015.00	5	1.0000E-01	2.1904E+00	-9.9232E-06	0.3400	288.1
132	1015.10	5	0.0000E+00	2.1920E+00	-1.5572E-08	0.3400	288.1

Total Initial Storage - 112.7934 cm

NSURPE = 0: There will be no surface evaporation

IRAIN = 0
NWATER (number of days of rain/irrigation) =365

Rainfall/Irrigation Details

Day	Time (hr)	Amount (cm)	Application Type	Efficiency	Changes In Rate/Head
1	0.000	0.0016	1	1.000	2
	24.000	0.0000			
2	0.000	0.0016	1	1.000	2
	24.000	0.0000			
3	0.000	0.0016	1	1.000	2
	24.000	0.0000			
•					
•					
•					
362	0.000	0.0016	1	1.000	2
	24.000	0.0000			
363	0.000	0.0016	1	1.000	2
	24.000	0.0000			
364	0.000	0.0016	1	1.000	2
	24.000	0.0000			
365	0.000	0.0016	1	1.000	2
	24.000	0.0000			

Total Water Applied = 0.5950 cm

UNSAT-H OUTPUT FILES

CAS-T27e.out	Class A South Cell Top Slope, 0.276 cm/yr
CAS-S28c.out	Class A South Cell Side Slope, 0.286 cm/yr
CAS-S59c.out	Class A South Cell Side Slope, 0.595 cm/yr

UNSAT-H Version 2.05
INITIAL CONDITIONS

Input Filename: C:\Projects\4101L\CAS2007\Unsat07\CAS-T27e.inp
Results Filename: C:\Projects\4101L\CAS2007\Unsat07\CAS-T27e.res
Date of Run: 06 Dec 2007
Time of Run: 12:10:48.95
Title:
CAS-T27e.INP: Class A South cell Unsat flow, frost-prot. top slope, 0.276 cm/yr

		Initial Conditions					Initial Conditions		
NODE	DEPTH (cm)	HEAD (cm)	THETA (vol.)	TEMP (K)	NODE	DEPTH (cm)	HEAD (cm)	THETA (vol.)	TEMP (K)
1	0.000E+00	4.201E+01	0.4279	0.00	2	1.000E-01	4.210E+01	0.4279	0.00
3	3.000E-01	4.229E+01	0.4279	0.00	4	6.000E-01	4.257E+01	0.4278	0.00
5	1.100E+00	4.305E+01	0.4278	0.00	6	2.000E+00	4.394E+01	0.4277	0.00
7	3.300E+00	4.527E+01	0.4275	0.00	8	5.600E+00	4.778E+01	0.4273	0.00
9	6.900E+00	4.930E+01	0.4271	0.00	10	7.800E+00	5.039E+01	0.4270	0.00
11	8.300E+00	5.102E+01	0.4269	0.00	12	8.600E+00	5.140E+01	0.4269	0.00
13	8.800E+00	5.165E+01	0.4268	0.00	14	8.900E+00	5.178E+01	0.4268	0.00
15	9.000E+00	5.191E+01	0.4268	0.00	16	9.200E+00	5.217E+01	0.4268	0.00
17	9.500E+00	5.256E+01	0.4267	0.00	18	1.000E+01	5.323E+01	0.4267	0.00
19	1.090E+01	5.446E+01	0.4265	0.00	20	1.310E+01	5.765E+01	0.4262	0.00
21	1.640E+01	6.299E+01	0.4256	0.00	22	2.150E+01	7.280E+01	0.4245	0.00
23	2.480E+01	8.040E+01	0.4237	0.00	24	2.700E+01	8.614E+01	0.4230	0.00
25	2.850E+01	9.041E+01	0.4226	0.00	26	2.940E+01	9.312E+01	0.4223	0.00
27	2.990E+01	9.468E+01	0.4221	0.00	28	3.020E+01	9.564E+01	0.4220	0.00
29	3.040E+01	9.628E+01	0.4219	0.00	30	3.050E+01	9.661E+01	0.4219	0.00
31	3.060E+01	9.660E+01	0.4219	0.00	32	3.080E+01	9.644E+01	0.4219	0.00
33	3.110E+01	9.621E+01	0.4219	0.00	34	3.160E+01	9.581E+01	0.4220	0.00
35	3.230E+01	9.526E+01	0.4221	0.00	36	3.330E+01	9.447E+01	0.4221	0.00
37	3.480E+01	9.328E+01	0.4223	0.00	38	3.700E+01	9.152E+01	0.4225	0.00
39	3.970E+01	8.936E+01	0.4227	0.00	40	4.270E+01	8.693E+01	0.4230	0.00
41	4.570E+01	8.449E+01	0.4232	0.00	42	4.870E+01	8.203E+01	0.4235	0.00
43	5.170E+01	7.956E+01	0.4238	0.00	44	5.450E+01	7.723E+01	0.4240	0.00
45	5.670E+01	7.539E+01	0.4242	0.00	46	5.820E+01	7.413E+01	0.4244	0.00
47	5.920E+01	7.329E+01	0.4245	0.00	48	5.990E+01	7.270E+01	0.4245	0.00
49	6.040E+01	7.228E+01	0.4246	0.00	50	6.070E+01	7.203E+01	0.4246	0.00
51	6.090E+01	7.186E+01	0.4246	0.00	52	6.100E+01	7.177E+01	0.4246	0.00
53	6.110E+01	7.171E+01	0.0587	0.00	54	6.130E+01	7.171E+01	0.0587	0.00
55	6.160E+01	7.171E+01	0.0587	0.00	56	6.210E+01	7.171E+01	0.0587	0.00
57	6.300E+01	7.171E+01	0.0587	0.00	58	6.450E+01	7.171E+01	0.0587	0.00
59	6.750E+01	7.171E+01	0.0587	0.00	60	7.250E+01	7.171E+01	0.0587	0.00
61	8.250E+01	7.171E+01	0.0587	0.00	62	1.025E+02	7.171E+01	0.0587	0.00
63	1.325E+02	7.171E+01	0.0587	0.00	64	1.775E+02	7.171E+01	0.0587	0.00
65	2.425E+02	7.171E+01	0.0587	0.00	66	3.425E+02	7.171E+01	0.0587	0.00
67	5.025E+02	7.171E+01	0.0587	0.00	68	7.468E+02	7.171E+01	0.0587	0.00
69	9.911E+02	7.171E+01	0.0587	0.00	70	1.151E+03	7.171E+01	0.0587	0.00
71	1.251E+03	7.171E+01	0.0587	0.00	72	1.316E+03	7.171E+01	0.0587	0.00
73	1.361E+03	7.174E+01	0.0586	0.00	74	1.391E+03	7.294E+01	0.0580	0.00
75	1.411E+03	7.810E+01	0.0555	0.00	76	1.421E+03	8.661E+01	0.0520	0.00
77	1.426E+03	9.650E+01	0.0487	0.00	78	1.429E+03	1.083E+02	0.0456	0.00
79	1.431E+03	1.185E+02	0.0433	0.00	80	1.432E+03	1.278E+02	0.0416	0.00
81	1.432E+03	1.350E+02	0.0405	0.00	82	1.432E+03	1.403E+02	0.0397	0.00
83	1.433E+03	1.445E+02	0.0391	0.00	84	1.433E+03	1.469E+02	0.0388	0.00
85	1.433E+03	1.471E+02	0.4166	0.00	86	1.433E+03	1.470E+02	0.4166	0.00
87	1.433E+03	1.468E+02	0.4166	0.00	88	1.434E+03	1.465E+02	0.4166	0.00
89	1.434E+03	1.460E+02	0.4167	0.00	90	1.435E+03	1.454E+02	0.4167	0.00
91	1.437E+03	1.444E+02	0.4168	0.00	92	1.439E+03	1.430E+02	0.4170	0.00
93	1.443E+03	1.404E+02	0.4173	0.00	94	1.450E+03	1.357E+02	0.4177	0.00
95	1.463E+03	1.268E+02	0.4187	0.00	96	1.476E+03	1.174E+02	0.4197	0.00
97	1.483E+03	1.123E+02	0.4202	0.00	98	1.487E+03	1.093E+02	0.4205	0.00
99	1.489E+03	1.076E+02	0.4207	0.00	100	1.491E+03	1.065E+02	0.4208	0.00
101	1.492E+03	1.057E+02	0.4209	0.00	102	1.493E+03	1.052E+02	0.4210	0.00
103	1.493E+03	1.048E+02	0.4210	0.00	104	1.493E+03	1.046E+02	0.4210	0.00
105	1.494E+03	1.044E+02	0.4211	0.00	106	1.494E+03	1.043E+02	0.4211	0.00
107	1.494E+03	1.043E+02	0.0424	0.00	108	1.494E+03	1.043E+02	0.0424	0.00
109	1.494E+03	1.043E+02	0.0424	0.00	110	1.495E+03	1.043E+02	0.0424	0.00
111	1.495E+03	1.043E+02	0.0424	0.00	112	1.496E+03	1.043E+02	0.0424	0.00
113	1.498E+03	1.043E+02	0.0424	0.00	114	1.500E+03	1.043E+02	0.0424	0.00
115	1.504E+03	1.043E+02	0.0424	0.00	116	1.510E+03	1.043E+02	0.0424	0.00
117	1.520E+03	1.043E+02	0.0424	0.00	118	1.534E+03	1.043E+02	0.0424	0.00
119	1.554E+03	1.043E+02	0.0424	0.00	120	1.583E+03	1.043E+02	0.0424	0.00
121	1.626E+03	1.043E+02	0.0424	0.00	122	1.691E+03	1.042E+02	0.0424	0.00
123	1.734E+03	8.540E+01	0.0502	0.00	124	1.763E+03	5.978E+01	0.0710	0.00
125	1.783E+03	4.007E+01	0.1092	0.00	126	1.797E+03	2.610E+01	0.1708	0.00
127	1.807E+03	1.610E+01	0.2495	0.00	128	1.813E+03	1.010E+01	0.3028	0.00
129	1.817E+03	6.100E+00	0.3283	0.00	130	1.819E+03	4.300E+00	0.3350	0.00
131	1.820E+03	2.800E+00	0.3383	0.00	132	1.821E+03	1.800E+00	0.3394	0.00
133	1.822E+03	1.100E+00	0.3398	0.00	134	1.822E+03	6.000E-01	0.3400	0.00
135	1.823E+03	3.000E-01	0.3400	0.00	136	1.823E+03	1.000E-01	0.3400	0.00
137	1.823E+03	0.000E+00	0.3400	0.00					

Initial Water Storage = 154.6118 cm

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---------------------------------------------------------------------------

 DAILY SUMMARY:  Day =    1, Simulated Time = 24.0000 hr
 -------------
 Node Number         =      25          50          75         100         125
 Depth (cm)          =   28.50000    60.70000  1411.10000  1490.80000  1782.70000
 Water (cm3/cm3)     =    0.42258     0.42460     0.05549     0.42083     0.10925
 Head (cm)           = 9.04056E+01 7.20277E+01 7.81033E+01 1.06483E+02 4.00727E+01
 Water Flow (cm)     = 7.50000E-04 7.50000E-04 7.50186E-04 7.50210E-04 7.50331E-04

  PRESTOR   INFIL  RUNOFF    EVAPO   TRANS    DRAIN   NEWSTOR          STORAGE
 154.6118+ 0.0008- 0.0000 - 0.0000- 0.0000-  0.0008 =154.6118  Versus 154.6118

 Mass Balance =  2.2737E-13 cm;  Time step attempts =  388 and successes =  388

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 DAILY SUMMARY:  Day = 365, Simulated Time = 24.0000 hr
 -------------
 Node Number         =      25          50          75         100         125
 Depth (cm)          =   28.50000    60.70000  1411.10000  1490.80000  1782.70000
 Water (cm3/cm3)     =    0.42258     0.42460     0.05549     0.42083     0.10925
 Head (cm)           = 9.04056E-01 7.20277E+01 7.81039E-01 1.06484E-02 4.00727E-01
 Water Flow (cm)     = 7.50000E-04 7.50000E-04 7.50163E-04 7.50187E-04 7.50306E-04

  PRESTOR   INFIL  RUNOFF    EVAPO   TRANS    DRAIN   NEWSTOR          STORAGE
 154.6117+ 0.0008+ 0.0000 - 0.0000- 0.0000-  0.0008 =154.6117  Versus 154.6117

 Mass Balance =  2.8422E-14 cm;  Time step attempts =  160 and successes =  160
1

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                             UNSAT-H Version 2.05
                              SIMULATION SUMMARY

 Title:
 CAS-T27e.INP: Class A South disposal cell Unsat flow, frost-prot. top slope, 0.
---------------------------------------------------------------------------

 Transpiration Scheme is:             =    0
 Potential Evapotranspiration         =  0.0000E+00      [cm]
 Potential Transpiration              =  0.0000E+00      [cm]
 Actual Transpiration                 =  0.0000E+00      [cm]
 Potential Evaporation                =  0.0000E+00      [cm]
 Actual Evaporation                   =  0.0000E+00      [cm]
 Evaporation during Growth            =  0.0000E+00      [cm]
 Total Runoff                         =  0.0000E+00      [cm]
 Total Infiltration                   =  2.7375E-01      [cm]
 Total Drainage at Base of Profile    =  2.7387E-01      [cm]
 Total Applied Water                  =  2.7375E-01      [cm]
 Actual Rainfall                      =  2.7375E-01      [cm]
 Actual Irrigation                    =  0.0000E+00      [cm]
 Total Final Moisture Storage         =  1.5461E+02      [cm]
 Mass Balance Error                   =  4.4338E-12      [cm]
 Total Successful Time Steps          =      58628
 Total Attempted Time Steps           =      58628
 Total Time Step Reductions (DHMAX)   =          0
 Total Changes in Surface Boundary    =          0
 Total Time Actually Simulated        =  3.6500E+02      [days]


 Total water flow (cm) across different depths at the end of 3.6500E-02 days:
```

DEPTH	FLOW	DEPTH	FLOW	DEPTH	FLOW
0.000	2.7375E-01	0.050	2.7375E-01	0.200	2.7375E-01
0.450	2.7375E-01	0.850	2.7375E-01	1.550	2.7375E-01
2.650	2.7375E-01	4.450	2.7375E-01	6.250	2.7375E-01
7.350	2.7375E-01	8.050	2.7375E-01	8.450	2.7375E-01
8.700	2.7375E-01	8.850	2.7375E-01	8.950	2.7375E-01
9.100	2.7375E-01	9.350	2.7375E-01	9.750	2.7375E-01
10.450	2.7375E-01	12.000	2.7375E-01	14.750	2.7375E-01
18.950	2.7375E-01	23.150	2.7375E-01	25.900	2.7375E-01
27.750	2.7375E-01	28.950	2.7375E-01	29.650	2.7375E-01
30.050	2.7375E-01	30.300	2.7375E-01	30.450	2.7375E-01
30.550	2.7375E-01	30.700	2.7375E-01	30.950	2.7375E-01
31.350	2.7375E-01	31.950	2.7375E-01	32.800	2.7375E-01
34.050	2.7375E-01	35.900	2.7375E-01	38.350	2.7375E-01
41.200	2.7375E-01	44.200	2.7375E-01	47.200	2.7375E-01
50.200	2.7375E-01	53.100	2.7375E-01	55.600	2.7375E 01
57.450	2.7375E-01	58.700	2.7375E-01	59.550	2.7375E-01
60.150	2.7375E-01	60.550	2.7375E-01	60.800	2.7375E-01
60.950	2.7375E-01	61.050	2.7375E-01	61.200	2.7375E-01

61.450	2.7375E-01	61.850	2.7375E-01	62.550	2.7375E-01
63.750	2.7375E-01	66.000	2.7375E-01	70.000	2.7375E-01
77.500	2.7375E-01	92.500	2.7375E-01	117.500	2.7375E-01
155.000	2.7375E 01	210.000	2.7375E-01	292.500	2.7375E-01
422.500	2.7376E-01	624.650	2.7375E-01	868.950	2.7373E 01
1071.100	2.7374E-01	1201.100	2.7376E-01	1283.600	2.7378E-01
1338.600	2.7379E-01	1376.100	2.7380E-01	1401.100	2.7381E-01
1416.100	2.7381E-01	1423.600	2.7382E-01	1427.600	2.7382E-01
1429.850	2.7382E-01	1431.050	2.7382E-01	1431.750	2.7382E-01
1432.150	2.7382E-01	1432.400	2.7382E-01	1432.550	2.7382E-01
1432.650	2.7382E-01	1432.800	2.7382E-01	1433.050	2.7382E-01
1433.450	2.7382E-01	1434.050	2.7382E-01	1434.900	2.7382E-01
1436.150	2.7382E-01	1438.000	2.7382E-01	1441.100	2.7382E-01
1446.600	2.7382E-01	1456.600	2.7382E-01	1469.600	2.7382E-01
1479.600	2.7382E-01	1485.100	2.7382E-01	1488.200	2.7382E-01
1490.050	2.7382E-01	1491.300	2.7382E-01	1492.150	2.7382E-01
1492.750	2.7382E-01	1493.150	2.7382E-01	1493.400	2.7382E-01
1493.550	2.7382E-01	1493.650	2.7382E-01	1493.800	2.7382E-01
1494.050	2.7382E-01	1494.450	2.7382E-01	1495.050	2.7382E-01
1495.900	2.7382E-01	1497.150	2.7382E-01	1498.800	2.7382E-01
1501.700	2.7382E-01	1506.700	2.7383E-01	1514.700	2.7383E-01
1526.700	2.7383E-01	1543.700	2.7383E-01	1568.200	2.7384E-01
1604.200	2.7384E-01	1658.200	2.7385E-01	1712.200	2.7386E-01
1748.200	2.7387E-01	1772.700	2.7387E 01	1789.700	2.7387E-01
1801.700	2.7387E-01	1809.700	2.7387E-01	1814.700	2.7387E-01
1817.600	2.7387E-01	1819.250	2.7387E-01	1820.500	2.7387E-01
1821.350	2.7387E-01	1821.950	2.7387E-01	1822.350	2.7387E-01
1822.600	2.7387E-01	1822.750	2.7387E-01	1822.800	2.7387E-01

UNSAT-H Version 2.05
INITIAL CONDITIONS

Input Filename: C:\Projects\4101L\CAS2007\Unsat07\CAS-28c.inp
Results Filename: C:\Projects\4101L\CAS2007\Unsat07\CAS-28c.res
Date of Run: 06 Dec 2007
Time of Run: 12:42:50.03
Title:
CAS-28c.INP: Class A South cell Unsat flow, frost-protected side slope, 0.286 c

NODE	DEPTH (cm)	Initial Conditions HEAD (cm)	THETA (vol.)	TEMP (K)	NODE	DEPTH (cm)	Initial Conditions HEAD (cm)	THETA (vol.)	TEMP (K)
1	0.000E+00	3.997E+01	0.4281	0.00	2	1.000E-01	4.006E+01	0.4281	0.00
3	3.000E-01	4.025E+01	0.4281	0.00	4	6.000E-01	4.053E+01	0.4281	0.00
5	1.100E+00	4.101E+01	0.4280	0.00	6	2.000E+00	4.190E+01	0.4279	0.00
7	3.300E+00	4.324E+01	0.4278	0.00	8	5.600E+00	4.577E+01	0.4275	0.00
9	6.900E+00	4.730E+01	0.4273	0.00	10	7.800E+00	4.841E+01	0.4272	0.00
11	8.300E+00	4.904E+01	0.4271	0.00	12	8.600E+00	4.942E+01	0.4271	0.00
13	8.800E+00	4.968E+01	0.4271	0.00	14	8.900E+00	4.981E+01	0.4271	0.00
15	9.000E+00	4.994E+01	0.4270	0.00	16	9.200E+00	5.020E+01	0.4270	0.00
17	9.500E+00	5.060E+01	0.4270	0.00	18	1.000E+01	5.127E+01	0.4269	0.00
19	1.090E+01	5.252E+01	0.4268	0.00	20	1.310E+01	5.576E+01	0.4264	0.00
21	1.640E+01	6.119E+01	0.4258	0.00	22	2.150E+01	7.123E+01	0.4247	0.00
23	2.480E+01	7.904E+01	0.4238	0.00	24	2.700E+01	8.496E+01	0.4232	0.00
25	2.850E+01	8.937E+01	0.4227	0.00	26	2.940E+01	9.219E+01	0.4224	0.00
27	2.990E+01	9.381E+01	0.4222	0.00	28	3.020E+01	9.480E+01	0.4221	0.00
29	3.040E+01	9.547E+01	0.4220	0.00	30	3.050E+01	9.581E+01	0.4220	0.00
31	3.060E+01	9.581E+01	0.4220	0.00	32	3.080E+01	9.565E+01	0.4220	0.00
33	3.110E+01	9.541E+01	0.4220	0.00	34	3.160E+01	9.502E+01	0.4221	0.00
35	3.230E+01	9.448E+01	0.4221	0.00	36	3.330E+01	9.369E+01	0.4222	0.00
37	3.480E+01	9.251E+01	0.4224	0.00	38	3.700E+01	9.077E+01	0.4225	0.00
39	3.970E+01	8.862E+01	0.4228	0.00	40	4.270E+01	8.621E+01	0.4230	0.00
41	4.570E+01	8.379E+01	0.4233	0.00	42	4.870E+01	8.134E+01	0.4236	0.00
43	5.170E+01	7.888E+01	0.4238	0.00	44	5.450E+01	7.657E+01	0.4241	0.00
45	5.670E+01	7.475E+01	0.4243	0.00	46	5.820E+01	7.349E+01	0.4244	0.00
47	5.920E+01	7.266E+01	0.4245	0.00	48	5.990E+01	7.207E+01	0.4246	0.00
49	6.040E+01	7.165E+01	0.4246	0.00	50	6.070E+01	7.140E+01	0.4247	0.00
51	6.090E+01	7.123E+01	0.4247	0.00	52	6.100E+01	7.115E+01	0.4247	0.00
53	6.110E+01	7.109E+01	0.0590	0.00	54	6.130E+01	7.109E+01	0.0590	0.00
55	6.160E+01	7.109E+01	0.0590	0.00	56	6.210E+01	7.109E+01	0.0590	0.00
57	6.300E+01	7.109E+01	0.0590	0.00	58	6.450E+01	7.109E+01	0.0590	0.00
59	6.750E+01	7.109E+01	0.0590	0.00	60	7.250E+01	7.109E+01	0.0590	0.00
61	8.250E+01	7.109E+01	0.0590	0.00	62	1.025E+02	7.109E+01	0.0590	0.00
63	1.325E+02	7.109E+01	0.0590	0.00	64	1.825E+02	7.109E+01	0.0590	0.00
65	2.725E+02	7.109E+01	0.0590	0.00	66	4.134E+02	7.109E+01	0.0590	0.00
67	5.034E+02	7.108E+01	0.0590	0.00	68	5.534E+02	7.112E+01	0.0590	0.00
69	5.834E+02	7.227E+01	0.0584	0.00	70	6.034E+02	7.734E+01	0.0558	0.00
71	6.134E+02	8.573E+01	0.0523	0.00	72	6.184E+02	9.551E+01	0.0490	0.00
73	6.214E+02	1.072E+02	0.0458	0.00	74	6.229E+02	1.173E+02	0.0436	0.00
75	6.238E+02	1.266E+02	0.0418	0.00	76	6.243E+02	1.338E+02	0.0407	0.00
77	6.246E+02	1.391E+02	0.0399	0.00	78	6.248E+02	1.433E+02	0.0393	0.00
79	6.249E+02	1.456E+02	0.0390	0.00	80	6.250E+02	1.459E+02	0.4167	0.00
81	6.252E+02	1.457E+02	0.4167	0.00	82	6.255E+02	1.455E+02	0.4167	0.00
83	6.260E+02	1.452E+02	0.4168	0.00	84	6.267E+02	1.448E+02	0.4168	0.00
85	6.277E+02	1.442E+02	0.4169	0.00	86	6.292E+02	1.432E+02	0.4170	0.00
87	6.314E+02	1.418E+02	0.4171	0.00	88	6.354E+02	1.392E+02	0.4174	0.00
89	6.424E+02	1.346E+02	0.4178	0.00	90	6.554E+02	1.258E+02	0.4188	0.00
91	6.684E+02	1.166E+02	0.4197	0.00	92	6.754E+02	1.115E+02	0.4203	0.00
93	6.794E+02	1.085E+02	0.4206	0.00	94	6.816E+02	1.069E+02	0.4208	0.00
95	6.831E+02	1.058E+02	0.4209	0.00	96	6.841E+02	1.050E+02	0.4210	0.00
97	6.848E+02	1.045E+02	0.4211	0.00	98	6.853E+02	1.041E+02	0.4211	0.00
99	6.856E+02	1.039E+02	0.4211	0.00	100	6.858E+02	1.037E+02	0.4211	0.00
101	6.859E+02	1.036E+02	0.4211	0.00	102	6.860E+02	1.036E+02	0.0426	0.00
103	6.862E+02	1.036E+02	0.0426	0.00	104	6.865E+02	1.036E+02	0.0426	0.00
105	6.870E+02	1.036E+02	0.0426	0.00	106	6.877E+02	1.036E+02	0.0426	0.00
107	6.887E+02	1.036E+02	0.0426	0.00	108	6.902E+02	1.036E+02	0.0426	0.00
109	6.920E+02	1.036E+02	0.0426	0.00	110	6.960E+02	1.036E+02	0.0426	0.00
111	7.020E+02	1.036E+02	0.0426	0.00	112	7.120E+02	1.036E+02	0.0426	0.00
113	7.260E+02	1.036E+02	0.0426	0.00	114	7.460E+02	1.036E+02	0.0426	0.00
115	7.750E+02	1.036E+02	0.0426	0.00	116	8.180E+02	1.036E+02	0.0426	0.00
117	8.830E+02	1.036E+02	0.0426	0.00	118	9.260E+02	8.527E+01	0.0503	0.00
119	9.550E+02	5.977E+01	0.0710	0.00	120	9.750E+02	4.007E+01	0.1093	0.00
121	9.890E+02	2.610E+01	0.1708	0.00	122	9.990E+02	1.610E+01	0.2495	0.00
123	1.005E+03	1.010E+01	0.3028	0.00	124	1.009E+03	6.100E+00	0.3283	0.00
125	1.011E+03	4.300E+00	0.3350	0.00	126	1.012E+03	2.800E+00	0.3383	0.00
127	1.013E+03	1.800E+00	0.3394	0.00	128	1.014E+03	1.100E+00	0.3398	0.00
129	1.015E+03	6.000E-01	0.3400	0.00	130	1.015E+03	3.000E-01	0.3400	0.00
131	1.015E+03	1.000E-01	0.3400	0.00	132	1.015E+03	0.000E+00	0.3400	0.00

Initial Water Storage = 107.4932 cm

```
DAILY SUMMARY:  Day =    1, Simulated Time = 24.0000 hr
-------------
Node Number         =       25           50           75          100          125
Depth (cm)          =    28.50000     60.70000    623.80000    685.80000   1010.80000
Water (cm3/cm3)     =      0.42269      0.42467      0.04183      0.42113      0.33499
Head (cm)           = 8.93738E+01 7.14008E+01 1.26640E+02 1.03714E+02 4.29993E+00
Water Flow (cm)     = 7.80000E-04 7.80000E-04 7.79999E-04 7.79999E-04 7.79999E-04

 PRESTOR   INFIL  RUNOFF    EVAPO    TRANS     DRAIN   NEWSTOR          STORAGE
107.4932+ 0.0008+ 0.0000 - 0.0000- 0.0000-  0.0008 =107.4932  Versus 107.4932

Mass Balance = -1.9895E-13 cm;  Time step attempts =  388 and successes =  388

--------------------------------------------------------------------------------

DAILY SUMMARY:  Day = 365, Simulated Time = 24.0000 hr
-------------
Node Number         =       25           50           75          100          125
Depth (cm)          =    28.50000     60.70000    623.80000    685.80000   1010.80000
Water (cm3/cm3)     =      0.42269      0.42467      0.04183      0.42113      0.33499
Head (cm)           = 8.93738E+01 7.14008E+01 1.26640E+02 1.03714E+02 4.29993E+00
Water Flow (cm)     = 7.80000E-04 7.80000E-04 7.79999E-04 7.79999E-04 7.79999E-04

 PRESTOR   INFIL  RUNOFF    EVAPO    TRANS     DRAIN   NEWSTOR          STORAGE
107.4932+ 0.0008+ 0.0000 - 0.0000- 0.0000-  0.0008 =107.4932  Versus 107.4932

Mass Balance =  1.4211E-14 cm;  Time step attempts =  160 and successes =  160
1
--------------------------------------------------------------------------------
                            UNSAT-H Version 2.05
                             SIMULATION SUMMARY

Title:
CAS-28c.INP: Class A South cell Unsat flow, frost-protected side slope, 0.286 c
--------------------------------------------------------------------------------

Transpiration Scheme is:            =    0
Potential Evapotranspiration        =  0.0000E+00      (cm)
Potential Transpiration             =  0.0000E+00      (cm)
Actual Transpiration                =  0.0000E+00      (cm)
Potential Evaporation               =  0.0000E+00      (cm)
Actual Evaporation                  =  0.0000E+00      (cm)
Evaporation during Growth           =  0.0000E+00      (cm)
Total Runoff                        =  0.0000E+00      (cm)
Total Infiltration                  =  2.8470E-01      (cm)
Total Drainage at Base of Profile   =  2.8470E-01      (cm)
Total Applied Water                 =  2.8470E-01      (cm)
Actual Rainfall                     =  2.8470E-01      (cm)
Actual Irrigation                   =  0.0000E+00      (cm)
Total Final Moisture Storage        =  1.0749E+02      (cm)
Mass Balance Error                  =  1.9270E-11      (cm)
Total Successful Time Steps         =     58628
Total Attempted Time Steps          =     58628
Total Time Step Reductions (DHMAX)  =         0
Total Changes in Surface Boundary   =         0
Total Time Actually Simulated       =  3.6500E+02      (days)


Total water flow (cm) across different depths at the end of 3.6500E+02 days:

    DEPTH        FLOW        DEPTH        FLOW        DEPTH        FLOW
    ------    -----------   -------    -----------   -------    -----------
     0.000    2.8470E-01      0.050    2.8470E-01      0.200    2.8470E-01
     0.450    2.8470E-01      0.850    2.8470E-01      1.550    2.8470E-01
     2.650    2.8470E-01      4.450    2.8470E-01      6.250    2.8470E-01
     7.350    2.8470E-01      8.050    2.8470E-01      8.450    2.8470E-01
     8.700    2.8470E-01      8.850    2.8470E-01      8.950    2.8470E-01
     9.100    2.8470E-01      9.350    2.8470E-01      9.750    2.8470E-01
    10.450    2.8470E-01     12.000    2.8470E-01     14.750    2.8470E-01
    18.950    2.8470E-01     23.150    2.8470E-01     25.900    2.8470E-01
    27.750    2.8470E-01     28.950    2.8470E-01     29.650    2.8470E-01
    30.050    2.8470E-01     30.300    2.8470E-01     30.450    2.8470E-01
    30.550    2.8470E-01     30.700    2.8470E-01     30.950    2.8470E-01
    31.350    2.8470E-01     31.950    2.8470E-01     32.800    2.8470E-01
    34.050    2.8470E-01     35.900    2.8470E-01     38.350    2.8470E-01
    41.200    2.8470E-01     44.200    2.8470E-01     47.200    2.8470E-01
    50.200    2.8470E-01     53.100    2.8470E-01     55.600    2.8470E-01
    57.450    2.8470E-01     58.700    2.8470E-01     59.550    2.8470E-01
    60.150    2.8470E-01     60.550    2.8470E-01     60.800    2.8470E-01
    60.950    2.8470E-01     61.050    2.8470E-01     61.200    2.8470E-01
    61.450    2.8470E-01     61.850    2.8470E-01     62.550    2.8470E-01
    63.750    2.8470E-01     66.000    2.8470E-01     70.000    2.8470E-01
    77.500    2.8470E-01     92.500    2.8470E-01    117.500    2.8470E-01
```

157.500	2.8470E-01	227.500	2.8470E-01	342.950	2.8470E-01
458.400	2.8470E-01	528.400	2.8470E-01	568.400	2.8470E-01
593.400	2.8470E-01	608.400	2.8470E-01	615.900	2.8470E-01
619.900	2.8470E-01	622.150	2.8470E-01	623.350	2.8470E-01
624.050	2.8470E-01	624.450	2.8470E-01	624.700	2.8470E-01
624.850	2.8470E-01	624.950	2.8470E-01	625.100	2.8470E-01
625.350	2.8470E-01	625.750	2.8470E-01	626.350	2.8470E-01
627.200	2.8470E-01	628.450	2.8470E-01	630.300	2.8470E-01
633.400	2.8470E-01	638.900	2.8470E-01	648.900	2.8470E-01
661.900	2.8470E-01	671.900	2.8470E-01	677.400	2.8470E-01
680.500	2.8470E-01	682.350	2.8470E-01	683.600	2.8470E-01
684.450	2.8470E-01	685.050	2.8470E-01	685.450	2.8470E-01
685.700	2.8470E-01	685.850	2.8470E-01	685.950	2.8470E-01
686.100	2.8470E-01	686.350	2.8470E-01	686.750	2.8470E-01
687.350	2.8470E-01	688.200	2.8470E-01	689.450	2.8470E-01
691.100	2.8470E-01	694.000	2.8470E-01	699.000	2.8470E-01
707.000	2.8470E-01	719.000	2.8470E-01	736.000	2.8470E-01
760.500	2.8470E-01	796.500	2.8470E-01	850.500	2.8470E-01
904.500	2.8470E-01	940.500	2.8470E-01	965.000	2.8470E-01
982.000	2.8470E-01	994.000	2.8470E-01	1002.000	2.8470E-01
1007.000	2.8470E-01	1009.900	2.8470E-01	1011.550	2.8470E-01
1012.800	2.8470E-01	1013.650	2.8470E-01	1014.250	2.8470E-01
1014.650	2.8470E-01	1014.900	2.8470E-01	1015.050	2.8470E-01
1015.100	2.8470E-01				

UNSAT-H Version 2.05
INITIAL CONDITIONS

Input Filename: C:\Projects\4101L\CAS2007\Unsat07\CAS-59c.inp
Results Filename: C:\Projects\4101L\CAS2007\Unsat07\CAS-59c.res
Date of Run: 06 Dec 2007
Time of Run: 12:45:08.25
Title:
CAS-59c.INP: Class A South cell Unsat flow, frost-prot. side slope, 12"filter,

		Initial Conditions					Initial Conditions		
NODE	DEPTH (cm)	HEAD (cm)	THETA (vol.)	TEMP (K)	NODE	DEPTH (cm)	HEAD (cm)	THETA (vol.)	TEMP (K)
1	0.000E+00	7.057E+00	0.4315	0.00	2	1.000E-01	7.118E+00	0.4315	0.00
3	3.000E-01	7.243E+00	0.4315	0.00	4	6.000E-01	7.433E+00	0.4314	0.00
5	1.100E+00	7.762E+00	0.4314	0.00	6	2.000E+00	8.388E+00	0.4314	0.00
7	3.300E+00	9.376E+00	0.4313	0.00	8	5.600E+00	1.139E+01	0.4311	0.00
9	6.900E+00	1.270E+01	0.4310	0.00	10	7.800E+00	1.368E+01	0.4309	0.00
11	8.300E+00	1.425E+01	0.4308	0.00	12	8.600E+00	1.460E+01	0.4308	0.00
13	8.800E+00	1.484E+01	0.4307	0.00	14	8.900E+00	1.496E+01	0.4307	0.00
15	9.000E+00	1.509E+01	0.4307	0.00	16	9.200E+00	1.533E+01	0.4307	0.00
17	9.500E+00	1.571E+01	0.4307	0.00	18	1.000E+01	1.636E+01	0.4306	0.00
19	1.090E+01	1.759E+01	0.4305	0.00	20	1.310E+01	2.095E+01	0.4301	0.00
21	1.640E+01	2.709E+01	0.4295	0.00	22	2.150E+01	4.001E+01	0.4281	0.00
23	2.480E+01	5.147E+01	0.4269	0.00	24	2.700E+01	6.100E+01	0.4258	0.00
25	2.850E+01	6.862E+01	0.4250	0.00	26	2.940E+01	7.372E+01	0.4244	0.00
27	2.990E+01	7.675E+01	0.4241	0.00	28	3.020E+01	7.864E+01	0.4239	0.00
29	3.040E+01	7.992E+01	0.4237	0.00	30	3.050E+01	8.058E+01	0.4237	0.00
31	3.060E+01	8.065E+01	0.4236	0.00	32	3.080E+01	8.052E+01	0.4237	0.00
33	3.110E+01	8.034E+01	0.4237	0.00	34	3.160E+01	8.002E+01	0.4237	0.00
35	3.230E+01	7.959E+01	0.4238	0.00	36	3.330E+01	7.896E+01	0.4238	0.00
37	3.480E+01	7.801E+01	0.4239	0.00	38	3.700E+01	7.661E+01	0.4241	0.00
39	3.970E+01	7.487E+01	0.4243	0.00	40	4.270E+01	7.291E+01	0.4245	0.00
41	4.570E+01	7.092E+01	0.4247	0.00	42	4.870E+01	6.890E+01	0.4249	0.00
43	5.170E+01	6.685E+01	0.4252	0.00	44	5.450E+01	6.492E+01	0.4254	0.00
45	5.670E+01	6.338E+01	0.4256	0.00	46	5.820E+01	6.233E+01	0.4257	0.00
47	5.920E+01	6.162E+01	0.4257	0.00	48	5.990E+01	6.112E+01	0.4258	0.00
49	6.040E+01	6.076E+01	0.4258	0.00	50	6.070E+01	6.055E+01	0.4259	0.00
51	6.090E+01	6.041E+01	0.4259	0.00	52	6.100E+01	6.033E+01	0.4259	0.00
53	6.110E+01	6.029E+01	0.0659	0.00	54	6.130E+01	6.029E+01	0.0659	0.00
55	6.160E+01	6.029E+01	0.0659	0.00	56	6.210E+01	6.029E+01	0.0659	0.00
57	6.300E+01	6.029E+01	0.0659	0.00	58	6.450E+01	6.029E+01	0.0659	0.00
59	6.750E+01	6.029E+01	0.0659	0.00	60	7.250E+01	6.029E+01	0.0659	0.00
61	8.250E+01	6.029E+01	0.0659	0.00	62	1.025E+02	6.029E+01	0.0659	0.00
63	1.325E+02	6.029E+01	0.0659	0.00	64	1.825E+02	6.029E+01	0.0659	0.00
65	2.725E+02	6.029E+01	0.0659	0.00	66	4.134E+02	6.028E+01	0.0660	0.00
67	5.034E+02	6.030E+01	0.0659	0.00	68	5.534E+02	6.026E+01	0.0660	0.00
69	5.834E+02	6.077E+01	0.0656	0.00	70	6.034E+02	6.419E+01	0.0632	0.00
71	6.134E+02	7.051E+01	0.0593	0.00	72	6.184E+02	7.823E+01	0.0554	0.00
73	6.214E+02	8.768E+01	0.0516	0.00	74	6.229E+02	9.605E+01	0.0488	0.00
75	6.238E+02	1.038E+02	0.0467	0.00	76	6.243E+02	1.098E+02	0.0452	0.00
77	6.246E+02	1.144E+02	0.0442	0.00	78	6.248E+02	1.180E+02	0.0434	0.00
79	6.249E+02	1.200E+02	0.0430	0.00	80	6.250E+02	1.203E+02	0.4194	0.00
81	6.252E+02	1.202E+02	0.4194	0.00	82	6.255E+02	1.201E+02	0.4194	0.00
83	6.260E+02	1.199E+02	0.4194	0.00	84	6.267E+02	1.196E+02	0.4194	0.00
85	6.277E+02	1.192E+02	0.4195	0.00	86	6.292E+02	1.186E+02	0.4195	0.00
87	6.314E+02	1.177E+02	0.4196	0.00	88	6.354E+02	1.160E+02	0.4198	0.00
89	6.424E+02	1.130E+02	0.4201	0.00	90	6.554E+02	1.070E+02	0.4208	0.00
91	6.684E+02	1.006E+02	0.4215	0.00	92	6.754E+02	9.690E+01	0.4219	0.00
93	6.794E+02	9.473E+01	0.4221	0.00	94	6.816E+02	9.352E+01	0.4222	0.00
95	6.831E+02	9.268E+01	0.4223	0.00	96	6.841E+02	9.212E+01	0.4224	0.00
97	6.848E+02	9.173E+01	0.4224	0.00	98	6.853E+02	9.145E+01	0.4225	0.00
99	6.856E+02	9.128E+01	0.4225	0.00	100	6.858E+02	9.117E+01	0.4225	0.00
101	6.859E+02	9.111E+01	0.4225	0.00	102	6.860E+02	9.107E+01	0.0474	0.00
103	6.862E+02	9.107E+01	0.0474	0.00	104	6.865E+02	9.107E+01	0.0474	0.00
105	6.870E+02	9.107E+01	0.0474	0.00	106	6.877E+02	9.107E+01	0.0474	0.00
107	6.887E+02	9.107E+01	0.0474	0.00	108	6.902E+02	9.107E+01	0.0474	0.00
109	6.920E+02	9.107E+01	0.0474	0.00	110	6.960E+02	9.107E+01	0.0474	0.00
111	7.020E+02	9.107E+01	0.0474	0.00	112	7.120E+02	9.107E+01	0.0474	0.00
113	7.260E+02	9.108E+01	0.0474	0.00	114	7.460E+02	9.108E+01	0.0474	0.00
115	7.750E+02	9.113E+01	0.0474	0.00	116	8.180E+02	9.073E+01	0.0476	0.00
117	8.830E+02	9.209E+01	0.0470	0.00	118	9.260E+02	8.199E+01	0.0521	0.00
119	9.550E+02	5.943E+01	0.0715	0.00	120	9.750E+02	4.004E+01	0.1093	0.00
121	9.890E+02	2.609E+01	0.1708	0.00	122	9.990E+02	1.610E+01	0.2495	0.00
123	1.005E+03	1.010E+01	0.3028	0.00	124	1.009E+03	6.100E+00	0.3283	0.00
125	1.011E+03	4.300E+00	0.3350	0.00	126	1.012E+03	2.800E+00	0.3383	0.00
127	1.013E+03	1.800E+00	0.3394	0.00	128	1.014E+03	1.100E+00	0.3398	0.00
129	1.015E+03	6.000E-01	0.3400	0.00	130	1.015E+03	3.000E-01	0.3400	0.00
131	1.015E+03	1.000E-01	0.3400	0.00	132	1.015E+03	0.000E+00	0.3400	0.00

Initial Water Storage = 112.7976 cm

```
DAILY SUMMARY:  Day =   1, Simulated Time = 24.0000 hr
-------------
Node Number         =      25          50          75         100         125
Depth (cm)          =   28.50000    60.70000   623.80000   685.80000  1010.80000
Water (cm3/cm3)     =    0.42498     0.42587     0.04667     0.42250     0.33499
Head (cm)           = 6.86249E+01 6.05491E+01 1.03810E+02 9.11654E+01 4.29985E+00
Water Flow (cm)     = 1.63000E-03 1.63000E-03 1.63000E-03 1.63000E-03 1.63000E-03

 PRESTOR   INFIL  RUNOFF    EVAPO   TRANS    DRAIN   NEWSTOR          STORAGE
112.7976+ 0.0016+ 0.0000 - 0.0000- 0.0000-  0.0016 =112.7976  Versus 112.7976

Mass Balance = -1.7053E-13 cm;  Time step attempts =  388 and successes =  388

--------------------------------------------------------------------------------


DAILY SUMMARY:  Day = 365, Simulated Time = 24.0000 hr
-------------
Node Number         =      25          50          75         100         125
Depth (cm)          =   28.50000    60.70000   623.80000   685.80000  1010.80000
Water (cm3/cm3)     =    0.42498     0.42587     0.04667     0.42250     0.33499
Head (cm)           = 6.86249E+01 6.05491E+01 1.03810E+02 9.11654E+01 4.29985E+00
Water Flow (cm)     = 1.63000E-03 1.63000E-03 1.63000E-03 1.63000E-03 1.63000E-03

 PRESTOR   INFIL  RUNOFF    EVAPO   TRANS    DRAIN   NEWSTOR          STORAGE
112.7976+ 0.0016+ 0.0000 - 0.0000- 0.0000-  0.0016 =112.7976  Versus 112.7976

Mass Balance =  3.4106E-13 cm;  Time step attempts =  160 and successes =  160
1

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                             UNSAT-H Version 2.05
                              SIMULATION SUMMARY

Title:
CAS-59c.INP: Class A South cell Unsat flow, frost-prot. side slope, 12"filter,
---  ---  ----------------------------------------------------------------------

Transpiration Scheme is:             =    0
Potential Evapotranspiration         =  0.0000E+00      [cm]
Potential Transpiration              =  0.0000E+00      [cm]
Actual Transpiration                 =  0.0000E+00      [cm]
Potential Evaporation                =  0.0000E+00      [cm]
Actual Evaporation                   =  0.0000E+00      [cm]
Evaporation during Growth            =  0.0000E+00      [cm]
Total Runoff                         =  0.0000E+00      [cm]
Total Infiltration                   =  5.9495E-01      [cm]
Total Drainage at Base of Profile    =  5.9495E-01      [cm]
Total Applied Water                  =  5.9495E-01      [cm]
Actual Rainfall                      =  5.9495E-01      [cm]
Actual Irrigation                    =  0.0000E+00      [cm]
Total Final Moisture Storage         =  1.1280E+02      [cm]
Mass Balance Error                   =  1.1021E-10      [cm]
Total Successful Time Steps          =     58628
Total Attempted Time Steps           =     58628
Total Time Step Reductions (DHMAX)   =         0
Total Changes in Surface Boundary    =         0
Total Time Actually Simulated        =  3.6500E+02      [days]


Total water flow (cm) across different depths at the end of 3.6500E+02 days:

    DEPTH       FLOW        DEPTH       FLOW        DEPTH       FLOW
   -------   -----------   -------   -----------   -------   -----------
     0.000   5.9495E-01      0.050   5.9495E-01      0.200   5.9495E-01
     0.450   5.9495E-01      0.850   5.9495E-01      1.550   5.9495E-01
     2.650   5.9495E-01      4.450   5.9495E-01      6.250   5.9495E-01
     7.350   5.9495E-01      8.050   5.9495E-01      8.450   5.9495E-01
     8.700   5.9495E-01      8.850   5.9495E-01      8.950   5.9495E-01
     9.100   5.9495E-01      9.350   5.9495E-01      9.750   5.9495E-01
    10.450   5.9495E-01     12.000   5.9495E-01     14.750   5.9495E-01
    18.950   5.9495E-01     23.150   5.9495E-01     25.900   5.9495E-01
    27.750   5.9495E-01     28.950   5.9495E-01     29.650   5.9495E-01
    30.050   5.9495E-01     30.300   5.9495E-01     30.450   5.9495E-01
    30.550   5.9495E-01     30.700   5.9495E-01     30.950   5.9495E-01
    31.350   5.9495E-01     31.950   5.9495E-01     32.800   5.9495E-01
    34.050   5.9495E-01     35.900   5.9495E-01     38.350   5.9495E-01
    41.200   5.9495E-01     44.200   5.9495E-01     47.200   5.9495E-01
    50.200   5.9495E-01     53.100   5.9495E-01     55.600   5.9495E-01
    57.450   5.9495E-01     58.700   5.9495E-01     59.550   5.9495E-01
    60.150   5.9495E-01     60.550   5.9495E-01     60.800   5.9495E-01
    60.950   5.9495E-01     61.050   5.9495E-01     61.200   5.9495E-01
    61.450   5.9495E-01     61.850   5.9495E-01     62.550   5.9495E-01
    63.750   5.9495E-01     66.000   5.9495E-01     70.000   5.9495E-01
    77.500   5.9495E-01     92.500   5.9495E-01    117.500   5.9495E-01
```

157.500	5.9495E-01	227.500	5.9495E-01	342.950	5.9495E-01
458.400	5.9495E-01	528.400	5.9495E-01	568.400	5.9495E-01
593.400	5.9495E-01	608.400	5.9495E-01	615.900	5.9495E-01
619.900	5.9495E-01	622.150	5.9495E-01	623.350	5.9495E-01
624.050	5.9495E-01	624.450	5.9495E-01	624.700	5.9495E-01
624.850	5.9495E-01	624.950	5.9495E-01	625.100	5.9495E-01
625.350	5.9495E-01	625.750	5.9495E-01	626.350	5.9495E-01
627.200	5.9495E-01	628.450	5.9495E-01	630.300	5.9495E-01
633.400	5.9495E-01	638.900	5.9495E-01	648.900	5.9495E-01
661.900	5.9495E-01	671.900	5.9495E-01	677.400	5.9495E-01
680.500	5.9495E-01	682.350	5.9495E-01	683.600	5.9495E-01
684.450	5.9495E-01	685.050	5.9495E-01	685.450	5.9495E-01
685.700	5.9495E-01	685.850	5.9495E-01	685.950	5.9495E-01
686.100	5.9495E-01	686.350	5.9495E-01	686.750	5.9495E-01
687.350	5.9495E-01	688.200	5.9495E-01	689.450	5.9495E-01
691.100	5.9495E-01	694.000	5.9495E-01	699.000	5.9495E-01
707.000	5.9495E-01	719.000	5.9495E-01	736.000	5.9495E-01
760.500	5.9495E-01	796.500	5.9495E-01	850.500	5.9495E-01
904.500	5.9495E-01	940.500	5.9495E-01	965.000	5.9495E-01
982.000	5.9495E-01	994.000	5.9495E-01	1002.000	5.9495E-01
1007.000	5.9495E-01	1009.900	5.9495E-01	1011.550	5.9495E-01
1012.800	5.9495E-01	1013.650	5.9495E-01	1014.250	5.9495E-01
1014.650	5.9495E-01	1014.900	5.9495E-01	1015.050	5.9495E-01
1015.100	5.9495E-01				

Whetstone Associates

ATTACHMENT 3
ENERGY*SOLUTIONS*
CLASS A SOUTH CELL
PATHRAE MODEL FILES

Prepared for

Energy*Solutions*, LLC
423 West 300 South, Suite 200
Salt Lake City, UT 84101

Prepared by

Whetstone Associates, Inc.
714 S. Oak Street
P.O. Box 1156
La Veta, Colorado 81055-1156
719-742-5155

Document 4101L.071207

December 2007

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PATHRAE-RAD(PC)  Version 2.2d  February 1995
  Date: 12- 6-2007
  Time: 19: 2:53
EnergySolutions Class A South cell top slope, vertical/vadose, part 1, T27a
*****  Mirror Image of Input Files  *****
-- Input File:  ABCDEF.DAT
EnergySolutions Class A South cell top slope, vertical/vadose, part 1, T27a
118,1.,3.,6.,9.,12.,15.,18.,21.,24.,27.,30.,35.,40.,45.,50.,55.,60.,65.,70.,75.,80.,85.,90.,95.,100.,105.,110.,115.,120.,125.,130.,1
65,0,1
1,2
0,1.,1.,2.76E-03,2.76E-03,3.64,0
1558.,0.100,0,0,0.307,3.34E-02,97.4,0
1,0,0,0,0,0
0,1.,1.,3.64,0,1800.,1.,0,0,0
0,0,0,0.0,1.
0,0,0,0,0,0,0
0,0,0,0,0,0,0,0,0,0,0
0,0,0,1,0,0,1
1,0,1,0
0.00276,0.025,0.109,0,0,1.,0,1.,0,0.355

-- Input File:  BRCDCF.DAT
 101,Ac-227  0,0,0,0,0,0,0
 102,Ag-108m 0,0,0,0,0,0,0
 103,Al-26   0,0,0,0,0,0,0
 48,Am-241   0,0,0,0,0,0,0
 104,Am-242m 0,0,0,0,0,0,0
 105,Am-243  0,0,0,0,0,0,0
 106,Ba-133  0,0,0,0,0,0,0
 107,Be-10   0,0,0,0,0,0,0
 108,Bi-207  0,0,0,0,0,0,0
 109,Bi-210m 0,0,0,0,0,0,0
 110,Bk-247  0,0,0,0,0,0,0
 111,C-14    0,0,0,0,0,0,0
 112,Ca-41   0,0,0,0,0,0,0
 113,Cd-113  0,0,0,0,0,0,0
 114,Cd-113m 0,0,0,0,0,0,0
 115,Cf-249  0,0,0,0,0,0,0
 116,Cf-250  0,0,0,0,0,0,0
 117,Cf-251  0,0,0,0,0,0,0
 118,Cf-252  0,0,0,0,0,0,0
 119,Cl-36   0,0,0,0,0,0,0
 120,Cm-243  0,0,0,0,0,0,0
 50,Cm-244   0,0,0,0,0,0,0
 121,Cm-245  0,0,0,0,0,0,0
 122,Cm-246  0,0,0,0,0,0,0
 123,Cm-247  0,0,0,0,0,0,0
 124,Cm-248  0,0,0,0,0,0,0
 125,Co-60   0,0,0,0,0,0,0
 126,Cs-135  0,0,0,0,0,0,0
 127,Cs-137  0,0,0,0,0,0,0
 128,Eu-152  0,0,0,0,0,0,0
 129,Eu-154  0,0,0,0,0,0,0
 130,Eu-155  0,0,0,0,0,0,0
 131,Fe-55   0,0,0,0,0,0,0
 132,Fe-60   0,0,0,0,0,0,0
 133,Gd-148  0,0,0,0,0,0,0
 134,H-3     0,0,0,0,0,0,0
 135,Hg-194  0,0,0,0,0,0,0
 136,Ho-166m 0,0,0,0,0,0,0
 137,I-129   0,0,0,0,0,0,0
 138,K-40    0,0,0,0,0,0,0
 139,Mn-53   0,0,0,0,0,0,0
 140,Na-22   0,0,0,0,0,0,0
 141,Nb-91   0,0,0,0,0,0,0
 142,Nb-92   0,0,0,0,0,0,0
 143,Nb-93m  0,0,0,0,0,0,0
 144,Nb-94   0,0,0,0,0,0,0
 146,Ni-59   0,0,0,0,0,0,0
 147,Ni-63   0,0,0,0,0,0,0
 42,Np-237   0,0,0,0,0,0,0
 148,Os-194  0,0,0,0,0,0,0
 149,Pa-231  0,0,0,0,0,0,0
 150,Pb-202  0,0,0,0,0,0,0
 151,Pb-210  0,0,0,0,0,0,0
 152,Pd-107  0,0,0,0,0,0,0
 153,Pm-145  0,0,0,0,0,0,0
 154,Pm-147  0,0,0,0,0,0,0
 155,Po-208  0,0,0,0,0,0,0
 156,Po-209  0,0,0,0,0,0,0
 157,Pt-193  0,0,0,0,0,0,0
 45,Pu-240   0,0,0,0,0,0,0
 46,Pu-241   0,0,0,0,0,0,0
 55,Ra-226   0,0,0,0,0,0,0
 36,Th-230   0,0,0,0,0,0,0
 40,U-236    0,0,0,0,0,0,0
 41,U-238    0,0,0,0,0,0,0
 -- Input File:  INVNTRY.DAT
 101,2.18E+01,1.30E+08,0,0,0,0,0
 102,4.18E+02,4.69E+07,0,0,0,0,0
 103,7.40E+05,3.72E-02,0,0,0,0,0
 48,4.32E+02,1.80E-02,0,0,0,0,0
 104,1.41E+02,1.80E-02,0,0,0,0,0
 105,7.37E+03,1.80E-02,0,0,0,0,0
 106,1.05E+01,4.61E+08,0,0,0,0,0
 107,1.51E+06,3.96E+04,0,0,0,0,0
 108,3.16E+01,9.66E+07,0,0,0,0,0
 109,3.04E+06,1.02E+03,0,0,0,0,0
 110,1.40E+03,1.77E-10,0,0,0,0,0
 111,5.73E+03,1.30E+01,0,0,0,0,0
 112,1.03E+05,3.70E-06,0,0,0,0,0
 113,9.30E+15,7.75E-07,0,0,0,0,0
 114,1.41E+01,4.04E+08,0,0,0,0,0
 115,3.51E+02,1.80E-02,0,0,0,0,0
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116,1.31E+01,9.00E-04,0,0,0,0,0
117,8.98E+02,1.80E-02,0,0,0,0,0
118,2.65E+00,7.92E+02,0,0,0,0,0
119,3.01E+05,5.14E-07,0,0,0,0,0
120,2.91E+01,1.80E-02,0,0,0,0,0
50,1.81E+01,1.80E-02,0,0,0,0,0
121,8.50E+03,1.80E-02,0,0,0,0,0
122,4.73E+03,1.80E-02,0,0,0,0,0
123,1.56E+07,1.80E-02,0,0,0,0,0
124,3.40E+05,1.80E-02,0,0,0,0,0
125,5.27E+00,7.92E+02,0,0,0,0,0
126,2.30E+06,2.07E+03,0,0,0,0,0
127,3.01E+01,1.13E+00,0,0,0,0,0
128,1.35E+01,3.11E+08,0,0,0,0,0
129,8.59E+00,4.87E+08,0,0,0,0,0
130,4.76E+00,7.92E+02,0,0,0,0,0
131,2.73E+00,7.92E+02,0,0,0,0,0
132,1.50E+06,7.15E+03,0,0,0,0,0
133,7.46E+01,5.80E+07,0,0,0,0,0
134,1.23E+01,4.50E+01,0,0,0,0,0
135,4.44E+02,6.38E+06,0,0,0,0,0
136,1.20E+03,3.24E+06,0,0,0,0,0
137,1.57E+07,9.00E-03,0,0,0,0,0
138,1.28E+09,1.26E+01,0,0,0,0,0
139,3.74E+06,3.24E+03,0,0,0,0,0
140,2.60E+00,7.92E+02,0,0,0,0,0
141,6.80E+02,1.04E+07,0,0,0,0,0
142,3.47E+07,2.02E+02,0,0,0,0,0
143,1.61E+01,4.74E+08,0,0,0,0,0
144,2.03E+04,2.34E-02,0,0,0,0,0
146,7.60E+04,2.52E+01,0,0,0,0,0
147,1.00E+02,3.96E+00,0,0,0,0,0
42,2.14E+06,1.80E-02,0,0,0,0,0
148,6.00E+00,5.53E+08,0,0,0,0,0
149,3.28E+04,8.46E+04,0,0,0,0,0
150,5.25E+04,6.12E+03,0,0,0,0,0
151,2.23E+01,1.37E+08,0,0,0,0,0
152,6.50E+06,9.18E+02,0,0,0,0,0
153,1.77E+01,2.52E+08,0,0,0,0,0
154,2.62E+00,7.92E+02,0,0,0,0,0
155,2.90E+00,7.92E+02,0,0,0,0,0
156,1.02E+02,3.02E+07,0,0,0,0,0
157,5.00E+01,6.66E+07,0,0,0,0,0
55,1.60E+03,1.80E-02,0,0,0,0,0
45,6.56E+03,1.80E-02,0,0,0,0,0
46,1.44E+01,6.30E-01,0,0,0,0,0
36,7.54E+04,3.71E+04,0,0,0,0,0
40,2.34E+07,1.16E+02,0,0,0,0,0
41,4.47E+09,6.05E-01,0,0,0,0,0
-- Input File:  RQSITE.DAT
101,3.38E-04,4.5,4.5
102,5.61E-04,2.7,2.7
103,1.02E-04,15.0,15.0
48,1.48E-03,1.0,1.0
104,1.48E-03,1.0,1.0
105,1.48E-03,1.0,1.0
106,1.53E-04,10.0,10.0
107,6.05E-04,2.5,2.5
108,1.48E-03,1.0,1.0
109,1.48E-03,1.0,1.0
110,4.54E-02,0.001,0.001
111,1.79E-04,8.52,8.52
112,1.85E-02,0.05,0.05
113,1.48E-03,1.0,1.0
114,1.48E-03,1.0,1.0
115,7.54E-04,2.0,2.0
116,7.54E-04,2.0,2.0
117,7.54E-04,2.0,2.0
118,7.54E-04,2.0,2.0
119,4.35E-02,0.0025,0.0025
120,1.64E-05,93.3,93.3
50,1.64E-05,93.3,93.3
121,1.64E-05,93.3,93.3
122,1.64E-05,93.3,93.3
123,1.64E-05,93.3,93.3
124,1.64E-05,93.3,93.3
125,4.14E-06,370.0,370.0
126,1.15E-05,133.0,133.0
127,1.15E 05,133.0,133.0
128,2.35E-04,6.5,6.5
129,2.35E-04,6.5,6.5
130,2.35E-04,6.5,6.5
131,1.07E-03,1.4,1.4
132,1.07E-03,1.4,1.4
133,2.35E-04,6.5,6.5
134,2.11E-02,0.04,0.04
135,1.53E-04,10.0,10.0
136,6.05E-04,2.5,2.5
137,1.00E-02,0.12,0.12
138,8.39E-03,0.15,0.15
139,2.38E-04,6.4,6.4
140,1.48E-03,1.0,1.0
141,9.39E-04,1.6,1.6
142,9.39E-04,1.6,1.6
143,9.39E-04,1.6,1.6
144,9.39E-04,1.6,1.6
146,1.53E-04,10.0,10.0
147,1.53E-04,10.0,10.0
42,5.06E-04,3.0,3.0
148,3.38E-04,4.5,4.5
149,2.77E-04,5.5,5.5
150,8.06E-05,19.0,19.0
151,8.06E-05,19.0,19.0
152,2.63E-03,0.55,0.55
153,2.35E-04,6.5,6.5
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154,2.35E-04,6.5,6.5
155,1.70E-04,9.0,9.0
156,1.70E-04,9.0,9.0
157,1.64E-03,0.9,0.9
45,1.53E-04,10.0,10.0
46,1.53E-04,10.0,10.0
55,1.53E-04,9.99,9.99
36,1.53E-04,10.0,10.0
40,2.54E-04,6.0,6.0
41,2.54E-04,6.0,6.0

-- Input File:  UPTAKE.DAT
2.76E-03,3.55E-01,1.558
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0,0,0
0,0,0,0
0,0,0,0,0
0,0,0,0,0,730.,0
101,0.00E+00,0.0,0.0,0,0,0,0
102,0.00E+00,0.0,0.0,0,0,0,0
103,0.00E+00,0.0,0.0,0,0,0,0
48,0.00E+00,0.0,0.0,0,0,0,0
104,0.00E+00,0.0,0.0,0,0,0,0
105,0.00E+00,0.0,0.0,0,0,0,0
106,0.00E+00,0.0,0.0,0,0,0,0
107,0.00E+00,0.0,0.0,0,0,0,0
108,0.00E+00,0.0,0.0,0,0,0,0
109,0.00E+00,0.0,0.0,0,0,0,0
110,0.00E+00,0.0,0.0,0,0,0,0
111,0.00E+00,0.0,0.0,0,0,0,0
112,0.00E+00,0.0,0.0,0,0,0,0
113,0.00E+00,0.0,0.0,0,0,0,0
114,0.00E+00,0.0,0.0,0,0,0,0
115,0.00E+00,0.0,0.0,0,0,0,0
116,0.00E+00,0.0,0.0,0,0,0,0
117,0.00E+00,0.0,0.0,0,0,0,0
118,0.00E+00,0.0,0.0,0,0,0,0
119,0.00E+00,0.0,0.0,0,0,0,0
120,0.00E+00,0.0,0.0,0,0,0,0
50,0.00E+00,0.0,0.0,0,0,0,0
121,0.00E+00,0.0,0.0,0,0,0,0
122,0.00E+00,0.0,0.0,0,0,0,0
123,0.00E+00,0.0,0.0,0,0,0,0
124,0.00E+00,0.0,0.0,0,0,0,0
125,0.00E+00,0.0,0.0,0,0,0,0
126,0.00E+00,0.0,0.0,0,0,0,0
127,0.00E+00,0.0,0.0,0,0,0,0
128,0.00E+00,0.0,0.0,0,0,0,0
129,0.00E+00,0.0,0.0,0,0,0,0
130,0.00E+00,0.0,0.0,0,0,0,0
131,0.00E+00,0.0,0.0,0,0,0,0
132,0.00E+00,0.0,0.0,0,0,0,0
133,0.00E+00,0.0,0.0,0,0,0,0
134,0.00E+00,0.0,0.0,0,0,0,0
135,0.00E+00,0.0,0.0,0,0,0,0
136,0.00E+00,0.0,0.0,0,0,0,0
137,0.00E+00,0.0,0.0,0,0,0,0
138,0.00E+00,0.0,0.0,0,0,0,0
139,0.00E+00,0.0,0.0,0,0,0,0
140,0.00E+00,0.0,0.0,0,0,0,0
141,0.00E+00,0.0,0.0,0,0,0,0
142,0.00E+00,0.0,0.0,0,0,0,0
143,0.00E+00,0.0,0.0,0,0,0,0
144,0.00E+00,0.0,0.0,0,0,0,0
146,0.00E+00,0.0,0.0,0,0,0,0
147,0.00E+00,0.0,0.0,0,0,0,0
42,0.00E+00,0.0,0.0,0,0,0,0
148,0.00E+00,0.0,0.0,0,0,0,0
149,0.00E+00,0.0,0.0,0,0,0,0
150,0.00E+00,0.0,0.0,0,0,0,0
151,0.00E+00,0.0,0.0,0,0,0,0
152,0.00E+00,0.0,0.0,0,0,0,0
153,0.00E+00,0.0,0.0,0,0,0,0
154,0.00E+00,0.0,0.0,0,0,0,0
155,0.00E+00,0.0,0.0,0,0,0,0
156,0.00E+00,0.0,0.0,0,0,0,0
157,0.00E+00,0.0,0.0,0,0,0,0
45,0.00E+00,0.0,0.0,0,0,0,0
46,0.00E+00,0.0,0.0,0,0,0,0
55,0.00E+00,0.0,0.0,0,0,0,0
36,0.00E+00,0.0,0.0,0,0,0,0
40,0.00E+00,0.0,0.0,0,0,0,0
41,0.00E+00,0.0,0.0,0,0,0,0
1
                    TOTAL EQUIVALENT UPTAKE FACTORS FOR PATHRAE
            UT(J,1)   UT(J,2)   UT(J,3)   UT(J,4)   UT(J,5)   UT(J,6)
             RIVER     WELL     EROSION   BATHTUB  SPILLAGE    FOOD
NUCLIDE      L/YR      L/YR      L/YR      L/YR      L/YR      KG/YR
  Ac-227    0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Ag-108m   0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
•
•
•
  Po-209    0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Pt-193    0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
**********  PATHRAE INPUT SUMMARY  **********
THERE ARE 80 ISOTOPES IN THE DOSE FACTOR LIBRARY
NUMBER OF TIMES FOR CALCULATION IS118
YEARS TO BE CALCULATED ARE ...
     1.00     3.00     6.00     9.00    12.00
    15.00    18.00    21.00    24.00    27.00
    30.00    35.00    40.00    45.00    50.00
    55.00    60.00    65.00    70.00    75.00
    80.00    85.00    90.00    95.00   100.00
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     105.00    110.00    115.00    120.00    125.00
     130.00    135.00    140.00    145.00    150.00
     155.00    160.00    165.00    170.00    175.00
     180.00    185.00    190.00    195.00    200.00
     205.00    210.00    215.00    220.00    225.00
     230.00    235.00    240.00    245.00    250.00
     255.00    260.00    265.00    270.00    275.00
     280.00    285.00    290.00    295.00    300.00
     310.00    320.00    330.00    340.00    350.00
     360.00    370.00    380.00    390.00    400.00
     410.00    420.00    430.00    440.00    450.00
     460.00    470.00    480.00    490.00    500.00
     510.00    520.00    530.00    540.00    550.00
     560.00    570.00    580.00    590.00    600.00
     610.00    620.00    630.00    640.00    650.00
     660.00    670.00    680.00    690.00    700.00
     720.00    740.00    760.00    780.00    800.00
     825.00    850.00    875.00    900.00    925.00
     950.00    975.00   1000.00
THERE ARE  65 ISOTOPES IN THE INVENTORY FILE
THE VALUE OF IFLAG IS 0
NUMBER OF PATHWAYS IS  1
          PATHWAY              TYPE OF USAGE
                             FOR UPTAKE FACTORS
   1  GROUNDWATER TO RIVER          2
TIME OF OPERATION OF WASTE FACILITY IN YEARS                      0.
LENGTH OF REPOSITORY (M)                                          1.
WIDTH OF REPOSITORY (M)                                           1.
RIVER FLOW RATE (M**3/YR)                                         2.76E-03
STREAM FLOW RATE (M**3/YR)                                        2.76E-03
DISTANCE TO RIVER (M)                                             4.
OPERATIONAL SPILLAGE FRACTION                                     0.00E+00
DENSITY OF AQUIFER (KG/M**3)                                   1558.
LONGITUDINAL DISPERSIVITY (M)                                     1.00E-01
LATERAL DISPERSION COEFFICIENT -- Y AXIS (M**2/YR)                0.00E+00
NUMBER OF MESH POINTS FOR DISPERSION CALCULATION                  1
FLAG FOR GAMMA PATHWAY OPTIONS                                    0
FLAG FOR GAMMA BUILDUP CALCULATION                                0
FLAG FOR ATMOSPHERIC PATHWAY                                      0
COVER THICKNESS OVER WASTE (M)                                     .00
THICKNESS OF WASTE IN PITS (M)                                    1.00
TOTAL WASTE VOLUME (M**3)                                         1.000E+00
DISTANCE TO WELL -- X COORDINATE (M)                              4.
DISTANCE TO WELL -- Y COORDINATE (M)                              0.
DENSITY OF WASTE (KG/M**3)                                     1800.
FRACTION OF FOOD CONSUMED THAT IS GROWN ON SITE                   1.000
FRACTION OF YEAR SPENT IN DIRECT RADIATION FIELD                   .000
DEPTH OF PLANT ROOT ZONE (M)                                       .000
AREAL DENSITY OF PLANTS (KG/M**2)                                  .000
AVERAGE DUST LOADING IN AIR (KG/M**3)                             0.00E+00
ANNUAL ADULT BREATHING RATE (M**3/YR)                             0.
FRACTION OF YEAR EXPOSED TO DUST                                   .000
CANISTER LIFETIME (YEARS)                                         0.
INVENTORY SCALING FACTOR                                          1.00E+00
HEIGHT OF ROOMS IN RECLAIMER HOUSE (CM)                           0.
AIR CHANGE RATE IN RECLAIMER HOUSE (CHANGES/SEC)                  0.00E+00
RADON EMANATING POWER OF THE WASTE                                0.00E+00

DIFFUSION COEFF. OF RADON IN WASTE (CM**2/SEC)                    0.00E+00
DIFFUSION COEFF. OF RN IN CONCRETE (CM**2/SEC)                    0.00E+00
THICKNESS OF CONCRETE SLAB FLOOR (CM)                              .0
DIFFUSION COEFF. OF RADON IN COVER (CM**2/SEC)                    0.00E+00
ATMOSPHERIC STABILITY CLASS                                       0
AVERAGE WIND SPEED (M/S)                                           .00
FRACTION OF TIME WIND BLOWS TOWARD RECEPTOR                        .0000
RECEPTOR DISTANCE FOR ATMOSPHERIC PATHWAY (M)                      .0
DUST RESUSPENSION RATE FOR OFFSITE TRANSPORT (M**3/S)             0.00E+00
DEPOSITION VELOCITY (M/S)                                          .0000
STACK HEIGHT (M)                                                   .0
STACK INSIDE DIAMETER (M)                                          .00
STACK GAS VELOCITY (M/S)                                           .0
HEAT EMISSION RATE FROM BURNING (CAL/S)                           0.00E+00
DECAY CHAIN FLAGS                                  0    0    0    1    0    0    1
FLAG FOR INPUT SUMMARY PRINTOUT                                   1
FLAG FOR DIRECTION OF TRENCH FILLING                              1
FLAG FOR GROUNDWATER PATHWAY OPTIONS                              0
AMOUNT OF WATER PERCOLATING THROUGH WASTE ANNUALLY (M)            2.76E-03
DEGREE OF SOIL SATURATION                                          .307
RESIDUAL SOIL SATURATION                                           .033
PERMEABILITY OF VERTICAL ZONE (M/YR)                             97.40
SOIL NUMBER                                                        .000
POROSITY OF AQUIFER                                                .11
POROSITY OF UNSATURATED ZONE                                       .36
DISTANCE FROM AQUIFER TO WASTE (M)                                 .0
AVERAGE VERTICAL GROUNDWATER VELOCITY (M/YR)                      2.53E-02
HORIZONTAL VELOCITY OF AQUIFER (M/YR)                              .0
LENGTH OF PERFORATED WELL CASING (M)                              1.000
SURFACE EROSION RATE (M/YR)                                       0.000E+00
LEACH RATE SCALING FACTOR                                         1.000E+00
ANNUAL RUNOFF OF PRECIPITATION (M)                                0.00E+00
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NUCLIDE	INGESTION DOSE FACTORS (MREM/PCI)	INHALATION DOSE FACTORS (MREM/PCI)	DIRECT GAMMA DOSE FACTORS (MREM-M2/PCI-YR)	HALF LIFE (YR)
Ac-227	0.000E+00	0.000E+00	0.000E+00	2.180E+01
Ag-108m	0.000E+00	0.000E+00	0.000E+00	4.180E+02
Al-26	0.000E+00	0.000E+00	0.000E+00	7.400E+05
Am-242m	0.000E+00	0.000E+00	0.000E+00	1.410E+02
Am-243	0.000E+00	0.000E+00	0.000E+00	7.370E+03
Ba-133	0.000E+00	0.000E+00	0.000E+00	1.050E+01
Be-10	0.000E+00	0.000E+00	0.000E+00	1.510E+06
Bi-207	0.000E+00	0.000E+00	0.000E+00	3.160E+01
Bi-210m	0.000E+00	0.000E+00	0.000E+00	3.040E+06
Bk-247	0.000E+00	0.000E+00	0.000E+00	1.400E+03
C-14	0.000E+00	0.000E+00	0.000E+00	5.730E+03
Ca-41	0.000E+00	0.000E+00	0.000E+00	1.030E+05

Cd-113	0.000E+00	0.000E+00	0.000E+00	9.300E+15
Cd-113m	0.000E+00	0.000E+00	0.000E+00	1.410E+01
Cf-249	0.000E+00	0.000E+00	0.000E+00	3.510E+02
Cf-250	0.000E+00	0.000E+00	0.000E+00	1.310E+01
Cf-251	0.000E+00	0.000E+00	0.000E+00	8.980E+02
Cf-252	0.000E+00	0.000E+00	0.000E+00	2.650E+00
Cl-36	0.000E+00	0.000E+00	0.000E+00	3.010E+05
Cm-243	0.000E+00	0.000E+00	0.000E+00	2.910E+01
Cm-245	0.000E+00	0.000E+00	0.000E+00	8.500E+03
Cm-246	0.000E+00	0.000E+00	0.000E+00	4.730E+03
Cm-247	0.000E+00	0.000E+00	0.000E+00	1.560E+07
Cm-248	0.000E+00	0.000E+00	0.000E+00	3.400E+05
Co-60	0.000E+00	0.000E+00	0.000E+00	5.270E+00
Cs-135	0.000E+00	0.000E+00	0.000E+00	2.300E+06
Cs-137	0.000E+00	0.000E+00	0.000E+00	3.010E+01
Eu-152	0.000E+00	0.000E+00	0.000E+00	1.350E+01
Eu-154	0.000E+00	0.000E+00	0.000E+00	8.590E+00
Eu-155	0.000E+00	0.000E+00	0.000E+00	4.760E+00
Fe-55	0.000E+00	0.000E+00	0.000E+00	2.730E+00
Fe-60	0.000E+00	0.000E+00	0.000E+00	1.500E+06
Gd-148	0.000E+00	0.000E+00	0.000E+00	7.460E+01
H-3	0.000E+00	0.000E+00	0.000E+00	1.230E+01
Hg-194	0.000E+00	0.000E+00	0.000E+00	4.440E+02
Th-230	0.000E+00	0.000E+00	0.000E+00	7.540E+04
U-236	0.000E+00	0.000E+00	0.000E+00	2.340E+07
U-238	0.000E+00	0.000E+00	0.000E+00	4.470E+09
Np-237	0.000E+00	0.000E+00	0.000E+00	2.140E+06
Pu-240	0.000E+00	0.000E+00	0.000E+00	6.560E+03
Pu-241	0.000E+00	0.000E+00	0.000E+00	1.440E+01
Am-241	0.000E+00	0.000E+00	0.000E+00	4.320E+02
Cm-244	0.000E+00	0.000E+00	0.000E+00	1.810E+01
Ra-226	0.000E+00	0.000E+00	0.000E+00	1.600E+03
Ho-166m	0.000E+00	0.000E+00	0.000E+00	1.200E+03
I-129	0.000E+00	0.000E+00	0.000E+00	1.570E+07
K-40	0.000E+00	0.000E+00	0.000E+00	1.280E+09
Mn-53	0.000E+00	0.000E+00	0.000E+00	3.740E+06
Na-22	0.000E+00	0.000E+00	0.000E+00	2.600E+00
Nb-91	0.000E+00	0.000E+00	0.000E+00	6.800E+02
Nb-92	0.000E+00	0.000E+00	0.000E+00	3.470E+07
Nb-93m	0.000E+00	0.000E+00	0.000E+00	1.610E+01
Nb-94	0.000E+00	0.000E+00	0.000E+00	2.030E+04
Ni-59	0.000E+00	0.000E+00	0.000E+00	7.600E+04
Ni-63	0.000E+00	0.000E+00	0.000E+00	1.000E+02
Os-194	0.000E+00	0.000E+00	0.000E+00	6.000E+00
Pa-231	0.000E+00	0.000E+00	0.000E+00	3.280E+04
Pb-202	0.000E+00	0.000E+00	0.000E+00	5.250E+04
Pb-210	0.000E+00	0.000E+00	0.000E+00	2.230E+01
Pd-107	0.000E+00	0.000E+00	0.000E+00	6.500E+06
Pm-145	0.000E+00	0.000E+00	0.000E+00	1.770E+01
Pm-147	0.000E+00	0.000E+00	0.000E+00	2.620E+00
Po-208	0.000E+00	0.000E+00	0.000E+00	2.900E+00
Po-209	0.000E+00	0.000E+00	0.000E+00	1.020E+02
Pt-193	0.000E+00	0.000E+00	0.000E+00	5.000E+01

NUCLIDE	VOLATILITY FRACTION	GAMMA ENERGY (MEV)	GAMMA ATTENUATION (1/M)
Ac-227	0.000E+00	0.000E+00	0.000E+00
Ag-108m	0.000E+00	0.000E+00	0.000E+00

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Po-209	0.000E+00	0.000E+00	0.000E+00
Pt-193	0.000E+00	0.000E+00	0.000E+00

NUCLIDE	INPUT LEACH RATE (1/YR)	FINAL LEACH RATE (1/YR)	SOLUBILITY (MOLE/L)	INPUT INVENTORY (CI)
Ac-227	3.380E-04	3.380E-04	0.000E+00	1.300E+08
Ag-108m	5.610E-04	5.610E-04	0.000E+00	4.690E+07
Al-26	1.020E-04	1.020E-04	0.000E+00	3.720E-02
Am-242m	1.480E-03	1.480E-03	0.000E+00	1.800E-02
Am-243	1.480E-03	1.480E-03	0.000E+00	1.800E-02
Ba-133	1.530E-04	1.530E-04	0.000E+00	4.610E+08
Be-10	6.050E-04	6.050E-04	0.000E+00	3.960E+04
Bi-207	1.480E-03	1.480E-03	0.000E+00	9.660E+07
Bi-210m	1.480E-03	1.480E-03	0.000E+00	1.020E+03
Bk-247	4.540E-02	4.540E-02	0.000E+00	1.770E-10
C-14	1.790E-04	1.790E-04	0.000E+00	1.300E+01
Ca-41	1.850E-02	1.850E-02	0.000E+00	3.700E-06
Cd-113	1.480E-03	1.480E-03	0.000E+00	7.750E-07
Cd-113m	1.480E-03	1.480E-03	0.000E+00	4.040E+08
Cf-249	7.540E-04	7.540E-04	0.000E+00	1.800E-02
Cf-250	7.540E-04	7.540E-04	0.000E+00	9.000E-04
Cf-251	7.540E-04	7.540E-04	0.000E+00	1.800E-02
Cf-252	7.540E-04	7.540E-04	0.000E+00	7.920E+02
Cl-36	4.350E-02	4.350E-02	0.000E+00	5.140E-07
Cm-243	1.640E-05	1.640E-05	0.000E+00	1.800E-02
Cm-245	1.640E-05	1.640E-05	0.000E+00	1.800E-02
Cm-246	1.640E-05	1.640E-05	0.000E+00	1.800E-02
Cm-247	1.640E-05	1.640E-05	0.000E+00	1.800E-02
Cm-248	1.640E-05	1.640E-05	0.000E+00	1.800E-02
Co-60	4.140E-06	4.140E-06	0.000E+00	7.920E+02
Cs-135	1.150E-05	1.150E-05	0.000E+00	2.070E+03
Cs-137	1.150E-05	1.150E-05	0.000E+00	1.130E+00
Eu-152	2.350E-04	2.350E-04	0.000E+00	3.110E+08
Eu-154	2.350E-04	2.350E-04	0.000E+00	4.870E+08
Eu-155	2.350E-04	2.350E-04	0.000E+00	7.920E+02
Fe-55	1.070E-03	1.070E-03	0.000E+00	7.920E+02
Fe-60	1.070E-03	1.070E-03	0.000E+00	7.150E+03
Gd-148	2.350E-04	2.350E-04	0.000E+00	5.800E+07
H-3	2.110E-02	2.110E-02	0.000E+00	4.500E+01
Hg-194	1.530E-04	1.530E-04	0.000E+00	6.380E+06
Th-230	1.530E-04	1.530E-04	0.000E+00	3.710E+04
U-236	2.540E-04	2.540E-04	0.000E+00	1.160E+02
U-238	2.540E-04	2.540E-04	0.000E+00	6.050E-01

Np-237	5.060E-04	5.060E-04	0.000E+00	1.800E-02
Pu-240	1.530E-04	1.530E-04	0.000E+00	1.800E-02
Pu-241	1.530E-04	1.530E-04	0.000E+00	6.300E-01
Am-241	1.480E-03	1.480E-03	0.000E+00	1.800E-02
Cm-244	1.640E-05	1.640E-05	0.000E+00	1.800E-02
Ra-226	1.530E-04	1.530E-04	0.000E+00	1.800E-02
Ho-166m	6.050E-04	6.050E-04	0.000E+00	3.240E+06
I-129	1.000E-02	1.000E-02	0.000E+00	9.000E-03
K-40	8.390E-03	8.390E-03	0.000E+00	1.260E+01
Mn-53	2.380E-04	2.380E-04	0.000E+00	3.240E+03
Na-22	1.480E-03	1.480E-03	0.000E+00	7.920E+02
Nb-91	9.390E-04	9.390E-04	0.000E+00	1.040E+07
Nb-92	9.390E-04	9.390E-04	0.000E+00	2.020E+02
Nb-93m	9.390E-04	9.390E-04	0.000E+00	4.740E+08
Nb-94	9.390E-04	9.390E-04	0.000E+00	2.340E-02
Ni-59	1.530E-04	1.530E-04	0.000E+00	2.520E+01
Ni-63	1.530E-04	1.530E-04	0.000E+00	3.960E+00
Os-194	3.380E-04	3.380E-04	0.000E+00	5.530E+08
Pa-231	2.770E-04	2.770E-04	0.000E+00	8.460E+04
Pb-202	8.060E-05	8.060E-05	0.000E+00	6.120E+03
Pb-210	8.060E-05	8.060E-05	0.000E+00	1.370E+08
Pd-107	2.630E-03	2.630E-03	0.000E+00	9.180E+02
Pm-145	2.350E-04	2.350E-04	0.000E+00	2.520E+08
Pm-147	2.350E-04	2.350E-04	0.000E+00	7.920E+02
Po-208	1.700E-04	1.700E-04	0.000E+00	7.920E+02
Po-209	1.700E-04	1.700E-04	0.000E+00	3.020E+07
Pt-193	1.640E-03	1.640E-03	0.000E+00	6.660E+07

NUCLIDE	AQUIFER SORPTION	AQUIFER RETARDATION	VERTICAL SORPTION	VERTICAL RETARDATION
Ac-227	4.500E+00	6.532E+01	4.500E+00	6.533E+01
Ag-108m	2.700E+00	3.959E+01	2.700E+00	3.960E+01
Al-26	1.500E+01	2.154E+02	1.500E+01	2.154E+02
Am-242m	1.000E+00	1.529E+01	1.000E+00	1.530E+01
Am-243	1.000E+00	1.529E+01	1.000E+00	1.530E+01
Ba-133	1.000E+01	1.439E+02	1.000E+01	1.440E+02
Be-10	2.500E+00	3.673E+01	2.500E+00	3.674E+01
Bi-207	1.000E+00	1.529E+01	1.000E+00	1.530E+01
Bi-210m	1.000E+00	1.529E+01	1.000E+00	1.530E+01
Bk-247	1.000E-03	1.014E+00	1.000E-03	1.014E+00
C-14	8.520E+00	1.228E+02	8.520E+00	1.228E+02
Ca-41	5.000E-02	1.715E+00	5.000E-02	1.715E+00
Cd-113	1.000E+00	1.529E+01	1.000E+00	1.530E+01
Cd-113m	1.000E+00	1.529E+01	1.000E+00	1.530E+01
Cf-249	2.000E+00	2.959E+01	2.000E+00	2.959E+01
Cf-250	2.000E+00	2.959E+01	2.000E+00	2.959E+01
Cf-251	2.000E+00	2.959E+01	2.000E+00	2.959E+01
Cf-252	2.000E+00	2.959E+01	2.000E+00	2.959E+01
Cl-36	2.500E-03	1.036E+00	2.500E-03	1.036E+00
Cm-243	9.330E+01	1.335E+03	9.330E+01	1.335E+03
Cm-245	9.330E+01	1.335E+03	9.330E+01	1.335E+03
Cm-246	9.330E+01	1.335E+03	9.330E+01	1.335E+03
Cm-247	9.330E+01	1.335E+03	9.330E+01	1.335E+03
Cm-248	9.330E+01	1.335E+03	9.330E+01	1.335E+03
Co-60	3.700E+02	5.290E+03	3.700E+02	5.290E+03
Cs-135	1.330E+02	1.902E+03	1.330E+02	1.902E+03
Cs-137	1.330E+02	1.902E+03	1.330E+02	1.902E+03
Eu-152	6.500E+00	9.391E+01	6.500E+00	9.392E+01
Eu-154	6.500E+00	9.391E+01	6.500E+00	9.392E+01
Eu-155	6.500E+00	9.391E+01	6.500E+00	9.392E+01
Fe-55	1.400E+00	2.101E+01	1.400E+00	2.101E+01
Fe-60	1.400E+00	2.101E+01	1.400E+00	2.101E+01
Gd-148	6.500E+00	9.391E+01	6.500E+00	9.392E+01
H-3	4.000E-02	1.572E+00	4.000E-02	1.572E+00
Hg-194	1.000E+01	1.439E+02	1.000E+01	1.440E+02
Th-230	1.000E+01	1.439E+02	1.000E+01	1.440E+02
U-236	6.000E+00	8.676E+01	6.000E+00	8.677E+01
U-238	6.000E+00	8.676E+01	6.000E+00	8.677E+01
Np-237	3.000E+00	4.388E+01	3.000E+00	4.389E+01
Pu-240	1.000E+01	1.439E+02	1.000E+01	1.440E+02
Pu-241	1.000E+01	1.439E+02	1.000E+01	1.440E+02
Am-241	1.000E+00	1.529E+01	1.000E+00	1.530E+01
Cm-244	9.330E+01	1.335E+03	9.330E+01	1.335E+03
Ra-226	9.990E+00	1.438E+02	9.990E+00	1.438E+02
Ho-166m	2.500E+00	3.673E+01	2.500E+00	3.674E+01
I-129	1.200E-01	2.715E+00	1.200E-01	2.715E+00
K-40	1.500E-01	3.144E+00	1.500E-01	3.144E+00
Mn-53	6.400E+00	9.248E+01	6.400E+00	9.249E+01
Na-22	1.000E+00	1.529E+01	1.000E+00	1.530E+01
Nb-91	1.600E+00	2.387E+01	1.600E+00	2.387E+01
Nb-92	1.600E+00	2.387E+01	1.600E+00	2.387E+01
Nb-93m	1.600E+00	2.387E+01	1.600E+00	2.387E+01
Nb-94	1.600E+00	2.387E+01	1.600E+00	2.387E+01
Ni-59	1.000E+01	1.439E+02	1.000E+01	1.440E+02
Ni-63	1.000E+01	1.439E+02	1.000E+01	1.440E+02
Os-194	4.500E+00	6.532E+01	4.500E+00	6.533E+01
Pa-231	5.500E+00	7.961E+01	5.500E+00	7.963E+01
Pb-202	1.900E+01	2.726E+02	1.900E+01	2.726E+02
Pb-210	1.900E+01	2.726E+02	1.900E+01	2.726E+02
Pd-107	5.500E-01	8.861E+00	5.500E-01	8.863E+00
Pm-145	6.500E+00	9.391E+01	6.500E+00	9.392E+01
Pm-147	6.500E+00	9.391E+01	6.500E+00	9.392E+01
Po-208	9.000E+00	1.296E+02	9.000E+00	1.297E+02
Po-209	9.000E+00	1.296E+02	9.000E+00	1.297E+02
Pt-193	9.000E-01	1.386E+01	9.000E-01	1.387E+01

BIOACCUMULATION FACTORS

NUCLIDE	SOIL-PLANT Bv	SOIL-PLANT Br	FORAGE-MILK Fm (D/L)	FORAGE-MEAT Ff (D/KG)
Ac-227	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Ag-108m	0.000E+00	0.000E+00	0.000E+00	0.000E+00
•				
•				
•				
Po-209	0.000E+00	0.000E+00	0.000E+00	0.000E+00

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    Pt-193              0.000E+00       0.000E+00       0.000E+00       0.000E+00
                                                        PATHWAY  1
                                                   GROUNDWATER TO RIVER
********* NUCLIDE DOSES (mrem/yr) ********
  NUCLIDE/TIME          1.        3.        6.        9.       12.       15.       18.       21.       24.       27.       30.       35.
40.       45.       50.       55.       60.       65.       70.       75.       80.       85.       90.       95.      100.      105.
110.      115.      120.      125.      130.      135.      140.      145.      150.      155.      160.      165.      170.      175.
180.      185.      190.      195.      200.      205.      210.      215.      220.      225.      230.      235.      240.      245.
250.      255.      260.      265.      270.      275.      280.      285.      290.      295.      300.      310.      320.      330.
340.      350.      360.      370.      380.      390.      400.      410.      420.      430.      440.      450.      460.      470.
480.      490.      500.      510.      520.      530.      540.      550.      560.      570.      580.      590.      600.      610.
620.      630.      640.      650.      660.      670.      680.      690.      700.      720.      740.      760.      780.      800.
825.      850.      875.      900.      925.      950.      975.     1000.
    Ac-227          0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
    Ag-108m         0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
    Al-26           0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
    Am-242m         0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
    Am-243          0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
    Ba-133          0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
    Be-10           0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
    Bi-207          0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
    Bi-210m         0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
    Bk-247          0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
    C-14            0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
```

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Ca-41		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Cd-113		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Cd-113m		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Cf-249		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Cf-250		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Cf-251		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Cf-252		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Cl-36		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Cm-243		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Cm-245		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Cm-246		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Cm-247		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Cm-248		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Co-60		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Cs-135		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Cs-137		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Eu-152		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Eu-154		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Eu-155		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Fe-55		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Fe-60		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Gd-148		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
H-3		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Hg-194		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Th-230		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
U-236		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
U-238		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Np-237		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Pu-240		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Pu-241		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Am-241		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Cm-244		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Ra-226		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Ho-166m		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						

I-129		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
K-40		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Mn-53		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Na-22		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Nb-91		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Nb-92		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Nb-93m		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Nb-94		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Ni-59		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Ni-63		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Os-194		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Pa-231		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

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    Pb-202      0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
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    Pb-210      0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
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    Pd-107      0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
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    Pm-145      0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
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    Pm-147      0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
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    Po-208      0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
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    Po-209      0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
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    Pt-193      0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
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PATHRAE-RAD(PC)  Version 2.2d  February 1995
  Date: 11-29-2007
  Time: 13:54:35
EnergySolutions Class A South cell top slope, vertical/vadose, part 2, T27b
*****  Mirror Image of Input Files  *****
-- Input File:  ABCDEF.DAT
EnergySolutions Class A South cell top slope, vertical/vadose, part 2, T27b
118,1.,3.,6.,9.,12.,15.,18.,21.,24.,27.,30.,35.,40.,45.,50.,55.,60.,65.,70.,75.,80.,85.,90.,95.,100.,105.,110.,115.,120.,125.,130.,1
35,0,1
1,2
0,1.,1.,2.76E-03,2.76E-03,3.64,0
1558.,0.100,0,0,0.307,3.34E-02,97.4,0
1,0,0,0,0,0
0,1.,1.,3.64,0,1800.,1.,0,0,0
0,0,0,0.0,1.
0,0,0,0,0,0,0
0,0,0,0,0,0,0,0,0,0,0
0,0
1,0,1,0
0.00276,0.025,0.109,0,0,1.,0,1.,0,0.355

-- Input File:  BRCDCF.DAT
158,Pu-236  0,0,0,0,0,0,0
159,Pu-238  0,0,0,0,0,0,0
160,Pu-239  0,0,0,0,0,0,0
161,Pu-242  0,0,0,0,0,0,0
162,Pu-244  0,0,0,0,0,0,0
163,Ra-228  0,0,0,0,0,0,0
164,Re-187  0,0,0,0,0,0,0
165,Se-79   0,0,0,0,0,0,0
166,Si-32   0,0,0,0,0,0,0
167,Sm-151  0,0,0,0,0,0,0
168,Sn-121m 0,0,0,0,0,0,0
169,Sn-126  0,0,0,0,0,0,0
170,Sr-90   0,0,0,0,0,0,0
171,Tb-157  0,0,0,0,0,0,0
172,Tb-158  0,0,0,0,0,0,0
173,Tc-99   0,0,0,0,0,0,0
174,Te-123  0,0,0,0,0,0,0
175,Th-229  0,0,0,0,0,0,0
176,Th-232  0,0,0,0,0,0,0
177,Ti-44   0,0,0,0,0,0,0
178,Tl-204  0,0,0,0,0,0,0
179,Tm-170  0,0,0,0,0,0,0
180,U-232   0,0,0,0,0,0,0
181,U-233   0,0,0,0,0,0,0
182,U-234   0,0,0,0,0,0,0
183,U-235   0,0,0,0,0,0,0
184,V-50    0,0,0,0,0,0,0
185,Zr-93   0,0,0,0,0,0,0
186,Ks-20   0,0,0,0,0,0,0
187,Ks-21   0,0,0,0,0,0,0
188,Ks-22   0,0,0,0,0,0,0
189,Ks-23   0,0,0,0,0,0,0
190,Ks-24   0,0,0,0,0,0,0
191,Ks-25   0,0,0,0,0,0,0
192,Ks-26   0,0,0,0,0,0,0
-- Input File:  INVNTRY.DAT
158,2.86E+00,9.00E-04,0,0,0,0,0
159,8.77E+01,1.80E-02,0,0,0,0,0
160,2.41E+04,1.80E-02,0,0,0,0,0
161,3.73E+05,1.80E-02,0,0,0,0,0
162,8.08E+07,9.00E-04,0,0,0,0,0
163,5.75E+00,4.90E+08,0,0,0,0,0
164,4.35E+10,3.21E-02,0,0,0,0,0
165,6.50E+04,1.25E+05,0,0,0,0,0
166,1.72E+02,1.17E+08,0,0,0,0,0
167,9.00E+01,4.74E+07,0,0,0,0,0
168,5.50E+01,9.68E+07,0,0,0,0,0
169,1.00E+05,5.11E+04,0,0,0,0,0
170,2.88E+01,4.50E-02,0,0,0,0,0
171,7.10E+01,2.70E+07,0,0,0,0,0
172,1.80E+02,2.70E+07,0,0,0,0,0
173,2.11E+05,3.38E-01,0,0,0,0,0
174,1.00E+13,5.24E-04,0,0,0,0,0
175,7.88E+03,3.83E+05,0,0,0,0,0
176,1.41E+10,1.98E-01,0,0,0,0,0
177,6.30E+01,2.81E+08,0,0,0,0,0
178,3.78E+00,7.92E+02,0,0,0,0,0
179,3.52E-01,7.92E+02,0,0,0,0,0
180,6.89E+01,3.97E+07,0,0,0,0,0
181,1.59E+05,1.35E-01,0,0,0,0,0
182,2.46E+05,1.12E+04,0,0,0,0,0
183,7.04E+08,3.42E-03,0,0,0,0,0
184,1.40E+17,9.20E-08,0,0,0,0,0
185,1.53E+06,4.53E+03,0,0,0,0,0
186,1.00E+00,7.92E+02,0,0,0,0,0
187,1.00E+00,7.92E+02,0,0,0,0,0
188,1.00E+00,7.92E+02,0,0,0,0,0
189,1.00E+00,7.92E+02,0,0,0,0,0
190,4.00E+00,7.92E+02,0,0,0,0,0
191,4.00E+00,7.92E+02,0,0,0,0,0
192,2.00E+00,7.92E+02,0,0,0,0,0
-- Input File:  RQSITE.DAT
158,1.53E-04,10.0,10.0
159,1.53E-04,10.0,10.0
160,1.53E-04,10.0,10.0
161,1.53E-04,10.0,10.0
162,1.53E-04,10.0,10.0
163,1.53E-04,10.0,10.0
164,1.42E-02,0.075,0.075
165,1.48E-03,1.0,1.0
166,4.01E-03,0.35,0.35
167,6.18E-04,2.45,2.45
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 168,3.06E-05,50.0,50.0
 169,3.06E-05,50.0,50.0
 170,1.85E-02,0.05,0.05
 171,2.35E-04,6.5,6.5
 172,2.35E-04,6.5,6.5
 173,1.07E-02,0.11,0.11
 174,1.20E-03,1.25,1.25
 175,1.53E-04,10.0,10.0
 176,1.53E-04,10.0,10.0
 177,1.53E-04,10.0,10.0
 178,8.39E-03,0.15,0.15
 179,2.35E-04,6.5,6.5
 180,2.54E-04,6.0,6.0
 181,2.54E-04,6.0,6.0
 182,2.54E-04,6.0,6.0
 183,2.54E-04,6.0,6.0
 184,1.53E-04,10.0,10.0
 185,1.53E-04,10.0,10.0
 186,4.54E-02,0.001,0.001
 187,3.58E-02,0.01,0.01
 188,1.15E-02,0.1,0.1
 189,1.48E-03,1.0,1.0
 190,3.06E-05,50.0,50.0
 191,1.53E-05,100.0,100.0
 192,1.48E-03,1.0,1.0
 -- Input File:  UPTAKE.DAT
 2.76E-03,3.55E-01,1.558
 0,0,0,0,0
 0,0,0
 0,0,0,0
 0,0,0,0,0
 0,0,0,0,0,730.,0
 158,0.00E+00,0.0,0.0,0,0,0,0
 159,0.00E+00,0.0,0.0,0,0,0,0
 160,0.00E+00,0.0,0.0,0,0,0,0
 161,0.00E+00,0.0,0.0,0,0,0,0
 162,0.00E+00,0.0,0.0,0,0,0,0
 163,0.00E+00,0.0,0.0,0,0,0,0
 164,0.00E+00,0.0,0.0,0,0,0,0
 165,0.00E+00,0.0,0.0,0,0,0,0
 166,0.00E+00,0.0,0.0,0,0,0,0
 167,0.00E+00,0.0,0.0,0,0,0,0
 168,0.00E+00,0.0,0.0,0,0,0,0
 169,0.00E+00,0.0,0.0,0,0,0,0
 170,0.00E+00,0.0,0.0,0,0,0,0
 171,0.00E+00,0.0,0.0,0,0,0,0
 172,0.00E+00,0.0,0.0,0,0,0,0
 173,0.00E+00,0.0,0.0,0,0,0,0
 174,0.00E+00,0.0,0.0,0,0,0,0
 175,0.00E+00,0.0,0.0,0,0,0,0
 176,0.00E+00,0.0,0.0,0,0,0,0
 177,0.00E+00,0.0,0.0,0,0,0,0
 178,0.00E+00,0.0,0.0,0,0,0,0
 179,0.00E+00,0.0,0.0,0,0,0,0
 180,0.00E+00,0.0,0.0,0,0,0,0
 181,0.00E+00,0.0,0.0,0,0,0,0
 182,0.00E+00,0.0,0.0,0,0,0,0
 183,0.00E+00,0.0,0.0,0,0,0,0
 184,0.00E+00,0.0,0.0,0,0,0,0
 185,0.00E+00,0.0,0.0,0,0,0,0
 186,0.00E+00,0.0,0.0,0,0,0,0
 187,0.00E+00,0.0,0.0,0,0,0,0
 188,0.00E+00,0.0,0.0,0,0,0,0
 189,0.00E+00,0.0,0.0,0,0,0,0
 190,0.00E+00,0.0,0.0,0,0,0,0
 191,0.00E+00,0.0,0.0,0,0,0,0
 192,0.00E+00,0.0,0.0,0,0,0,0
1
                       TOTAL EQUIVALENT UPTAKE FACTORS FOR PATHRAE
               UT(J,1)    UT(J,2)    UT(J,3)    UT(J,4)    UT(J,5)    UT(J,6)
                RIVER      WELL      EROSION    BATHTUB   SPILLAGE     FOOD
 NUCLIDE        L/YR       L/YR       L/YR       L/YR       L/YR       KG/YR
   Pu-236     0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Pu-238     0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Pu-239     0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   •
   •
   •
   Ks-24      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Ks-25      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Ks-26      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
 **********  PATHRAE INPUT SUMMARY  **********
 THERE ARE 80 ISOTOPES IN THE DOSE FACTOR LIBRARY
 NUMBER OF TIMES FOR CALCULATION IS118
 YEARS TO BE CALCULATED ARE ...
      1.00      3.00      6.00      9.00     12.00
     15.00     18.00     21.00     24.00     27.00
     30.00     35.00     40.00     45.00     50.00
     55.00     60.00     65.00     70.00     75.00
     80.00     85.00     90.00     95.00    100.00
    105.00    110.00    115.00    120.00    125.00
    130.00    135.00    140.00    145.00    150.00
    155.00    160.00    165.00    170.00    175.00
    180.00    185.00    190.00    195.00    200.00
    205.00    210.00    215.00    220.00    225.00
    230.00    235.00    240.00    245.00    250.00
    255.00    260.00    265.00    270.00    275.00
    280.00    285.00    290.00    295.00    300.00
    310.00    320.00    330.00    340.00    350.00
    360.00    370.00    380.00    390.00    400.00
    410.00    420.00    430.00    440.00    450.00
    460.00    470.00    480.00    490.00    500.00
    510.00    520.00    530.00    540.00    550.00
    560.00    570.00    580.00    590.00    600.00
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   610.00   620.00   630.00   640.00   650.00
   660.00   670.00   680.00   690.00   700.00
   720.00   740.00   760.00   780.00   800.00
   825.00   850.00   875.00   900.00   925.00
   950.00   975.00  1000.00
THERE ARE  35 ISOTOPES IN THE INVENTORY FILE
THE VALUE OF IFLAG IS 0
NUMBER OF PATHWAYS IS  1
          PATHWAY              TYPE OF USAGE
                             FOR UPTAKE FACTORS
   1  GROUNDWATER TO RIVER           2
TIME OF OPERATION OF WASTE FACILITY IN YEARS                   0.
LENGTH OF REPOSITORY (M)                                       1.
WIDTH OF REPOSITORY (M)                                        1.
RIVER FLOW RATE (M**3/YR)                                      2.76E-03
STREAM FLOW RATE (M**3/YR)                                     2.76E-03
DISTANCE TO RIVER (M)                                          4.
OPERATIONAL SPILLAGE FRACTION                                  0.00E+00
DENSITY OF AQUIFER (KG/M**3)                                1558.
LONGITUDINAL DISPERSIVITY (M)                                  1.00E-01
LATERAL DISPERSION COEFFICIENT -- Y AXIS (M**2/YR)             0.00E+00
NUMBER OF MESH POINTS FOR DISPERSION CALCULATION               1
FLAG FOR GAMMA PATHWAY OPTIONS                                 0
FLAG FOR GAMMA BUILDUP CALCULATION                             0
FLAG FOR ATMOSPHERIC PATHWAY                                   0
COVER THICKNESS OVER WASTE (M)                                  .00
THICKNESS OF WASTE IN PITS (M)                                 1.00
TOTAL WASTE VOLUME (M**3)                                      1.000E+00
DISTANCE TO WELL -- X COORDINATE (M)                           4.
DISTANCE TO WELL -- Y COORDINATE (M)                           0.
DENSITY OF WASTE (KG/M**3)                                  1800.
FRACTION OF FOOD CONSUMED THAT IS GROWN ON SITE                1.000
FRACTION OF YEAR SPENT IN DIRECT RADIATION FIELD                .000
DEPTH OF PLANT ROOT ZONE (M)                                    .000
AREAL DENSITY OF PLANTS (KG/M**2)                               .000
AVERAGE DUST LOADING IN AIR (KG/M**3)                          0.00E+00
ANNUAL ADULT BREATHING RATE (M**3/YR)                          0.
FRACTION OF YEAR EXPOSED TO DUST                                .000
CANISTER LIFETIME (YEARS)                                      0.
INVENTORY SCALING FACTOR                                       1.00E+00
HEIGHT OF ROOMS IN RECLAIMER HOUSE (CM)                        0.
AIR CHANGE RATE IN RECLAIMER HOUSE (CHANGES/SEC)               0.00E+00
RADON EMANATING POWER OF THE WASTE                             0.00E+00
DIFFUSION COEFF. OF RADON IN WASTE (CM**2/SEC)                 0.00E+00
DIFFUSION COEFF. OF RN IN CONCRETE (CM**2/SEC)                 0.00E+00
THICKNESS OF CONCRETE SLAB FLOOR (CM)                           .0
DIFFUSION COEFF. OF RADON IN COVER (CM**2/SEC)                 0.00E+00
ATMOSPHERIC STABILITY CLASS                                    0
AVERAGE WIND SPEED (M/S)                                        .00
FRACTION OF TIME WIND BLOWS TOWARD RECEPTOR                     .0000
RECEPTOR DISTANCE FOR ATMOSPHERIC PATHWAY (M)                   .0
DUST RESUSPENSION RATE FOR OFFSITE TRANSPORT (M**3/S)          0.00E+00
DEPOSITION VELOCITY (M/S)                                       .0000
STACK HEIGHT (M)                                                .0
STACK INSIDE DIAMETER (M)                                       .00
STACK GAS VELOCITY (M/S)                                        .0
HEAT EMISSION RATE FROM BURNING (CAL/S)                        0.00E+00
DECAY CHAIN FLAGS                              0   0   0   0   0   0   0
FLAG FOR INPUT SUMMARY PRINTOUT                                1
FLAG FOR DIRECTION OF TRENCH FILLING                           1
FLAG FOR GROUNDWATER PATHWAY OPTIONS                           0
AMOUNT OF WATER PERCOLATING THROUGH WASTE ANNUALLY (M)         2.76E-03
DEGREE OF SOIL SATURATION                                       .307
RESIDUAL SOIL SATURATION                                        .033
PERMEABILITY OF VERTICAL ZONE (M/YR)                          97.40
SOIL NUMBER                                                     .000
POROSITY OF AQUIFER                                             .11
POROSITY OF UNSATURATED ZONE                                    .36
DISTANCE FROM AQUIFER TO WASTE (M)                              .0
AVERAGE VERTICAL GROUNDWATER VELOCITY (M/YR)                   2.53E-02
HORIZONTAL VELOCITY OF AQUIFER (M/YR)                           .0
LENGTH OF PERFORATED WELL CASING (M)                           1.000
SURFACE EROSION RATE (M/YR)                                    0.000E+00
LEACH RATE SCALING FACTOR                                      1.000E+00
ANNUAL RUNOFF OF PRECIPITATION (M)                             0.00E+00
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NUCLIDE	INGESTION DOSE FACTORS (MREM/PCI)	INHALATION DOSE FACTORS (MREM/PCI)	DIRECT GAMMA DOSE FACTORS (MREM-M2/PCI-YR)	HALF LIFE (YR)
Pu-236	0.000E+00	0.000E+00	0.000E+00	2.860E+00
Pu-238	0.000E+00	0.000E+00	0.000E+00	8.770E+01
Pu-239	0.000E+00	0.000E+00	0.000E+00	2.410E+04
Pu-242	0.000E+00	0.000E+00	0.000E+00	3.730E+05
Pu-244	0.000E+00	0.000E+00	0.000E+00	8.080E+07
Ra-228	0.000E+00	0.000E+00	0.000E+00	5.750E+00
Re-187	0.000E+00	0.000E+00	0.000E+00	4.350E+10
Se-79	0.000E+00	0.000E+00	0.000E+00	6.500E+04
Si-32	0.000E+00	0.000E+00	0.000E+00	1.720E+02
Sm-151	0.000E+00	0.000E+00	0.000E+00	9.000E+01
Sn-121m	0.000E+00	0.000E+00	0.000E+00	5.500E+01
Sn-126	0.000E+00	0.000E+00	0.000E+00	1.000E+05
Sr-90	0.000E+00	0.000E+00	0.000E+00	2.880E+01
Tb-157	0.000E+00	0.000E+00	0.000E+00	7.100E+01
Tb-158	0.000E+00	0.000E+00	0.000E+00	1.800E+02
Tc-99	0.000E+00	0.000E+00	0.000E+00	2.110E+05
Te-123	0.000E+00	0.000E+00	0.000E+00	1.000E+13
Th-229	0.000E+00	0.000E+00	0.000E+00	7.880E+03
Th-232	0.000E+00	0.000E+00	0.000E+00	1.410E+10
Ti-44	0.000E+00	0.000E+00	0.000E+00	6.300E+01
Tl-204	0.000E+00	0.000E+00	0.000E+00	3.780E+00
Tm-170	0.000E+00	0.000E+00	0.000E+00	3.520E-01
U-232	0.000E+00	0.000E+00	0.000E+00	6.890E+01
U-233	0.000E+00	0.000E+00	0.000E+00	1.590E+05
U-234	0.000E+00	0.000E+00	0.000E+00	2.460E+05
U-235	0.000E+00	0.000E+00	0.000E+00	7.040E+08
V-50	0.000E+00	0.000E+00	0.000E+00	1.400E+17

Zr-93	0.000E+00	0.000E+00	0.000E+00	1.530E+06
Ks-20	0.000E+00	0.000E+00	0.000E+00	1.000E+00
Ks-21	0.000E+00	0.000E+00	0.000E+00	1.000E+00
Ks-22	0.000E+00	0.000E+00	0.000E+00	1.000E+00
Ks-23	0.000E+00	0.000E+00	0.000E+00	1.000E+00
Ks-24	0.000E+00	0.000E+00	0.000E+00	4.000E+00
Ks-25	0.000E+00	0.000E+00	0.000E+00	4.000E+00
Ks-26	0.000E+00	0.000E+00	0.000E+00	2.000E+00

NUCLIDE	VOLATILITY FRACTION	GAMMA ENERGY (MEV)	GAMMA ATTENUATION (1/M)
Pu-236	0.000E+00	0.000E+00	0.000E+00
Pu-238	0.000E+00	0.000E+00	0.000E+00

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Ks-24	0.000E+00	0.000E+00	0.000E+00
Ks-25	0.000E+00	0.000E+00	0.000E+00
Ks-26	0.000E+00	0.000E+00	0.000E+00

NUCLIDE	INPUT LEACH RATE (1/YR)	FINAL LEACH RATE (1/YR)	SOLUBILITY (MOLE/L)	INPUT INVENTORY (CI)
Pu-236	1.530E-04	1.530E-04	0.000E+00	9.000E-04
Pu-238	1.530E-04	1.530E-04	0.000E+00	1.800E-02
Pu-239	1.530E-04	1.530E-04	0.000E+00	1.800E-02
Pu-242	1.530E-04	1.530E-04	0.000E+00	1.800E-02
Pu-244	1.530E-04	1.530E-04	0.000E+00	9.000E-04
Ra-228	1.530E-04	1.530E-04	0.000E+00	4.900E+08
Re-187	1.420E-02	1.420E-02	0.000E+00	3.210E-02
Se-79	1.480E-03	1.480E-03	0.000E+00	1.250E+05
Si-32	4.010E-03	4.010E-03	0.000E+00	1.170E+08
Sm-151	6.180E-04	6.180E-04	0.000E+00	4.740E+07
Sn-121m	3.060E-05	3.060E-05	0.000E+00	9.680E+07
Sn-126	3.060E-05	3.060E-05	0.000E+00	5.110E+04
Sr-90	1.850E-02	1.850E-02	0.000E+00	4.500E-02
Tb-157	2.350E-04	2.350E-04	0.000E+00	2.700E+07
Tb-158	2.350E-04	2.350E-04	0.000E+00	2.700E+07
Tc-99	1.070E-02	1.070E-02	0.000E+00	3.380E-01
Te-123	1.200E-03	1.200E-03	0.000E+00	5.240E-04
Th-229	1.530E-04	1.530E-04	0.000E+00	3.830E+05
Th-232	1.530E-04	1.530E-04	0.000E+00	1.980E-01
Ti-44	1.530E-04	1.530E-04	0.000E+00	2.810E+08
Tl-204	8.390E-03	8.390E-03	0.000E+00	7.920E+02
Tm-170	2.350E-04	2.350E-04	0.000E+00	7.920E+02
U-232	2.540E-04	2.540E-04	0.000E+00	3.970E+07
U-233	2.540E-04	2.540E-04	0.000E+00	1.350E-01
U-234	2.540E-04	2.540E-04	0.000E+00	1.120E+04
U-235	2.540E-04	2.540E-04	0.000E+00	3.420E-03
V-50	1.530E-04	1.530E-04	0.000E+00	9.200E-08
Zr-93	1.530E-04	1.530E-04	0.000E+00	4.530E+03
Ks-20	4.540E-02	4.540E-02	0.000E+00	7.920E+02
Ks-21	3.580E-02	3.580E-02	0.000E+00	7.920E+02
Ks-22	1.150E-02	1.150E-02	0.000E+00	7.920E+02
Ks-23	1.480E-03	1.480E-03	0.000E+00	7.920E+02
Ks-24	3.060E-05	3.060E-05	0.000E+00	7.920E+02
Ks-25	1.530E-05	1.530E-05	0.000E+00	7.920E+02
Ks-26	1.480E-03	1.480E-03	0.000E+00	7.920E+02

NUCLIDE	AQUIFER SORPTION	AQUIFER RETARDATION	VERTICAL SORPTION	VERTICAL RETARDATION
Pu-236	1.000E+01	1.439E+02	1.000E+01	1.440E+02
Pu-238	1.000E+01	1.439E+02	1.000E+01	1.440E+02
Pu-239	1.000E+01	1.439E+02	1.000E+01	1.440E+02
Pu-242	1.000E+01	1.439E+02	1.000E+01	1.440E+02
Pu-244	1.000E+01	1.439E+02	1.000E+01	1.440E+02
Ra-228	1.000E+01	1.439E+02	1.000E+01	1.440E+02
Re-187	7.500E-02	2.072E+00	7.500E-02	2.072E+00
Se-79	1.000E+00	1.529E+01	1.000E+00	1.530E+01
Si-32	3.500E-01	6.003E+00	3.500E-01	6.003E+00
Sm-151	2.450E+00	3.602E+01	2.450E+00	3.602E+01
Sn-121m	5.000E+01	7.157E+02	5.000E+01	7.158E+02
Sn-126	5.000E+01	7.157E+02	5.000E+01	7.158E+02
Sr-90	5.000E-02	1.715E+00	5.000E-02	1.715E+00
Tb-157	6.500E+00	9.391E+01	6.500E+00	9.392E+01
Tb-158	6.500E+00	9.391E+01	6.500E+00	9.392E+01
Tc-99	1.100E-01	2.572E+00	1.100E-01	2.573E+00
Te-123	1.250E+00	1.887E+01	1.250E+00	1.887E+01
Th-229	1.000E+01	1.439E+02	1.000E+01	1.440E+02
Th-232	1.000E+01	1.439E+02	1.000E+01	1.440E+02
Ti-44	1.000E+01	1.439E+02	1.000E+01	1.440E+02
Tl-204	1.500E-01	3.144E+00	1.500E-01	3.144E+00
Tm-170	6.500E+00	9.391E+01	6.500E+00	9.392E+01
U-232	6.000E+00	8.676E+01	6.000E+00	8.677E+01
U-233	6.000E+00	8.676E+01	6.000E+00	8.677E+01
U-234	6.000E+00	8.676E+01	6.000E+00	8.677E+01
U-235	6.000E+00	8.676E+01	6.000E+00	8.677E+01
V-50	1.000E+01	1.439E+02	1.000E+01	1.440E+02
Zr-93	1.000E+01	1.439E+02	1.000E+01	1.440E+02
Ks-20	1.000E-03	1.014E+00	1.000E-03	1.014E+00
Ks-21	1.000E-02	1.143E+00	1.000E-02	1.143E+00
Ks-22	1.000E-01	2.429E+00	1.000E-01	2.430E+00
Ks-23	1.000E+00	1.529E+01	1.000E+00	1.530E+01
Ks-24	5.000E+01	7.157E+02	5.000E+01	7.158E+02
Ks-25	1.000E+02	1.430E+03	1.000E+02	1.431E+03
Ks-26	1.000E+00	1.529E+01	1.000E+00	1.530E+01

BIOACCUMULATION FACTORS

NUCLIDE	SOIL-PLANT Bv	SOIL-PLANT Br	FORAGE-MILK Fm (D/L)	FORAGE-MEAT Ff (D/KG)
Pu-236	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pu-238	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pu-239	0.000E+00	0.000E+00	0.000E+00	0.000E+00

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    Ks-25              0.000E+00         0.000E+00         0.000E+00         0.000E+00
    Ks-26              0.000E+00         0.000E+00         0.000E+00         0.000E+00
                                                              PATHWAY  1
                                                         GROUNDWATER TO RIVER
********* NUCLIDE DOSES (mrem/yr) ********
  NUCLIDE/TIME         1.          3.         6.         9.        12.        15.        18.        21.        24.        27.        30.        35.
40.       45.       50.       55.       60.       65.       70.       75.       80.       85.       90.       95.       100.      105.
110.      115.      120.      125.      130.      135.      140.      145.      150.      155.      160.      165.      170.      175.
180.      185.      190.      195.      200.      205.      210.      215.      220.      225.      230.      235.      240.      245.
250.      255.      260.      265.      270.      275.      280.      285.      290.      295.      300.      310.      320.      330.
340.      350.      360.      370.      380.      390.      400.      410.      420.      430.      440.      450.      460.      470.
480.      490.      500.      510.      520.      530.      540.      550.      560.      570.      580.      590.      600.      610.
620.      630.      640.      650.      660.      670.      680.      690.      700.      720.      740.      760.      780.      800.
825.      850.      875.      900.      925.      950.      975.      1000.
     Pu-236            0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
     Pu-238            0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
     Pu-239            0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
     Pu-242            0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
     Pu-244            0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
     Ra-228            0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
     Re-187            0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
     Se-79             0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
     Si-32             0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
     Sm-151            0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
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0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
U-232		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
U-233		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
U-234		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
U-235		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
V-50		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Zr-93		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Ks-20		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Ks-21		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Ks-22		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Ks-23		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Ks-24		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Ks-25		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

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0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
    Ks-26         0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
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PATHRAE-RAD(PC)  Version 2.2d  February 1995
  Date: 12- 6-2007
  Time: 19: 3: 5
EnergySolutions Class A South cell side slope, vertical/vadose, lim conc, part 1
*****  Mirror Image of Input Files  *****
-- Input File:  ABCDEF.DAT
EnergySolutions Class A South cell side slope, vertical/vadose, lim conc, part 1, S28La
118,1.,3.,6.,9.,12.,15.,18.,21.,24.,27.,30.,35.,40.,45.,50.,55.,60.,65.,70.,75.,80.,85.,90.,95.,100.,105.,110.,115.,120.,125.,130.,1
65,0,1
1,2
0,1.,1.,2.86E-03,2.86E-03,3.64,0
1558.,0.100,0,0,0.308,3.34E-02,97.4,0
1,0,0,0,0,0
0,1.,1.,3.64,0,1800.,1.,0,0,0
0,0,0,0.0,1.
0,0,0,0,0,0,0
0,0,0,0,0,0,0,0,0,0,0
0,0,0,1,0,0,1
1,0,1,0
0.00286,0.026,0.109,0,0,1.,0,1.,0,0.355

-- Input File:  BRCDCF.DAT
 101,Ac-227  0,0,0,0,0,0,0
 102,Ag-108m 0,0,0,0,0,0,0
 103,Al-26   0,0,0,0,0,0,0
 48,Am-241   0,0,0,0,0,0,0
 104,Am-242m 0,0,0,0,0,0,0
 105,Am-243  0,0,0,0,0,0,0
 106,Ba-133  0,0,0,0,0,0,0
 107,Be-10   0,0,0,0,0,0,0
 108,Bi-207  0,0,0,0,0,0,0
 109,Bi-210m 0,0,0,0,0,0,0
 110,Bk-247  0,0,0,0,0,0,0
 111,C-14    0,0,0,0,0,0,0
 112,Ca-41   0,0,0,0,0,0,0
 113,Cd-113  0,0,0,0,0,0,0
 114,Cd-113m 0,0,0,0,0,0,0
 115,Cf-249  0,0,0,0,0,0,0
 116,Cf-250  0,0,0,0,0,0,0
 117,Cf-251  0,0,0,0,0,0,0
 118,Cf-252  0,0,0,0,0,0,0
 119,Cl-36   0,0,0,0,0,0,0
 120,Cm-243  0,0,0,0,0,0,0
 50,Cm-244   0,0,0,0,0,0,0
 121,Cm-245  0,0,0,0,0,0,0
 122,Cm-246  0,0,0,0,0,0,0
 123,Cm-247  0,0,0,0,0,0,0
 124,Cm-248  0,0,0,0,0,0,0
 125,Co-60   0,0,0,0,0,0,0
 126,Cs-135  0,0,0,0,0,0,0
 127,Cs-137  0,0,0,0,0,0,0
 128,Eu-152  0,0,0,0,0,0,0
 129,Eu-154  0,0,0,0,0,0,0
 130,Eu-155  0,0,0,0,0,0,0
 131,Fe-55   0,0,0,0,0,0,0
 132,Fe-60   0,0,0,0,0,0,0
 133,Gd-148  0,0,0,0,0,0,0
 134,H-3     0,0,0,0,0,0,0
 135,Hg-194  0,0,0,0,0,0,0
 136,Ho-166m 0,0,0,0,0,0,0
 137,I-129   0,0,0,0,0,0,0
 138,K-40    0,0,0,0,0,0,0
 139,Mn-53   0,0,0,0,0,0,0
 140,Na-22   0,0,0,0,0,0,0
 141,Nb-91   0,0,0,0,0,0,0
 142,Nb-92   0,0,0,0,0,0,0
 143,Nb-93m  0,0,0,0,0,0,0
 144,Nb-94   0,0,0,0,0,0,0
 146,Ni 59   0,0,0,0,0,0,0
 147,Ni-63   0,0,0,0,0,0,0
 42,Np-237   0,0,0,0,0,0,0
 148,Os-194  0,0,0,0,0,0,0
 149,Pa-231  0,0,0,0,0,0,0
 150,Pb-202  0,0,0,0,0,0,0
 151,Pb-210  0,0,0,0,0,0,0
 152,Pd-107  0,0,0,0,0,0,0
 153,Pm-145  0,0,0,0,0,0,0
 154,Pm-147  0,0,0,0,0,0,0
 155,Po-208  0,0,0,0,0,0,0
 156,Po-209  0,0,0,0,0,0,0
 157,Pt-193  0,0,0,0,0,0,0
 45,Pu-240   0,0,0,0,0,0,0
 46,Pu-241   0,0,0,0,0,0,0
 55,Ra-226   0,0,0,0,0,0,0
 36,Th-230   0,0,0,0,0,0,0
 40,U-236    0,0,0,0,0,0,0
 41,U-238    0,0,0,0,0,0,0
 -- Input File:  INVNTRY.DAT
 101,2.18E+01,1.30E+08,0,0,0,0,0
 102,4.18E+02,4.69E+07,0,0,0,0,0
 103,7.40E+05,3.72E-02,0,0,0,0,0
 48,4.32E+02,1.80E-02,0,0,0,0,0
 104,1.41E+02,1.80E-02,0,0,0,0,0
 105,7.37E+03,1.80E-02,0,0,0,0,0
 106,1.05E+01,4.61E+08,0,0,0,0,0
 107,1.51E+06,3.96E+04,0,0,0,0,0
 108,3.16E+01,9.66E+07,0,0,0,0,0
 109,3.04E+06,1.02E+03,0,0,0,0,0
 110,1.40E+03,1.63E-10,0,0,0,0,0
 111,5.73E+03,1.30E+01,0,0,0,0,0
 112,1.03E+05,2.74E-06,0,0,0,0,0
 113,9.30E+15,7.75E-07,0,0,0,0,0
 114,1.41E+01,4.04E+08,0,0,0,0,0
 115,3.51E+02,1.80E-02,0,0,0,0,0
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116,1.31E+01,9.00E-04,0,0,0,0,0
117,8.98E+02,1.80E-02,0,0,0,0,0
118,2.65E+00,7.92E+02,0,0,0,0,0
119,3.01E+05,4.83E-07,0,0,0,0,0
120,2.91E+01,1.80E-02,0,0,0,0,0
50,1.81E+01,1.80E-02,0,0,0,0,0
121,8.50E+03,1.80E-02,0,0,0,0,0
122,4.73E+03,1.80E-02,0,0,0,0,0
123,1.56E+07,1.80E-02,0,0,0,0,0
124,3.40E+05,1.80E-02,0,0,0,0,0
125,5.27E+00,7.92E+02,0,0,0,0,0
126,2.30E+06,2.07E+03,0,0,0,0,0
127,3.01E+01,1.13E+00,0,0,0,0,0
128,1.35E+01,3.11E+08,0,0,0,0,0
129,8.59E+00,4.87E+08,0,0,0,0,0
130,4.76E+00,7.92E+02,0,0,0,0,0
131,2.73E+00,7.92E+02,0,0,0,0,0
132,1.50E+06,7.15E+03,0,0,0,0,0
133,7.46E+01,5.80E+07,0,0,0,0,0
134,1.23E+01,4.50E+01,0,0,0,0,0
135,4.44E+02,6.38E+06,0,0,0,0,0
136,1.20E+03,3.24E+06,0,0,0,0,0
137,1.57E+07,9.00E-03,0,0,0,0,0
138,1.28E+09,1.26E+01,0,0,0,0,0
139,3.74E+06,3.24E+03,0,0,0,0,0
140,2.60E+00,7.92E+02,0,0,0,0,0
141,6.80E+02,1.04E+07,0,0,0,0,0
142,3.47E+07,2.02E+02,0,0,0,0,0
143,1.61E+01,4.74E+08,0,0,0,0,0
144,2.03E+04,2.34E-02,0,0,0,0,0
146,7.60E+04,2.52E+01,0,0,0,0,0
147,1.00E+02,3.96E+00,0,0,0,0,0
42,2.14E+06,1.80E-02,0,0,0,0,0
148,6.00E+00,5.53E+08,0,0,0,0,0
149,3.28E+04,8.46E+04,0,0,0,0,0
150,5.25E+04,6.12E+03,0,0,0,0,0
151,2.23E+01,1.37E+08,0,0,0,0,0
152,6.50E+06,9.18E+02,0,0,0,0,0
153,1.77E+01,2.52E+08,0,0,0,0,0
154,2.62E+00,7.92E+02,0,0,0,0,0
155,2.90E+00,7.92E+02,0,0,0,0,0
156,1.02E+02,3.02E+07,0,0,0,0,0
157,5.00E+01,6.66E+07,0,0,0,0,0
55,1.60E+03,1.80E-02,0,0,0,0,0
45,6.56E+03,1.80E-02,0,0,0,0,0
46,1.44E+01,6.30E-01,0,0,0,0,0
36,7.54E+04,3.71E+04,0,0,0,0,0
40,2.34E+07,1.16E+02,0,0,0,0,0
41,4.47E+09,6.05E 01,0,0,0,0,0
-- Input File:  RQSITE.DAT
101,3.51E-04,4.5,4.5
102,5.81E-04,2.7,2.7
103,1.06E-04,15.0,15.0
48,1.54E-03,1.0,1.0
104,1.54E-03,1.0,1.0
105,1.54E-03,1.0,1.0
106,1.58E-04,10.0,10.0
107,6.27E-04,2.5,2.5
108,1.54E-03,1.0,1.0
109,1.54E-03,1.0,1.0
110,4.70E-02,0.001,0.001
111,1.86E-04,8.52,8.52
112,1.92E-02,0.05,0.05
113,1.54E-03,1.0,1.0
114,1.54E-03,1.0,1.0
115,7.82E-04,2.0,2.0
116,7.82E-04,2.0,2.0
117,7.82E-04,2.0,2.0
118,7.82E-04,2.0,2.0
119,4.50E-02,0.0025,0.0025
120,1.70E-05,93.3,93.3
50,1.70E-05,93.3,93.3
121,1.70E-05,93.3,93.3
122,1.70E-05,93.3,93.3
123,1.70E-05,93.3,93.3
124,1.70E-05,93.3,93.3
125,4.29E-06,370.0,370.0
126,1.19E-05,133.0,133.0
127,1.19E-05,133.0,133.0
128,2.43E-04,6.5,6.5
129,2.43E-04,6.5,6.5
130,2.43E-04,6.5,6.5
131,1.11E-03,1.4,1.4
132,1.11E-03,1.4,1.4
133,2.43E-04,6.5,6.5
134,2.18E-02,0.04,0.04
135,1.58E-04,10.0,10.0
136,6.27E-04,2.5,2.5
137,1.04E-02,0.12,0.12
138,8.69E-03,0.15,0.15
139,2.47E-04,6.4,6.4
140,1.54E-03,1.0,1.0
141,9.73E-04,1.6,1.6
142,9.73E-04,1.6,1.6
143,9.73E-04,1.6,1.6
144,9.73E-04,1.6,1.6
146,1.58E-04,10.0,10.0
147,1.58E-04,10.0,10.0
42,5.24E-04,3.0,3.0
148,3.51E-04,4.5,4.5
149,2.87E-04,5.5,5.5
150,8.35E-05,19.0,19.0
151,8.35E-05,19.0,19.0
152,2.73E-03,0.55,0.55
153,2.43E-04,6.5,6.5
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154,2.43E-04,6.5,6.5
155,1.76E-04,9.0,9.0
156,1.76E-04,9.0,9.0
157,1.70E-03,0.9,0.9
45,1.58E-04,10.0,10.0
46,1.58E-04,10.0,10.0
55,1.58E-04,9.99,9.99
36,1.58E-04,10.0,10.0
40,2.63E-04,6.0,6.0
41,2.63E-04,6.0,6.0

-- Input File:  UPTAKE.DAT
2.86E-03,3.55E-01,1.558
0,0,0,0,0
0,0,0
0,0,0,0
0,0,0,0,0
0,0,0,0,0,730.,0
101,0.00E+00,0.0,0.0,0,0,0,0
102,0.00E+00,0.0,0.0,0,0,0,0
103,0.00E+00,0.0,0.0,0,0,0,0
48,0.00E+00,0.0,0.0,0,0,0,0
104,0.00E+00,0.0,0.0,0,0,0,0
105,0.00E+00,0.0,0.0,0,0,0,0
106,0.00E+00,0.0,0.0,0,0,0,0
107,0.00E+00,0.0,0.0,0,0,0,0
108,0.00E+00,0.0,0.0,0,0,0,0
109,0.00E+00,0.0,0.0,0,0,0,0
110,0.00E+00,0.0,0.0,0,0,0,0
111,0.00E+00,0.0,0.0,0,0,0,0
112,0.00E+00,0.0,0.0,0,0,0,0
113,0.00E+00,0.0,0.0,0,0,0,0
114,0.00E+00,0.0,0.0,0,0,0,0
115,0.00E+00,0.0,0.0,0,0,0,0
116,0.00E+00,0.0,0.0,0,0,0,0
117,0.00E+00,0.0,0.0,0,0,0,0
118,0.00E+00,0.0,0.0,0,0,0,0
119,0.00E+00,0.0,0.0,0,0,0,0
120,0.00E+00,0.0,0.0,0,0,0,0
50,0.00E+00,0.0,0.0,0,0,0,0
121,0.00E+00,0.0,0.0,0,0,0,0
122,0.00E+00,0.0,0.0,0,0,0,0
123,0.00E+00,0.0,0.0,0,0,0,0
124,0.00E+00,0.0,0.0,0,0,0,0
125,0.00E+00,0.0,0.0,0,0,0,0
126,0.00E+00,0.0,0.0,0,0,0,0
127,0.00E+00,0.0,0.0,0,0,0,0
128,0.00E+00,0.0,0.0,0,0,0,0
129,0.00E+00,0.0,0.0,0,0,0,0
130,0.00E+00,0.0,0.0,0,0,0,0
131,0.00E+00,0.0,0.0,0,0,0,0
132,0.00E+00,0.0,0.0,0,0,0,0
133,0.00E+00,0.0,0.0,0,0,0,0
134,0.00E+00,0.0,0.0,0,0,0,0
135,0.00E+00,0.0,0.0,0,0,0,0
136,0.00E+00,0.0,0.0,0,0,0,0
137,0.00E+00,0.0,0.0,0,0,0,0
138,0.00E+00,0.0,0.0,0,0,0,0
139,0.00E+00,0.0,0.0,0,0,0,0
140,0.00E+00,0.0,0.0,0,0,0,0
141,0.00E+00,0.0,0.0,0,0,0,0
142,0.00E+00,0.0,0.0,0,0,0,0
143,0.00E+00,0.0,0.0,0,0,0,0
144,0.00E+00,0.0,0.0,0,0,0,0
146,0.00E+00,0.0,0.0,0,0,0,0
147,0.00E+00,0.0,0.0,0,0,0,0
42,0.00E+00,0.0,0.0,0,0,0,0
148,0.00E+00,0.0,0.0,0,0,0,0
149,0.00E+00,0.0,0.0,0,0,0,0
150,0.00E+00,0.0,0.0,0,0,0,0
151,0.00E+00,0.0,0.0,0,0,0,0
152,0.00E+00,0.0,0.0,0,0,0,0
153,0.00E+00,0.0,0.0,0,0,0,0
154,0.00E+00,0.0,0.0,0,0,0,0
155,0.00E+00,0.0,0.0,0,0,0,0
156,0.00E+00,0.0,0.0,0,0,0,0
157,0.00E+00,0.0,0.0,0,0,0,0
45,0.00E+00,0.0,0.0,0,0,0,0
46,0.00E+00,0.0,0.0,0,0,0,0
55,0.00E+00,0.0,0.0,0,0,0,0
36,0.00E+00,0.0,0.0,0,0,0,0
40,0.00E+00,0.0,0.0,0,0,0,0
41,0.00E+00,0.0,0.0,0,0,0,0
1
                        TOTAL EQUIVALENT UPTAKE FACTORS FOR PATHRAE
              UT(J,1)    UT(J,2)    UT(J,3)    UT(J,4)    UT(J,5)    UT(J,6)
               RIVER      WELL      EROSION    BATHTUB   SPILLAGE     FOOD
NUCLIDE        L/YR       L/YR       L/YR       L/YR       L/YR       KG/YR
  Ac-227     0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Ag-108m    0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  •
  •
  •
  Po-209     0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Pt-193     0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
**********  PATHRAE INPUT SUMMARY  **********
THERE ARE 80 ISOTOPES IN THE DOSE FACTOR LIBRARY
NUMBER OF TIMES FOR CALCULATION IS118
YEARS TO BE CALCULATED ARE ...
     1.00      3.00      6.00      9.00     12.00
    15.00     18.00     21.00     24.00     27.00
    30.00     35.00     40.00     45.00     50.00
    55.00     60.00     65.00     70.00     75.00
    80.00     85.00     90.00     95.00    100.00
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    105.00    110.00    115.00    120.00    125.00
    130.00    135.00    140.00    145.00    150.00
    155.00    160.00    165.00    170.00    175.00
    180.00    185.00    190.00    195.00    200.00
    205.00    210.00    215.00    220.00    225.00
    230.00    235.00    240.00    245.00    250.00
    255.00    260.00    265.00    270.00    275.00
    280.00    285.00    290.00    295.00    300.00
    310.00    320.00    330.00    340.00    350.00
    360.00    370.00    380.00    390.00    400.00
    410.00    420.00    430.00    440.00    450.00
    460.00    470.00    480.00    490.00    500.00
    510.00    520.00    530.00    540.00    550.00
    560.00    570.00    580.00    590.00    600.00
    610.00    620.00    630.00    640.00    650.00
    660.00    670.00    680.00    690.00    700.00
    720.00    740.00    760.00    780.00    800.00
    825.00    850.00    875.00    900.00    925.00
    950.00    975.00   1000.00
THERE ARE  65 ISOTOPES IN THE INVENTORY FILE
THE VALUE OF IFLAG IS 0
NUMBER OF PATHWAYS IS  1
           PATHWAY            TYPE OF USAGE
                            FOR UPTAKE FACTORS
   1  GROUNDWATER TO RIVER          2
TIME OF OPERATION OF WASTE FACILITY IN YEARS                    0.
LENGTH OF REPOSITORY (M)                                        1.
WIDTH OF REPOSITORY (M)                                         1.
RIVER FLOW RATE (M**3/YR)                                       2.86E-03
STREAM FLOW RATE (M**3/YR)                                      2.86E-03
DISTANCE TO RIVER (M)                                           4.
OPERATIONAL SPILLAGE FRACTION                                   0.00E+00
DENSITY OF AQUIFER (KG/M**3)                                 1558.
LONGITUDINAL DISPERSIVITY (M)                                   1.00E-01
LATERAL DISPERSION COEFFICIENT -- Y AXIS (M**2/YR)              0.00E+00
NUMBER OF MESH POINTS FOR DISPERSION CALCULATION                1
FLAG FOR GAMMA PATHWAY OPTIONS                                  0
FLAG FOR GAMMA BUILDUP CALCULATION                              0
FLAG FOR ATMOSPHERIC PATHWAY                                    0
COVER THICKNESS OVER WASTE (M)                                   .00
THICKNESS OF WASTE IN PITS (M)                                  1.00
TOTAL WASTE VOLUME (M**3)                                       1.000E+00
DISTANCE TO WELL -- X COORDINATE (M)                            4.
DISTANCE TO WELL -- Y COORDINATE (M)                            0.
DENSITY OF WASTE (KG/M**3)                                   1800.
FRACTION OF FOOD CONSUMED THAT IS GROWN ON SITE                 1.000
FRACTION OF YEAR SPENT IN DIRECT RADIATION FIELD                 .000
DEPTH OF PLANT ROOT ZONE (M)                                     .000
AREAL DENSITY OF PLANTS (KG/M**2)                                .000
AVERAGE DUST LOADING IN AIR (KG/M**3)                           0.00E+00
ANNUAL ADULT BREATHING RATE (M**3/YR)                           0.
FRACTION OF YEAR EXPOSED TO DUST                                 .000
CANISTER LIFETIME (YEARS)                                       0.
INVENTORY SCALING FACTOR                                        1.00E+00
HEIGHT OF ROOMS IN RECLAIMER HOUSE (CM)                         0.
AIR CHANGE RATE IN RECLAIMER HOUSE (CHANGES/SEC)                0.00E+00
RADON EMANATING POWER OF THE WASTE                              0.00E+00

DIFFUSION COEFF. OF RADON IN WASTE (CM**2/SEC)                  0.00E+00
DIFFUSION COEFF. OF RN IN CONCRETE (CM**2/SEC)                  0.00E+00
THICKNESS OF CONCRETE SLAB FLOOR (CM)                            .0
DIFFUSION COEFF. OF RADON IN COVER (CM**2/SEC)                  0.00E+00
ATMOSPHERIC STABILITY CLASS                                     0
AVERAGE WIND SPEED (M/S)                                         .00
FRACTION OF TIME WIND BLOWS TOWARD RECEPTOR                      .0000
RECEPTOR DISTANCE FOR ATMOSPHERIC PATHWAY (M)                    .0
DUST RESUSPENSION RATE FOR OFFSITE TRANSPORT (M**3/S)           0.00E+00
DEPOSITION VELOCITY (M/S)                                        .0000
STACK HEIGHT (M)                                                 .0
STACK INSIDE DIAMETER (M)                                        .00
STACK GAS VELOCITY (M/S)                                         .0
HEAT EMISSION RATE FROM BURNING (CAL/S)                         0.00E+00
DECAY CHAIN FLAGS                          0   0   0   1   0   0   1
FLAG FOR INPUT SUMMARY PRINTOUT                                 1
FLAG FOR DIRECTION OF TRENCH FILLING                            1
FLAG FOR GROUNDWATER PATHWAY OPTIONS                            0
AMOUNT OF WATER PERCOLATING THROUGH WASTE ANNUALLY (M)          2.86E-03
DEGREE OF SOIL SATURATION                                        .308
RESIDUAL SOIL SATURATION                                         .033
PERMEABILITY OF VERTICAL ZONE (M/YR)                           97.40
SOIL NUMBER                                                      .000
POROSITY OF AQUIFER                                              .11
POROSITY OF UNSATURATED ZONE                                     .36
DISTANCE FROM AQUIFER TO WASTE (M)                               .0
AVERAGE VERTICAL GROUNDWATER VELOCITY (M/YR)                    2.62E-02
HORIZONTAL VELOCITY OF AQUIFER (M/YR)                            .0
LENGTH OF PERFORATED WELL CASING (M)                            1.000
SURFACE EROSION RATE (M/YR)                                     0.000E+00
LEACH RATE SCALING FACTOR                                       1.000E+00
ANNUAL RUNOFF OF PRECIPITATION (M)                              0.00E+00
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NUCLIDE	INGESTION DOSE FACTORS (MREM/PCI)	INHALATION DOSE FACTORS (MREM/PCI)	DIRECT GAMMA DOSE FACTORS (MREM-M2/PCI-YR)	HALF LIFE (YR)
Ac-227	0.000E+00	0.000E+00	0.000E+00	2.180E+01
Ag-108m	0.000E+00	0.000E+00	0.000E+00	4.180E+02
Al-26	0.000E+00	0.000E+00	0.000E+00	7.400E+05
Am-242m	0.000E+00	0.000E+00	0.000E+00	1.410E+02
Am-243	0.000E+00	0.000E+00	0.000E+00	7.370E+03
Ba-133	0.000E+00	0.000E+00	0.000E+00	1.050E+01
Be-10	0.000E+00	0.000E+00	0.000E+00	1.510E+06
Bi-207	0.000E+00	0.000E+00	0.000E+00	3.160E+01
Bi-210m	0.000E+00	0.000E+00	0.000E+00	3.040E+06
Bk-247	0.000E+00	0.000E+00	0.000E+00	1.400E+03
C-14	0.000E+00	0.000E+00	0.000E+00	5.730E+03
Ca-41	0.000E+00	0.000E+00	0.000E+00	1.030E+05

Cd-113	0.000E+00	0.000E+00	0.000E+00	9.300E+15
Cd-113m	0.000E+00	0.000E+00	0.000E+00	1.410E+01
Cf-249	0.000E+00	0.000E+00	0.000E+00	3.510E+02
Cf-250	0.000E+00	0.000E+00	0.000E+00	1.310E+01
Cf-251	0.000E+00	0.000E+00	0.000E+00	8.980E+02
Cf-252	0.000E+00	0.000E+00	0.000E+00	2.650E+00
Cl-36	0.000E+00	0.000E+00	0.000E+00	3.010E+05
Cm-243	0.000E+00	0.000E+00	0.000E+00	2.910E+01
Cm-245	0.000E+00	0.000E+00	0.000E+00	8.500E+03
Cm-246	0.000E+00	0.000E+00	0.000E+00	4.730E+03
Cm-247	0.000E+00	0.000E+00	0.000E+00	1.560E+07
Cm-248	0.000E+00	0.000E+00	0.000E+00	3.400E+05
Co-60	0.000E+00	0.000E+00	0.000E+00	5.270E+00
Cs-135	0.000E+00	0.000E+00	0.000E+00	2.300E+06
Cs-137	0.000E+00	0.000E+00	0.000E+00	3.010E+01
Eu-152	0.000E+00	0.000E+00	0.000E+00	1.350E+01
Eu-154	0.000E+00	0.000E+00	0.000E+00	8.590E+00
Eu-155	0.000E+00	0.000E+00	0.000E+00	4.760E+00
Fe-55	0.000E+00	0.000E+00	0.000E+00	2.730E+00
Fe-60	0.000E+00	0.000E+00	0.000E+00	1.500E+06
Gd-148	0.000E+00	0.000E+00	0.000E+00	7.460E+01
H-3	0.000E+00	0.000E+00	0.000E+00	1.230E+01
Hg-194	0.000E+00	0.000E+00	0.000E+00	4.440E+02
Th-230	0.000E+00	0.000E+00	0.000E+00	7.540E+04
U-236	0.000E+00	0.000E+00	0.000E+00	2.340E+07
U-238	0.000E+00	0.000E+00	0.000E+00	4.470E+09
Np-237	0.000E+00	0.000E+00	0.000E+00	2.140E+06
Pu-240	0.000E+00	0.000E+00	0.000E+00	6.560E+03
Pu-241	0.000E+00	0.000E+00	0.000E+00	1.440E+01
Am-241	0.000E+00	0.000E+00	0.000E+00	4.320E+02
Cm-244	0.000E+00	0.000E+00	0.000E+00	1.810E+01
Ra-226	0.000E+00	0.000E+00	0.000E+00	1.600E+03
Ho-166m	0.000E+00	0.000E+00	0.000E+00	1.200E+03
I-129	0.000E+00	0.000E+00	0.000E+00	1.570E+07
K-40	0.000E+00	0.000E+00	0.000E+00	1.280E+09
Mn-53	0.000E+00	0.000E+00	0.000E+00	3.740E+06
Na-22	0.000E+00	0.000E+00	0.000E+00	2.600E+00
Nb-91	0.000E+00	0.000E+00	0.000E+00	6.800E+02
Nb-92	0.000E+00	0.000E+00	0.000E+00	3.470E+07
Nb-93m	0.000E+00	0.000E+00	0.000E+00	1.610E+01
Nb-94	0.000E+00	0.000E+00	0.000E+00	2.030E+04
Ni-59	0.000E+00	0.000E+00	0.000E+00	7.600E+04
Ni-63	0.000E+00	0.000E+00	0.000E+00	1.000E+02
Os-194	0.000E+00	0.000E+00	0.000E+00	6.000E+00
Pa-231	0.000E+00	0.000E+00	0.000E+00	3.280E+04
Pb-202	0.000E+00	0.000E+00	0.000E+00	5.250E+04
Pb-210	0.000E+00	0.000E+00	0.000E+00	2.230E+01
Pd-107	0.000E+00	0.000E+00	0.000E+00	6.500E+06
Pm-145	0.000E+00	0.000E+00	0.000E+00	1.770E+01
Pm-147	0.000E+00	0.000E+00	0.000E+00	2.620E+00
Po-208	0.000E+00	0.000E+00	0.000E+00	2.900E+00
Po-209	0.000E+00	0.000E+00	0.000E+00	1.020E+02
Pt-193	0.000E+00	0.000E+00	0.000E+00	5.000E+01

NUCLIDE	VOLATILITY FRACTION	GAMMA ENERGY (MEV)	GAMMA ATTENUATION (1/M)
Ac-227	0.000E+00	0.000E+00	0.000E+00
Ag-108m	0.000E+00	0.000E+00	0.000E+00
•			
•			
•			
Po-209	0.000E+00	0.000E+00	0.000E+00
Pt-193	0.000E+00	0.000E+00	0.000E+00

NUCLIDE	INPUT LEACH RATE (1/YR)	FINAL LEACH RATE (1/YR)	SOLUBILITY (MOLE/L)	INPUT INVENTORY (CI)
Ac-227	3.510E-04	3.510E-04	0.000E+00	1.300E+08
Ag-108m	5.810E-04	5.810E-04	0.000E+00	4.690E+07
Al-26	1.060E-04	1.060E-04	0.000E+00	3.720E-02
Am-242m	1.540E-03	1.540E-03	0.000E+00	1.800E-02
Am-243	1.540E-03	1.540E-03	0.000E+00	1.800E-02
Ba-133	1.580E-04	1.580E-04	0.000E+00	4.610E+08
Be-10	6.270E-04	6.270E-04	0.000E+00	3.960E+04
Bi-207	1.540E-03	1.540E-03	0.000E+00	9.660E+07
Bi-210m	1.540E-03	1.540E-03	0.000E+00	1.020E+03
Bk-247	4.700E-02	4.700E-02	0.000E+00	1.630E-10
C-14	1.860E-04	1.860E-04	0.000E+00	1.300E+01
Ca-41	1.920E-02	1.920E-02	0.000E+00	2.740E-06
Cd-113	1.540E-03	1.540E-03	0.000E+00	7.750E-07
Cd-113m	1.540E-03	1.540E-03	0.000E+00	4.040E+08
Cf-249	7.820E-04	7.820E-04	0.000E+00	1.800E-02
Cf-250	7.820E-04	7.820E-04	0.000E+00	9.000E-04
Cf-251	7.820E-04	7.820E-04	0.000E+00	1.800E-02
Cf-252	7.820E-04	7.820E-04	0.000E+00	7.920E+02
Cl-36	4.500E-02	4.500E-02	0.000E+00	4.830E-07
Cm-243	1.700E-05	1.700E-05	0.000E+00	1.800E-02
Cm-245	1.700E-05	1.700E-05	0.000E+00	1.800E-02
Cm-246	1.700E-05	1.700E-05	0.000E+00	1.800E-02
Cm-247	1.700E-05	1.700E-05	0.000E+00	1.800E-02
Cm-248	1.700E-05	1.700E-05	0.000E+00	1.800E-02
Co-60	4.290E-06	4.290E-06	0.000E+00	7.920E+02
Cs-135	1.190E-05	1.190E-05	0.000E+00	2.070E+03
Cs-137	1.190E-05	1.190E-05	0.000E+00	1.130E+00
Eu-152	2.430E-04	2.430E-04	0.000E+00	3.110E+08
Eu-154	2.430E-04	2.430E-04	0.000E+00	4.870E+08
Eu-155	2.430E-04	2.430E-04	0.000E+00	7.920E+02
Fe-55	1.110E-03	1.110E-03	0.000E+00	7.920E+02
Fe-60	1.110E-03	1.110E-03	0.000E+00	7.150E+03
Gd-148	2.430E-04	2.430E-04	0.000E+00	5.800E+07
H-3	2.180E-02	2.180E-02	0.000E+00	4.500E+01
Hg-194	1.580E-04	1.580E-04	0.000E+00	6.380E+06
Th-230	1.580E-04	1.580E-04	0.000E+00	3.710E+04
U-236	2.630E-04	2.630E-04	0.000E+00	1.160E+02
U-238	2.630E-04	2.630E-04	0.000E+00	6.050E-01
Np-237	5.240E-04	5.240E-04	0.000E+00	1.800E-02

Pu-240	1.580E-04	1.580E-04	0.000E+00	1.800E-02
Pu-241	1.580E-04	1.580E-04	0.000E+00	6.300E-01
Am-241	1.540E-03	1.540E-03	0.000E+00	1.800E-02
Cm-244	1.700E-05	1.700E-05	0.000E+00	1.800E-02
Ra-226	1.580E-04	1.580E-04	0.000E+00	1.800E-02
Ho-166m	6.270E-04	6.270E-04	0.000E+00	3.240E+06
I-129	1.040E-02	1.040E-02	0.000E+00	9.000E-03
K-40	8.690E-03	8.690E-03	0.000E+00	1.260E+01
Mn-53	2.470E-04	2.470E-04	0.000E+00	3.240E+03
Na-22	1.540E-03	1.540E-03	0.000E+00	7.920E+02
Nb-91	9.730E-04	9.730E-04	0.000E+00	1.040E+07
Nb-92	9.730E-04	9.730E-04	0.000E+00	2.020E+02
Nb-93m	9.730E-04	9.730E-04	0.000E+00	4.740E+08
Nb-94	9.730E-04	9.730E-04	0.000E+00	2.340E-02
Ni-59	1.580E-04	1.580E-04	0.000E+00	2.520E+01
Ni-63	1.580E-04	1.580E-04	0.000E+00	3.960E+00
Os-194	3.510E-04	3.510E-04	0.000E+00	5.530E+08
Pa-231	2.870E-04	2.870E-04	0.000E+00	8.460E+04
Pb-202	8.350E-05	8.350E-05	0.000E+00	6.120E+03
Pb-210	8.350E-05	8.350E-05	0.000E+00	1.370E+08
Pd-107	2.730E-03	2.730E-03	0.000E+00	9.180E+02
Pm-145	2.430E-04	2.430E-04	0.000E+00	2.520E+08
Pm-147	2.430E-04	2.430E-04	0.000E+00	7.920E+02
Po-208	1.760E-04	1.760E-04	0.000E+00	7.920E+02
Po-209	1.760E-04	1.760E-04	0.000E+00	3.020E+07
Pt-193	1.700E-03	1.700E-03	0.000E+00	6.660E+07

NUCLIDE	AQUIFER SORPTION	AQUIFER RETARDATION	VERTICAL SORPTION	VERTICAL RETARDATION
Ac-227	4.500E+00	6.532E+01	4.500E+00	6.512E+01
Ag-108m	2.700E+00	3.959E+01	2.700E+00	3.947E+01
Al-26	1.500E+01	2.154E+02	1.500E+01	2.147E+02
Am-242m	1.000E+00	1.529E+01	1.000E+00	1.525E+01
Am-243	1.000E+00	1.529E+01	1.000E+00	1.525E+01
Ba-133	1.000E+01	1.439E+02	1.000E+01	1.435E+02
Be-10	2.500E+00	3.673E+01	2.500E+00	3.662E+01
Bi-207	1.000E+00	1.529E+01	1.000E+00	1.525E+01
Bi-210m	1.000E+00	1.529E+01	1.000E+00	1.525E+01
Bk-247	1.000E-03	1.014E+00	1.000E-03	1.014E+00
C-14	8.520E+00	1.228E+02	8.520E+00	1.224E+02
Ca-41	5.000E-02	1.715E+00	5.000E-02	1.712E+00
Cd-113	1.000E+00	1.529E+01	1.000E+00	1.525E+01
Cd-113m	1.000E+00	1.529E+01	1.000E+00	1.525E+01
Cf-249	2.000E+00	2.959E+01	2.000E+00	2.950E+01
Cf-250	2.000E+00	2.959E+01	2.000E+00	2.950E+01
Cf-251	2.000E+00	2.959E+01	2.000E+00	2.950E+01
Cf-252	2.000E+00	2.959E+01	2.000E+00	2.950E+01
Cl-36	2.500E-03	1.036E+00	2.500E-03	1.036E+00
Cm-243	9.330E+01	1.335E+03	9.330E+01	1.330E+03
Cm-245	9.330E+01	1.335E+03	9.330E+01	1.330E+03
Cm-246	9.330E+01	1.335E+03	9.330E+01	1.330E+03
Cm-247	9.330E+01	1.335E+03	9.330E+01	1.330E+03
Cm-248	9.330E+01	1.335E+03	9.330E+01	1.330E+03
Co-60	3.700E+02	5.290E+03	3.700E+02	5.273E+03
Cs-135	1.330E+02	1.902E+03	1.330E+02	1.896E+03
Cs-137	1.330E+02	1.902E+03	1.330E+02	1.896E+03
Eu-152	6.500E+00	9.391E+01	6.500E+00	9.362E+01
Eu-154	6.500E+00	9.391E+01	6.500E+00	9.362E+01
Eu-155	6.500E+00	9.391E+01	6.500E+00	9.362E+01
Fe-55	1.400E+00	2.101E+01	1.400E+00	2.095E+01
Fe-60	1.400E+00	2.101E+01	1.400E+00	2.095E+01
Gd-148	6.500E+00	9.391E+01	6.500E+00	9.362E+01
H-3	4.000E-02	1.572E+00	4.000E-02	1.570E+00
Hg-194	1.000E+01	1.439E+02	1.000E+01	1.435E+02
Th-230	1.000E+01	1.439E+02	1.000E+01	1.435E+02
U-236	6.000E+00	8.676E+01	6.000E+00	8.649E+01
U-238	6.000E+00	8.676E+01	6.000E+00	8.649E+01
Np-237	3.000E+00	4.388E+01	3.000E+00	4.375E+01
Pu-240	1.000E+01	1.439E+02	1.000E+01	1.435E+02
Pu-241	1.000E+01	1.439E+02	1.000E+01	1.435E+02
Am-241	1.000E+00	1.529E+01	1.000E+00	1.525E+01
Cm-244	9.330E+01	1.335E+03	9.330E+01	1.330E+03
Ra-226	9.990E+00	1.438E+02	9.990E+00	1.433E+02
Ho-166m	2.500E+00	3.673E+01	2.500E+00	3.662E+01
I-129	1.200E-01	2.715E+00	1.200E-01	2.710E+00
K-40	1.500E-01	3.144E+00	1.500E-01	3.137E+00
Mn-53	6.400E+00	9.248E+01	6.400E+00	9.219E+01
Na-22	1.000E+00	1.529E+01	1.000E+00	1.525E+01
Nb-91	1.600E+00	2.387E+01	1.600E+00	2.380E+01
Nb-92	1.600E+00	2.387E+01	1.600E+00	2.380E+01
Nb-93m	1.600E+00	2.387E+01	1.600E+00	2.380E+01
Nb-94	1.600E+00	2.387E+01	1.600E+00	2.380E+01
Ni-59	1.000E+01	1.439E+02	1.000E+01	1.435E+02
Ni-63	1.000E+01	1.439E+02	1.000E+01	1.435E+02
Os-194	4.500E+00	6.532E+01	4.500E+00	6.512E+01
Pa-231	5.500E+00	7.961E+01	5.500E+00	7.937E+01
Pb-202	1.900E+01	2.726E+02	1.900E+01	2.717E+02
Pb-210	1.900E+01	2.726E+02	1.900E+01	2.717E+02
Pd-107	5.500E-01	8.861E+00	5.500E-01	8.837E+00
Pm-145	6.500E+00	9.391E+01	6.500E+00	9.362E+01
Pm-147	6.500E+00	9.391E+01	6.500E+00	9.362E+01
Po-208	9.000E+00	1.296E+02	9.000E+00	1.292E+02
Po-209	9.000E+00	1.296E+02	9.000E+00	1.292E+02
Pt-193	9.000E-01	1.386E+01	9.000E-01	1.382E+01

BIOACCUMULATION FACTORS

NUCLIDE	SOIL-PLANT Bv	SOIL-PLANT Br	FORAGE-MILK Fm (D/L)	FORAGE-MEAT Ff (D/KG)
Ac-227	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Ag-108m	0.000E+00	0.000E+00	0.000E+00	0.000E+00
•				
•				
•				
Po-209	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pt-193	0.000E+00	0.000E+00	0.000E+00	0.000E+00

PATHWAY 1

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                                                  GROUNDWATER TO RIVER
NUCLIDE CONCENTRATIONS IN RIVER  (Ci/m**3)
  NUCLIDE/TIME        1.        3.        6.        9.       12.       15.       18.       21.       24.       27.       30.       35.
40.       45.       50.       55.       60.       65.       70.       75.       80.       85.       90.       95.      100.      105.
110.      115.      120.      125.      130.      135.      140.      145.      150.      155.      160.      165.      170.      175.
180.      185.      190.      195.      200.      205.      210.      215.      220.      225.      230.      235.      240.      245.
250.      255.      260.      265.      270.      275.      280.      285.      290.      295.      300.      310.      320.      330.
340.      350.      360.      370.      380.      390.      400.      410.      420.      430.      440.      450.      460.      470.
480.      490.      500.      510.      520.      530.      540.      550.      560.      570.      580.      590.      600.      610.
620.      630.      640.      650.      660.      670.      680.      690.      700.      720.      740.      760.      780.      800.
825.      850.      875.      900.      925.      950.      975.     1000.
     Ac-227        0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
     Ag-108m       0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   1.7E-20   1.4E-19   1.0E-18   6.9E-18   4.1E-17   2.3E-16   1.1E-15
     Al-26         0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
     Am-242m       0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   1.7E-20   5.2E-20
1.5E-19   3.9E-19   1.0E-18   2.5E-18   6.0E-18   1.4E-17   3.1E-17   6.6E-17   1.4E-16   2.8E-16   5.6E-16   1.1E-15   2.0E-15   3.7E-15
6.6E-15   1.2E-14   2.0E-14   3.4E-14   5.6E-14   9.2E-14   1.5E-13   2.3E-13   3.6E-13   8.3E-13   1.8E-12   3.7E-12   7.4E-12   1.4E-11
3.0E-11   6.0E-11   1.1E-10   2.0E-10   3.5E-10   5.9E-10   9.4E-10   1.5E-09
     Am-243        0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   1.4E-20   4.9E-20   1.6E-19   5.0E-19
1.5E 18   4.2E-18   1.1E-17   2.9E-17   7.4E-17   1.8E-16   4.2E-16   9.4E-16   2.1E-15   4.4E-15   9.1E-15   1.8E-14   3.6E-14   7.0E-14
1.3E-13   2.4E-13   4.4E-13   7.8E-13   1.4E-12   2.3E-12   3.9E-12   6.4E-12   1.0E-11   2.7E-11   6.4E-11   1.5E-10   3.2E-10   6.7E-10
1.6E-09   3.6E-09   7.7E-09   1.6E-08   3.1E-08   5.7E-08   1.0E-07   1.8E-07
     Ba-133        0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
     Be-10         0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   1.5E-20   1.1E-19   7.4E-19   4.4E-18   2.4E-17   1.2E-16   5.5E-16
     Bi-207        0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   1.9E-20   1.1E-19   5.7E-19   2.7E-18   1.1E-17   4.5E-17   1.6E-16   5.5E 16   1.7E-15   5.1E-15   1.4E-14   3.7E-14   9.3E-14
2.2E-13   5.1E-13   1.1E-12   2.3E-12   4.6E-12   9.0E-12   1.7E-11   3.1E-11   5.4E-11   9.3E-11   1.5E-10   2.5E-10   4.0E-10   6.2E-10
9.3E-10   1.4E-09   2.0E-09   2.9E-09   4.0E-09   5.5E-09   7.4E-09   9.9E-09   1.3E-08   2.1E-08   3.3E-08   4.9E-08   6.9E-08   9.3E-08
1.3E-07   1.7E-07   2.1E-07   2.4E-07   2.8E-07   3.0E-07   3.1E-07   3.2E-07
     Bi-210m       0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   2.0E-20   1.2E-19   6.3E-19   3.1E-18   1.4E-17   5.8E-17   2.3E-16   8.4E-16   2.9E-15   9.5E-15   3.0E-14
8.8E-14   2.5E-13   6.7E-13   1.8E-12   4.4E-12   1.1E-11   2.5E-11   5.6E-11   1.2E-10   2.6E-10   5.5E-10   1.1E-09   2.2E-09   4.2E-09
7.9E-09   1.5E-08   2.6E-08   4.7E-08   8.2E-08   1.4E-07   2.4E-07   3.9E-07   6.3E-07   1.6E-06   3.9E-06   8.9E-06   1.9E-05   4.1E-05
9.8E-05   2.2E-04   4.7E-04   9.6E-04   1.9E-03   3.5E-03   6.4E-03   1.1E-02
     Bk-247        0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
1.3E-20   1.0E-18   3.3E-17   5.3E-16   5.2E-15   3.4E-14   1.7E-13   6.2E-13   1.9E-12   5.1E-12   1.2E-11   2.4E-11   4.3E-11   7.3E-11
1.1E-10   1.6E-10   2.3E-10   2.9E-10   3.6E-10   4.3E-10   4.9E-10   5.4E-10   5.8E-10   6.0E-10   6.1E-10   6.1E-10   5.9E-10   5.6E-10
5.3E-10   4.9E-10   4.4E-10   4.0E-10   3.5E-10   3.1E-10   2.7E-10   2.3E-10   2.0E-10   1.7E-10   1.4E-10   1.2E-10   9.5E-11   7.8E-11
6.4E-11   5.2E-11   4.2E-11   3.3E-11   2.7E-11   2.1E-11   1.7E-11   1.3E-11   1.0E-11   8.2E-12   6.4E-12   3.9E-12   2.3E-12   1.4E-12
8.1E-13   4.7E-13   2.7E-13   1.6E-13   9.0E-14   5.1E-14   2.9E-14   1.6E-14   9.1E-15   5.1E-15   2.8E-15   1.6E-15   8.7E-16   4.8E-16
2.6E-16   1.4E-16   7.8E-17   4.3E-17   2.3E-17   1.3E-17   6.8E-18   3.7E-18   2.0E-18   1.1E-18   5.8E-19   3.1E-19   1.7E-19   8.9E-20
4.8E-20   2.6E-20   1.4E-20   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
     C-14          0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
```

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Ca-41		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.5E-19	1.8E-17	3.5E-16	4.4E-15	4.0E-14	2.8E-13	1.5E-12	6.8E-12	2.6E-11	8.5E-11
2.5E-10	6.5E-10	1.6E-09	3.4E-09	7.0E-09	1.3E-08	2.4E-08	4.2E-08	6.9E-08	1.1E-07	1.6E-07	2.4E-07	3.4E-07	4.7E-07
6.4E-07	8.4E-07	1.1E-06	1.3E-06	1.7E-06	2.0E-06	2.4E-06	2.8E-06	3.2E-06	3.6E-06	4.0E-06	4.4E-06	4.8E-06	5.2E-06
5.5E-06	5.8E-06	6.0E-06	6.2E-06	6.3E-06	6.4E-06	6.5E-06	6.5E-06	6.4E-06	6.3E-06	6.2E-06	5.8E-06	5.3E-06	4.8E-06
4.2E-06	3.7E-06	3.1E-06	2.6E-06	2.2E-06	1.8E-06	1.5E-06	1.2E-06	9.4E-07	7.5E-07	5.9E-07	4.6E-07	3.5E-07	2.7E-07
2.1E-07	1.6E-07	1.2E-07	9.0E-08	6.7E-08	5.0E-08	3.7E-08	2.8E-08	2.0E-08	1.5E-08	1.1E-08	8.0E-09	5.9E-09	4.3E-09
3.1E-09	2.2E-09	1.6E-09	1.2E-09	8.4E-10	6.0E-10	4.3E-10	3.1E-10	2.2E-10	1.1E-10	5.6E-11	2.8E-11	1.4E-11	7.0E-12
2.9E-12	1.2E-12	4.9E-13	2.0E 13	8.2E-14	3.3E-14	1.3E-14	5.4E-15						
Cd-113		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.9E-20	4.3E-20	9.4E-20	2.0E-19	4.2E-19	8.4E-19	1.7E-18	3.2E-18
6.0E-18	1.1E-17	2.0E-17	3.6E-17	6.2E-17	1.1E-16	1.8E-16	3.0E-16	4.8E-16	1.2E-15	3.0E-15	6.8E-15	1.5E-14	3.1E-14
7.4E-14	1.7E-13	3.6E-13	7.3E-13	1.4E-12	2.7E-12	4.9E-12	8.6E-12						
Cd-113m		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.5E-20	5.9E-20	1.3E-19	2.8E-19	5.7E-19	1.1E-18
2.0E-18	3.4E-18	5.6E-18	9.0E-18	1.4E-17	2.0E-17	2.9E-17	4.0E-17	5.4E-17	7.1E-17	9.0E-17	1.1E-16	1.3E-16	1.6E-16
1.8E-16	2.1E-16	2.3E-16	2.5E-16	2.6E-16	2.7E-16	2.8E-16	2.9E-16	2.9E-16	2.7E-16	2.4E-16	2.1E-16	1.7E-16	1.3E-16
9.4E-17	6.2E-17	3.9E-17	2.3E-17	1.3E-17	7.3E-18	3.9E-18	2.0E-18						
Cf-249		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	2.6E-20	1.0E-19	3.8E-19	1.3E-18	4.1E-18						
Cf-250		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Cf-251		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	1.7E-20	7.7E-20	3.2E-19	1.2E-18	4.2E-18	1.4E-17						
Cf-252		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Cl-36		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.6E-20
1.6E-17	1.4E-15	5.0E-14	8.7E-13	9.0E-12	6.2E-11	3.2E-10	1.2E-09	4.0E-09	1.1E-08	2.6E-08	5.4E-08	1.0E-07	1.8E-07
2.8E-07	4.2E-07	5.9E-07	7.8E-07	9.9E-07	1.2E-06	1.4E-06	1.6E-06	1.7E-06	1.8E-06	1.9E-06	1.9E-06	1.9E-06	1.8E-06
1.8E-06	1.7E-06	1.5E-06	1.4E-06	1.3E-06	1.1E-06	9.8E-07	8.6E-07	7.4E-07	6.3E-07	5.4E-07	4.5E-07	3.8E-07	3.1E-07
2.6E-07	2.1E-07	1.7E-07	1.4E-07	1.1E-07	9.3E-08	7.4E-08	5.9E-08	4.7E-08	3.8E-08	3.0E-08	1.8E-08	1.1E-08	6.8E-09
4.1E-09	2.4E-09	1.4E-09	8.5E-10	5.0E-10	2.9E-10	1.7E-10	9.6E-11	5.5E-11	3.1E-11	1.8E-11	1.0E-11	5.6E-12	3.2E-12
1.8E-12	9.9E-13	5.5E-13	3.1E-13	1.7E-13	9.4E-14	5.2E-14	2.9E-14	1.6E-14	8.6E-15	4.7E-15	2.6E-15	1.4E-15	7.8E-16
4.2E-16	2.3E-16	1.3E-16	6.8E-17	3.7E-17	2.0E-17	1.1E-17	5.9E-18	3.2E-18	9.4E-19	2.8E-19	8.0E-20	2.3E-20	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Cm-243		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Cm-245		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Cm-246		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						

Cm-247		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Cm-248		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Co-60		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Cs-135		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Cs-137		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Eu-152		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Eu-154		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Eu-155		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Fe-55		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Fe-60		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	3.3E-20	1.3E-19	4.6E-19	1.6E-18	5.2E-18	1.6E-17	4.9E-17	1.4E-16	4.0E-16	1.1E-15	2.8E-15	7.0E-15
1.7E-14	4.1E-14	9.4E-14	2.1E-13	4.6E-13	9.9E-13	2.1E-12	4.2E-12	8.5E-12	3.2E-11	1.1E-10	3.7E-10	1.1E-09	3.3E-09
1.1E-08	3.7E-08	1.1E-07	3.2E-07	8.4E-07	2.1E-06	5.1E-06	1.2E-05						
Gd-148		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
H-3		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
3.6E-20	3.1E-17	6.5E-15	4.7E-13	1.5E-11	2.7E-10	3.0E-09	2.3E-08	1.3E-07	5.4E-07	1.9E-06	5.5E-06	1.4E-05	3.0E-05
5.9E-05	1.0E-04	1.7E-04	2.6E-04	3.7E-04	4.9E-04	6.2E-04	7.5E-04	8.7E-04	9.7E-04	1.0E-03	1.1E-03	1.1E-03	1.1E-03
1.0E-03	9.8E-04	9.0E-04	8.0E-04	7.1E-04	6.1E-04	5.2E-04	4.4E-04	3.6E-04	2.9E-04	2.4E-04	1.9E-04	1.5E-04	1.1E-04
8.8E-05	6.7E-05	5.0E-05	3.8E-05	2.8E-05	2.1E-05	1.5E-05	1.1E-05	7.8E-06	5.6E-06	4.0E-06	2.0E-06	9.7E-07	4.6E-07
2.2E-07	1.0E-07	4.6E-08	2.1E-08	9.4E-09	4.1E-09	1.8E-09	7.9E-10	3.4E-10	1.5E-10	6.2E-11	2.6E-11	1.1E-11	4.5E-12

```
1.9E-12  7.8E-13  3.2E-13  1.3E-13  5.3E-14  2.2E-14  8.7E-15  3.5E-15  1.4E-15  5.6E-16  2.3E-16  9.0E-17  3.6E-17  1.4E-17
5.6E-18  2.2E-18  8.7E-19  3.4E-19  1.3E-19  5.3E-20  2.1E-20  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
   Hg-194         0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
   Th-230         0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
   U-236          0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
   U-238          0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
   Np-237         0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
   Pu-240         0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
   Pu-241         0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
   Am-241         0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  3.5E-20  1.2E-19  3.9E-19  1.2E-18
3.5E-18  9.6E-18  2.6E-17  6.6E-17  1.6E-16  3.9E-16  8.9E-16  2.0E-15  4.3E-15  9.0E-15  1.8E-14  3.6E-14  7.1E-14  1.3E-13
2.5E-13  4.5E-13  8.1E-13  1.4E-12  2.4E-12  4.1E-12  6.7E-12  1.1E-11  1.8E-11  4.3E-11  1.0E-10  2.2E-10  4.7E-10  9.6E-10
2.2E-09  4.8E-09  9.9E-09  1.9E-08  3.6E-08  6.6E-08  1.1E-07  1.9E-07
   Cm-244         0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
   Ra-226         0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
   Ho-166m        0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
9.0E-20  7.5E-19  5.5E-18  3.6E-17  2.1E-16  1.1E-15  5.6E-15  2.5E-14
   I-129          0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  1.9E-19  4.6E-18  7.8E-17  9.8E-16  9.4E-15  7.3E-14
4.6E-13  2.5E-12  1.1E-11  4.6E-11  1.7E-10  5.4E-10  1.6E-09  4.4E-09  1.1E-08  2.7E-08  5.9E-08  1.3E-07  2.5E-07  4.9E-07
```

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9.0E-07  1.6E-06  2.8E-06  4.6E-06  7.4E-06  1.2E-05  1.8E-05  2.6E-05  3.8E-05  5.5E-05  7.6E-05  1.1E-04  1.4E-04  1.9E-04
2.5E-04  3.2E-04  4.1E-04  5.1E-04  6.3E-04  7.8E-04  9.5E-04  1.1E-03  1.4E-03  1.6E-03  1.9E-03  2.5E-03  3.3E-03  4.1E-03
5.1E-03  6.1E-03  7.1E-03  8.2E-03  9.2E-03  1.0E-02  1.1E-02  1.2E-02  1.2E-02  1.3E-02  1.3E-02  1.3E-02  1.3E-02  1.3E-02
1.3E-02  1.2E-02  1.2E-02  1.1E-02  1.1E-02  9.9E-03  9.2E-03  8.4E-03  7.7E-03  7.0E-03  6.3E-03  5.7E-03  5.1E-03  4.5E-03
4.0E-03  3.5E-03  3.1E-03  2.7E-03  2.4E-03  2.1E-03  1.8E-03  1.5E-03  1.3E-03  9.6E-04  7.0E-04  5.0E-04  3.6E-04  2.5E-04
1.6E-04  1.0E-04  6.3E-05  3.9E-05  2.4E-05  1.5E-05  8.8E-06  5.3E-06
   K-40           0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  3.8E-20  1.6E-18  4.4E-17  8.5E-16  1.2E-14  1.3E-13
1.1E-12  8.2E-12  5.0E-11  2.6E-10  1.2E-09  4.7E-09  1.7E-08  5.7E-08  1.7E-07  4.9E-07  1.3E-06  3.1E-06  7.3E-06  1.6E-05
3.3E-05  6.7E-05  1.3E-04  2.4E-04  4.3E-04  7.4E-04  1.2E-03  2.0E-03  3.2E-03  5.0E-03  7.6E-03  1.1E-02  1.6E-02  2.3E-02
3.3E-02  4.6E-02  6.2E-02  8.3E-02  1.1E-01  1.4E-01  1.8E-01  2.3E-01  3.0E-01  3.7E-01  4.5E-01  6.7E-01  9.6E-01  1.3E+00
1.8E+00  2.4E+00  3.0E+00  3.8E+00  4.6E+00  5.6E+00  6.6E+00  7.7E+00  8.8E+00  9.8E+00  1.1E+01  1.2E+01  1.3E+01  1.4E+01
1.4E+01  1.5E+01  1.6E+01  1.6E+01  1.6E+01  1.6E+01  1.6E+01  1.6E+01  1.5E+01  1.5E+01  1.4E+01  1.4E+01  1.3E+01  1.2E+01
1.2E+01  1.1E+01  1.0E+01  9.4E+00  8.6E+00  7.9E+00  7.2E+00  6.6E+00  6.0E+00  4.9E+00  3.9E+00  3.1E+00  2.4E+00  1.9E+00
1.4E+00  9.6E-01  6.7E-01  4.7E-01  3.2E-01  2.2E-01  1.5E-01  9.8E-02
   Mn-53          0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
   Na-22          0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
   Nb-91          0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  1.1E-20  4.5E-20  1.8E-19  7.1E-19  2.6E-18  9.0E-18  3.0E-17  9.6E-17  2.9E-16  8.7E-16  2.5E-15
6.8E-15  1.8E-14  4.7E-14  1.2E-13  2.8E-13  6.7E-13  1.5E-12  3.5E-12  7.6E-12  3.4E-11  1.4E-10  5.4E-10  1.9E-09  6.4E-09
2.6E-08  9.8E-08  3.4E-07  1.1E-06  3.3E-06  9.4E-06  2.5E-05  6.4E-05
   Nb-92          0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  1.0E-20  3.1E-20  9.0E-20
2.5E-19  6.7E-19  1.7E-18  4.4E-18  1.1E-17  2.6E-17  6.0E-17  1.4E-16  3.0E-16  1.4E-15  5.8E-15  2.3E-14  8.2E-14  2.8E-13
1.2E-12  4.5E-12  1.6E-11  5.4E-11  1.7E-10  4.8E-10  1.3E-09  3.5E-09
   Nb-93m         0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
   Nb-94          0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  1.5E-20  3.4E-20  1.6E-19  6.6E-19  2.6E 18  9.3E-18  3.1E-17
1.3E-16  5.1E-16  1.8E-15  6.0E-15  1.9E-14  5.4E-14  1.5E-13  3.9E-13
   Ni-59          0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
   Ni-63          0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
   Os-194         0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
   Pa-231         0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
```

Pb-202		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Pb-210		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Pd-107		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.9E-20	1.8E-19	7.6E-19	3.0E-18	1.1E-17	4.1E-17	1.4E-16
4.4E-16	1.4E-15	4.0E-15	1.1E-14	3.0E-14	7.8E-14	2.0E-13	4.8E-13	1.1E-12	2.6E-12	5.7E-12	2.6E-11	1.1E-10	4.1E-10
1.4E-09	4.6E-09	1.4E-08	3.9E-08	1.0E-07	2.6E-07	6.3E-07	1.5E-06	3.2E-06	6.8E-06	1.4E-05	2.7E-05	5.2E-05	9.7E-05
1.7E-04	3.1E-04	5.2E-04	8.8E-04	1.4E-03	2.3E-03	3.6E-03	5.6E-03	8.4E-03	1.3E-02	1.8E-02	2.7E-02	3.8E-02	5.3E-02
7.4E-02	1.0E-01	1.4E 01	1.8E-01	2.4E-01	3.2E-01	4.1E-01	5.3E-01	6.8E-01	1.1E+00	1.6E+00	2.5E+00	3.6E+00	5.1E+00
7.6E+00	1.1E+01	1.6E+01	2.2E+01	2.9E+01	3.8E+01	4.9E+01	6.1E+01						
Pm-145		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Pm-147		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Po-208		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Po-209		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Pt-193		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	9.0E-20	6.8E-19	5.0E-18
3.2E-17	1.9E-16	9.6E-16	4.5E-15	1.9E-14	7.6E-14	2.8E-13	9.3E-13	3.0E-12	8.8E-12	2.5E-11	6.6E-11	1.7E-10	4.1E-10
9.4E-10	2.1E-09	4.5E-09	9.2E-09	1.8E-08	3.5E-08	6.6E-08	1.2E-07	2.1E-07	3.6E-07	6.1E-07	9.9E-07	1.6E-06	2.5E-06
3.8E-06	5.8E-06	8.5E-06	1.2E-05	1.8E-05	2.5E-05	3.5E-05	4.7E-05	6.3E-05	1.1E-04	1.8E-04	2.9E-04	4.4E-04	6.5E-04
9.9E-04	1.4E-03	2.0E-03	2.6E-03	3.4E-03	4.2E-03	5.0E-03	5.7E-03						

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PATHRAE-RAD(PC)  Version 2.2d  February 1995
  Date: 11-29-2007
  Time: 18:25:11
EnergySolutions Class A South cell side slope, vertical/vadose, lim conc, part 2
*****  Mirror Image of Input Files  *****
-- Input File:  ABCDEF.DAT
EnergySolutions Class A South cell side slope, vertical/vadose, lim conc, part 2, S28Lb
118,1.,3.,6.,9.,12.,15.,18.,21.,24.,27.,30.,35.,40.,45.,50.,55.,60.,65.,70.,75.,80.,85.,90.,95.,100.,105.,110.,115.,120.,125.,130.,1
35,0,1
1,2
0,1.,1.,2.86E-03,2.86E-03,3.64,0
1558.,0.100,0,0,0.308,3.34E-02,97.4,0
1,0,0,0,0,0
0,1.,1.,3.64,0,1800.,1.,0,0,0
0,0,0,0,0,1.
0,0,0,0,0,0,0
0,0,0,0,0,0,0,0,0,0,0
0,0
1,0,1,0
0.00286,0.026,0.109,0,0,1.,0,1.,0,0.355

-- Input File:  BRCDCF.DAT
 158,Pu-236  0,0,0,0,0,0,0
 159,Pu-238  0,0,0,0,0,0,0
 160,Pu-239  0,0,0,0,0,0,0
 161,Pu-242  0,0,0,0,0,0,0
 162,Pu-244  0,0,0,0,0,0,0
 163,Ra-228  0,0,0,0,0,0,0
 164,Re-187  0,0,0,0,0,0,0
 165,Se-79   0,0,0,0,0,0,0
 166,Si-32   0,0,0,0,0,0,0
 167,Sm-151  0,0,0,0,0,0,0
 168,Sn-121m 0,0,0,0,0,0,0
 169,Sn-126  0,0,0,0,0,0,0
 170,Sr-90   0,0,0,0,0,0,0
 171,Tb-157  0,0,0,0,0,0,0
 172,Tb-158  0,0,0,0,0,0,0
 173,Tc-99   0,0,0,0,0,0,0
 174,Te-123  0,0,0,0,0,0,0
 175,Th-229  0,0,0,0,0,0,0
 176,Th-232  0,0,0,0,0,0,0
 177,Ti-44   0,0,0,0,0,0,0
 178,Tl-204  0,0,0,0,0,0,0
 179,Tm-170  0,0,0,0,0,0,0
 180,U-232   0,0,0,0,0,0,0
 181,U-233   0,0,0,0,0,0,0
 182,U-234   0,0,0,0,0,0,0
 183,U-235   0,0,0,0,0,0,0
 184,V-50    0,0,0,0,0,0,0
 185,Zr-93   0,0,0,0,0,0,0
 186,Ks-20   0,0,0,0,0,0,0
 187,Ks-21   0,0,0,0,0,0,0
 188,Ks-22   0,0,0,0,0,0,0
 189,Ks-23   0,0,0,0,0,0,0
 190,Ks-24   0,0,0,0,0,0,0
 191,Ks-25   0,0,0,0,0,0,0
 192,Ks-26   0,0,0,0,0,0,0
 -- Input File:  INVNTRY.DAT
 158,2.86E+00,9.00E-04,0,0,0,0,0
 159,8.77E+01,1.80E-02,0,0,0,0,0
 160,2.41E+04,1.80E-02,0,0,0,0,0
 161,3.73E+05,1.80E-02,0,0,0,0,0
 162,8.08E+07,9.00E-04,0,0,0,0,0
 163,5.75E+00,4.90E+08,0,0,0,0,0
 164,4.35E+10,1.00E-02,0,0,0,0,0
 165,6.50E+04,1.25E+05,0,0,0,0,0
 166,1.72E+02,1.17E+08,0,0,0,0,0
 167,9.00E+01,4.74E+07,0,0,0,0,0
 168,5.50E+01,9.68E+07,0,0,0,0,0
 169,1.00E+05,5.11E+04,0,0,0,0,0
 170,2.88E+01,4.50E-02,0,0,0,0,0
 171,7.10E+01,2.70E+07,0,0,0,0,0
 172,1.80E+02,2.70E+07,0,0,0,0,0
 173,2.11E+05,1.40E-01,0,0,0,0,0
 174,1.00E+13,5.24E-04,0,0,0,0,0
 175,7.88E+03,3.83E+05,0,0,0,0,0
 176,1.41E+10,1.98E-01,0,0,0,0,0
 177,6.30E+01,2.81E+08,0,0,0,0,0
 178,3.78E+00,7.92E+02,0,0,0,0,0
 179,3.52E-01,7.92E+02,0,0,0,0,0
 180,6.89E+01,3.97E+07,0,0,0,0,0
 181,1.59E+05,1.35E-01,0,0,0,0,0
 182,2.46E+05,1.12E+04,0,0,0,0,0
 183,7.04E+08,3.42E-03,0,0,0,0,0
 184,1.40E+17,9.20E-08,0,0,0,0,0
 185,1.53E+06,4.53E+03,0,0,0,0,0
 186,1.00E+00,7.92E+02,0,0,0,0,0
 187,1.00E+00,7.92E+02,0,0,0,0,0
 188,1.00E+00,7.92E+02,0,0,0,0,0
 189,1.00E+00,7.92E+02,0,0,0,0,0
 190,4.00E+00,7.92E+02,0,0,0,0,0
 191,4.00E+00,7.92E+02,0,0,0,0,0
 192,2.00E+00,7.92E+02,0,0,0,0,0
 -- Input File:  RQSITE.DAT
 158,1.58E-04,10.0,10.0
 159,1.58E-04,10.0,10.0
 160,1.58E-04,10.0,10.0
 161,1.58E-04,10.0,10.0
 162,1.58E-04,10.0,10.0
 163,1.58E-04,10.0,10.0
 164,1.47E-02,0.075,0.075
 165,1.54E-03,1.0,1.0
 166,4.15E-03,0.35,0.35
 167,6.40E-04,2.45,2.45
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168,3.18E-05,50.0,50.0
169,3.18E-05,50.0,50.0
170,1.92E-02,0.05,0.05
171,2.43E-04,6.5,6.5
172,2.43E-04,6.5,6.5
173,1.11E-02,0.11,0.11
174,1.24E-03,1.25,1.25
175,1.58E-04,10.0,10.0
176,1.58E-04,10.0,10.0
177,1.58E-04,10.0,10.0
178,8.69E-03,0.15,0.15
179,2.43E-04,6.5,6.5
180,2.63E-04,6.0,6.0
181,2.63E-04,6.0,6.0
182,2.63E-04,6.0,6.0
183,2.63E-04,6.0,6.0
184,1.58E-04,10.0,10.0
185,1.58E-04,10.0,10.0
186,4.70E-02,0.001,0.001
187,3.71E-02,0.01,0.01
188,1.20E-02,0.1,0.1
189,1.54E-03,1.0,1.0
190,3.18E-05,50.0,50.0
191,1.59E-05,100.0,100.0
192,1.54E-03,1.0,1.0

-- Input File:  UPTAKE.DAT
2.86E-03,3.55E-01,1.558
0,0,0,0,0
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0,0,0,0
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160,0.00E+00,0.0,0.0,0,0,0,0
161,0.00E+00,0.0,0.0,0,0,0,0
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163,0.00E+00,0.0,0.0,0,0,0,0
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182,0.00E+00,0.0,0.0,0,0,0,0
183,0.00E+00,0.0,0.0,0,0,0,0
184,0.00E+00,0.0,0.0,0,0,0,0
185,0.00E+00,0.0,0.0,0,0,0,0
186,0.00E+00,0.0,0.0,0,0,0,0
187,0.00E+00,0.0,0.0,0,0,0,0
188,0.00E+00,0.0,0.0,0,0,0,0
189,0.00E+00,0.0,0.0,0,0,0,0
190,0.00E+00,0.0,0.0,0,0,0,0
191,0.00E+00,0.0,0.0,0,0,0,0
192,0.00E+00,0.0,0.0,0,0,0,0
1
                      TOTAL EQUIVALENT UPTAKE FACTORS FOR PATHRAE
               UT(J,1)    UT(J,2)    UT(J,3)    UT(J,4)    UT(J,5)    UT(J,6)
                RIVER      WELL      EROSION    BATHTUB   SPILLAGE     FOOD
NUCLIDE         L/YR       L/YR       L/YR       L/YR       L/YR       KG/YR
  Pu-236      0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00
  Pu-238      0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00
  •
  •
  •
  Ks-25       0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00
  Ks-26       0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00
**********  PATHRAE INPUT SUMMARY  **********
THERE ARE 80 ISOTOPES IN THE DOSE FACTOR LIBRARY
NUMBER OF TIMES FOR CALCULATION IS118
YEARS TO BE CALCULATED ARE ...
     1.00      3.00      6.00      9.00     12.00
    15.00     18.00     21.00     24.00     27.00
    30.00     35.00     40.00     45.00     50.00
    55.00     60.00     65.00     70.00     75.00
    80.00     85.00     90.00     95.00    100.00
   105.00    110.00    115.00    120.00    125.00
   130.00    135.00    140.00    145.00    150.00
   155.00    160.00    165.00    170.00    175.00
   180.00    185.00    190.00    195.00    200.00
   205.00    210.00    215.00    220.00    225.00
   230.00    235.00    240.00    245.00    250.00
   255.00    260.00    265.00    270.00    275.00
   280.00    285.00    290.00    295.00    300.00
   310.00    320.00    330.00    340.00    350.00
   360.00    370.00    380.00    390.00    400.00
   410.00    420.00    430.00    440.00    450.00
   460.00    470.00    480.00    490.00    500.00
   510.00    520.00    530.00    540.00    550.00
   560.00    570.00    580.00    590.00    600.00
   610.00    620.00    630.00    640.00    650.00
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   660.00   670.00   680.00   690.00   700.00
   720.00   740.00   760.00   780.00   800.00
   825.00   850.00   875.00   900.00   925.00
   950.00   975.00  1000.00
THERE ARE  35 ISOTOPES IN THE INVENTORY FILE
THE VALUE OF IFLAG IS 0
NUMBER OF PATHWAYS IS  1
            PATHWAY              TYPE OF USAGE
                               FOR UPTAKE FACTORS
   1  GROUNDWATER TO RIVER           2
TIME OF OPERATION OF WASTE FACILITY IN YEARS                   0.
LENGTH OF REPOSITORY (M)                                       1.
WIDTH OF REPOSITORY (M)                                        1.
RIVER FLOW RATE (M**3/YR)                                      2.86E-03
STREAM FLOW RATE (M**3/YR)                                     2.86E-03
DISTANCE TO RIVER (M)                                          4.
OPERATIONAL SPILLAGE FRACTION                                  0.00E+00
DENSITY OF AQUIFER (KG/M**3)                                1558.
LONGITUDINAL DISPERSIVITY (M)                                  1.00E-01
LATERAL DISPERSION COEFFICIENT -- Y AXIS (M**2/YR)             0.00E+00
NUMBER OF MESH POINTS FOR DISPERSION CALCULATION               1
FLAG FOR GAMMA PATHWAY OPTIONS                                 0
FLAG FOR GAMMA BUILDUP CALCULATION                             0
FLAG FOR ATMOSPHERIC PATHWAY                                   0
COVER THICKNESS OVER WASTE (M)                                  .00
THICKNESS OF WASTE IN PITS (M)                                 1.00
TOTAL WASTE VOLUME (M**3)                                      1.000E+00
DISTANCE TO WELL -- X COORDINATE (M)                           4.
DISTANCE TO WELL -- Y COORDINATE (M)                           0.
DENSITY OF WASTE (KG/M**3)                                  1800.
FRACTION OF FOOD CONSUMED THAT IS GROWN ON SITE                1.000
FRACTION OF YEAR SPENT IN DIRECT RADIATION FIELD                .000
DEPTH OF PLANT ROOT ZONE (M)                                    .000
AREAL DENSITY OF PLANTS (KG/M**2)                               .000
AVERAGE DUST LOADING IN AIR (KG/M**3)                          0.00E+00
ANNUAL ADULT BREATHING RATE (M**3/YR)                          0.
FRACTION OF YEAR EXPOSED TO DUST                                .000
CANISTER LIFETIME (YEARS)                                      0.
INVENTORY SCALING FACTOR                                       1.00E+00
HEIGHT OF ROOMS IN RECLAIMER HOUSE (CM)                        0.
AIR CHANGE RATE IN RECLAIMER HOUSE (CHANGES/SEC)               0.00E+00
RADON EMANATING POWER OF THE WASTE                             0.00E+00
DIFFUSION COEFF. OF RADON IN WASTE (CM**2/SEC)                 0.00E+00
DIFFUSION COEFF. OF RN IN CONCRETE (CM**2/SEC)                 0.00E+00
THICKNESS OF CONCRETE SLAB FLOOR (CM)                           .0
DIFFUSION COEFF. OF RADON IN COVER (CM**2/SEC)                 0.00E+00
ATMOSPHERIC STABILITY CLASS                                    0
AVERAGE WIND SPEED (M/S)                                        .00
FRACTION OF TIME WIND BLOWS TOWARD RECEPTOR                     .0000
RECEPTOR DISTANCE FOR ATMOSPHERIC PATHWAY (M)                   .0
DUST RESUSPENSION RATE FOR OFFSITE TRANSPORT (M**3/S)          0.00E+00
DEPOSITION VELOCITY (M/S)                                       .0000
STACK HEIGHT (M)                                                .0
STACK INSIDE DIAMETER (M)                                       .00
STACK GAS VELOCITY (M/S)                                        .0
HEAT EMISSION RATE FROM BURNING (CAL/S)                        0.00E+00
DECAY CHAIN FLAGS                          0    0    0    0    0    0    0
FLAG FOR INPUT SUMMARY PRINTOUT                                1
FLAG FOR DIRECTION OF TRENCH FILLING                           1
FLAG FOR GROUNDWATER PATHWAY OPTIONS                           0
AMOUNT OF WATER PERCOLATING THROUGH WASTE ANNUALLY (M)         2.86E-03
DEGREE OF SOIL SATURATION                                       .308
RESIDUAL SOIL SATURATION                                        .033
PERMEABILITY OF VERTICAL ZONE (M/YR)                          97.40
SOIL NUMBER                                                     .000
POROSITY OF AQUIFER                                             .11
POROSITY OF UNSATURATED ZONE                                    .36
DISTANCE FROM AQUIFER TO WASTE (M)                              .0
AVERAGE VERTICAL GROUNDWATER VELOCITY (M/YR)                   2.62E-02
HORIZONTAL VELOCITY OF AQUIFER (M/YR)                           .0
LENGTH OF PERFORATED WELL CASING (M)                           1.000
SURFACE EROSION RATE (M/YR)                                    0.000E+00
LEACH RATE SCALING FACTOR                                      1.000E+00
ANNUAL RUNOFF OF PRECIPITATION (M)                             0.00E+00
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NUCLIDE	INGESTION DOSE FACTORS (MREM/PCI)	INHALATION DOSE FACTORS (MREM/PCI)	DIRECT GAMMA DOSE FACTORS (MREM-M2/PCI-YR)	HALF LIFE (YR)
Pu-236	0.000E+00	0.000E+00	0.000E+00	2.860E+00
Pu-238	0.000E+00	0.000E+00	0.000E+00	8.770E+01
Pu-239	0.000E+00	0.000E+00	0.000E+00	2.410E+04
Pu-242	0.000E+00	0.000E+00	0.000E+00	3.730E+05
Pu-244	0.000E+00	0.000E+00	0.000E+00	8.080E+07
Ra-228	0.000E+00	0.000E+00	0.000E+00	5.750E+00
Re-187	0.000E+00	0.000E+00	0.000E+00	4.350E+10
Se-79	0.000E+00	0.000E+00	0.000E+00	6.500E+04
Si-32	0.000E+00	0.000E+00	0.000E+00	1.720E+02
Sm-151	0.000E+00	0.000E+00	0.000E+00	9.000E+01
Sn-121m	0.000E+00	0.000E+00	0.000E+00	5.500E+01
Sn-126	0.000E+00	0.000E+00	0.000E+00	1.000E+05
Sr-90	0.000E+00	0.000E+00	0.000E+00	2.880E+01
Tb-157	0.000E+00	0.000E+00	0.000E+00	7.100E+01
Tb-158	0.000E+00	0.000E+00	0.000E+00	1.800E+02
Tc-99	0.000E+00	0.000E+00	0.000E+00	2.110E+05
Te-123	0.000E+00	0.000E+00	0.000E+00	1.000E+13
Th-229	0.000E+00	0.000E+00	0.000E+00	7.880E+03
Th-232	0.000E+00	0.000E+00	0.000E+00	1.410E+10
Ti-44	0.000E+00	0.000E+00	0.000E+00	6.300E+01
Tl-204	0.000E+00	0.000E+00	0.000E+00	3.780E+00
Tm-170	0.000E+00	0.000E+00	0.000E+00	3.520E-01
U-232	0.000E+00	0.000E+00	0.000E+00	6.890E+01
U-233	0.000E+00	0.000E+00	0.000E+00	1.590E+05
U-234	0.000E+00	0.000E+00	0.000E+00	2.460E+05
U-235	0.000E+00	0.000E+00	0.000E+00	7.040E+08
V-50	0.000E+00	0.000E+00	0.000E+00	1.400E+17
Zr-93	0.000E+00	0.000E+00	0.000E+00	1.530E+06

Ks-20	0.000E+00	0.000E+00	0.000E+00	1.000E+00
Ks-21	0.000E+00	0.000E+00	0.000E+00	1.000E+00
Ks-22	0.000E+00	0.000E+00	0.000E+00	1.000E+00
Ks-23	0.000E+00	0.000E+00	0.000E+00	1.000E+00
Ks-24	0.000E+00	0.000E+00	0.000E+00	4.000E+00
Ks-25	0.000E+00	0.000E+00	0.000E+00	4.000E+00
Ks-26	0.000E+00	0.000E+00	0.000E+00	2.000E+00

NUCLIDE	VOLATILITY FRACTION	GAMMA ENERGY (MEV)	GAMMA ATTENUATION (1/M)
Pu-236	0.000E+00	0.000E+00	0.000E+00
•			
•			
•			
Ks-25	0.000E+00	0.000E+00	0.000E+00
Ks-26	0.000E+00	0.000E+00	0.000E+00

NUCLIDE	INPUT LEACH RATE (1/YR)	FINAL LEACH RATE (1/YR)	SOLUBILITY (MOLE/L)	INPUT INVENTORY (CI)
Pu-236	1.580E-04	1.580E-04	0.000E+00	9.000E-04
Pu-238	1.580E-04	1.580E-04	0.000E+00	1.800E-02
Pu-239	1.580E-04	1.580E-04	0.000E+00	1.800E-02
Pu-242	1.580E-04	1.580E-04	0.000E+00	1.800E-02
Pu-244	1.580E-04	1.580E-04	0.000E+00	9.000E-04
Ra-228	1.580E-04	1.580E-04	0.000E+00	4.900E+08
Re-187	1.470E-02	1.470E-02	0.000E+00	1.000E-02
Se-79	1.540E-03	1.540E-03	0.000E+00	1.250E+05
Si-32	4.150E-03	4.150E-03	0.000E+00	1.170E+08
Sm-151	6.400E-04	6.400E-04	0.000E+00	4.740E+07
Sn-121m	3.180E-05	3.180E-05	0.000E+00	9.680E+07
Sn-126	3.180E-05	3.180E-05	0.000E+00	5.110E+04
Sr-90	1.920E-02	1.920E-02	0.000E+00	4.500E-02
Tb-157	2.430E-04	2.430E-04	0.000E+00	2.700E+07
Tb-158	2.430E-04	2.430E-04	0.000E+00	2.700E+07
Tc-99	1.110E-02	1.110E-02	0.000E+00	1.400E-01
Te-123	1.240E-03	1.240E-03	0.000E+00	5.240E-04
Th-229	1.580E-04	1.580E-04	0.000E+00	3.830E+05
Th-232	1.580E-04	1.580E-04	0.000E+00	1.980E-01
Ti-44	1.580E-04	1.580E-04	0.000E+00	2.810E+08
Tl-204	8.690E-03	8.690E-03	0.000E+00	7.920E+02
Tm-170	2.430E-04	2.430E-04	0.000E+00	7.920E+02
U-232	2.630E-04	2.630E-04	0.000E+00	3.970E+07
U-233	2.630E-04	2.630E-04	0.000E+00	1.350E-01
U-234	2.630E-04	2.630E-04	0.000E+00	1.120E+04
U-235	2.630E-04	2.630E-04	0.000E+00	3.420E-03
V-50	1.580E-04	1.580E-04	0.000E+00	9.200E-08
Zr-93	1.580E-04	1.580E-04	0.000E+00	4.530E+03
Ks-20	4.700E-02	4.700E-02	0.000E+00	7.920E+02
Ks-21	3.710E-02	3.710E-02	0.000E+00	7.920E+02
Ks-22	1.200E-02	1.200E-02	0.000E+00	7.920E+02
Ks-23	1.540E-03	1.540E-03	0.000E+00	7.920E+02
Ks-24	3.180E-05	3.180E-05	0.000E+00	7.920E+02
Ks-25	1.590E-05	1.590E-05	0.000E+00	7.920E+02
Ks-26	1.540E-03	1.540E-03	0.000E+00	7.920E+02

NUCLIDE	AQUIFER SORPTION	AQUIFER RETARDATION	VERTICAL SORPTION	VERTICAL RETARDATION
Pu-236	1.000E+01	1.439E+02	1.000E+01	1.435E+02
Pu-238	1.000E+01	1.439E+02	1.000E+01	1.435E+02
Pu-239	1.000E+01	1.439E+02	1.000E+01	1.435E+02
Pu-242	1.000E+01	1.439E+02	1.000E+01	1.435E+02
Pu-244	1.000E+01	1.439E+02	1.000E+01	1.435E+02
Ra-228	1.000E+01	1.439E+02	1.000E+01	1.435E+02
Re-187	7.500E-02	2.072E+00	7.500E-02	2.069E+00
Se-79	1.000E+00	1.529E+01	1.000E+00	1.525E+01
Si-32	3.500E-01	6.003E+00	3.500E-01	5.987E+00
Sm-151	2.450E+00	3.602E+01	2.450E+00	3.591E+01
Sn-121m	5.000E+01	7.157E+02	5.000E+01	7.135E+02
Sn-126	5.000E+01	7.157E+02	5.000E+01	7.135E+02
Sr-90	5.000E-02	1.715E+00	5.000E-02	1.712E+00
Tb-157	6.500E+00	9.391E+01	6.500E+00	9.362E+01
Tb-158	6.500E+00	9.391E+01	6.500E+00	9.362E+01
Tc-99	1.100E-01	2.572E+00	1.100E-01	2.567E+00
Te-123	1.250E+00	1.887E+01	1.250E+00	1.881E+01
Th-229	1.000E+01	1.439E+02	1.000E+01	1.435E+02
Th-232	1.000E+01	1.439E+02	1.000E+01	1.435E+02
Ti-44	1.000E+01	1.439E+02	1.000E+01	1.435E+02
Tl-204	1.500E-01	3.144E+00	1.500E-01	3.137E+00
Tm-170	6.500E+00	9.391E+01	6.500E+00	9.362E+01
U-232	6.000E+00	8.676E+01	6.000E+00	8.649E+01
U-233	6.000E+00	8.676E+01	6.000E+00	8.649E+01
U-234	6.000E+00	8.676E+01	6.000E+00	8.649E+01
U-235	6.000E+00	8.676E+01	6.000E+00	8.649E+01
V-50	1.000E+01	1.439E+02	1.000E+01	1.435E+02
Zr-93	1.000E+01	1.439E+02	1.000E+01	1.435E+02
Ks-20	1.000E-03	1.014E+00	1.000E-03	1.014E+00
Ks-21	1.000E-02	1.143E+00	1.000E-02	1.142E+00
Ks-22	1.000E-01	2.429E+00	1.000E-01	2.425E+00
Ks-23	1.000E+00	1.529E+01	1.000E+00	1.525E+01
Ks-24	5.000E+01	7.157E+02	5.000E+01	7.135E+02
Ks-25	1.000E+02	1.430E+03	1.000E+02	1.426E+03
Ks-26	1.000E+00	1.529E+01	1.000E+00	1.525E+01

BIOACCUMULATION FACTORS

NUCLIDE	SOIL-PLANT Bv	SOIL-PLANT Br	FORAGE-MILK Fm (D/L)	FORAGE-MEAT Ff (D/KG)
Pu-236	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pu-238	0.000E+00	0.000E+00	0.000E+00	0.000E+00
•				
•				
•				
Ks-25	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Ks-26	0.000E+00	0.000E+00	0.000E+00	0.000E+00

PATHWAY 1
GROUNDWATER TO RIVER

NUCLIDE CONCENTRATIONS IN RIVER (Ci/m**3)

NUCLIDE/TIME		1.	3.	6.	9.	12.	15.	18.	21.	24.	27.	30.	35.
40.	45.	50.	55.	60.	65.	70.	75.	80.	85.	90.	95.	100.	105.
110.	115.	120.	125.	130.	135.	140.	145.	150.	155.	160.	165.	170.	175.
180.	185.	190.	195.	200.	205.	210.	215.	220.	225.	230.	235.	240.	245.
250.	255.	260.	265.	270.	275.	280.	285.	290.	295.	300.	310.	320.	330.
340.	350.	360.	370.	380.	390.	400.	410.	420.	430.	440.	450.	460.	470.
480.	490.	500.	510.	520.	530.	540.	550.	560.	570.	580.	590.	600.	610.
620.	630.	640.	650.	660.	670.	680.	690.	700.	720.	740.	760.	780.	800.
825.	850.	875.	900.	925.	950.	975.	1000.						
Pu-236		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Pu-238		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Pu-239		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Pu-242		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Pu-244		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Ra-228		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Re-187		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E-19	8.0E-18	3.0E-16	7.0E-15	1.1E-13	1.2E-12	9.6E-12	6.3E-11	3.4E-10	1.5E-09
5.8E-09	2.0E-08	6.0E-08	1.7E-07	4.2E-07	9.8E-07	2.1E-06	4.3E-06	8.4E-06	1.5E-05	2.7E-05	4.5E-05	7.3E-05	1.1E-04
1.7E-04	2.6E-04	3.7E-04	5.1E-04	7.0E-04	9.4E-04	1.2E-03	1.6E-03	2.0E-03	2.5E-03	3.1E-03	3.7E-03	4.4E-03	5.2E-03
6.1E-03	7.0E-03	7.9E-03	8.9E-03	9.9E-03	1.1E-02	1.2E-02	1.3E-02	1.4E-02	1.5E-02	1.6E-02	1.7E-02	1.8E-02	1.9E-02
1.9E-02	1.9E-02	1.9E-02	1.8E-02	1.7E-02	1.6E-02	1.5E-02	1.3E-02	1.2E-02	1.0E-02	9.2E-03	8.0E-03	6.9E-03	5.9E-03
5.0E-03	4.2E-03	3.5E-03	2.9E-03	2.4E-03	2.0E-03	1.6E-03	1.3E-03	1.0E-03	8.4E-04	6.8E-04	5.4E-04	4.3E-04	3.4E-04
2.7E-04	2.1E-04	1.7E-04	1.3E-04	1.0E-04	7.9E-05	6.2E-05	4.8E-05	3.7E-05	2.2E-05	1.3E-05	7.7E-06	4.5E-06	2.6E-06
1.3E-06	6.5E-07	3.2E-07	1.6E-07	7.8E-08	3.8E-08	1.8E-08	8.9E-09						
Se-79		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	5.3E-20	3.8E-19	2.5E-18	1.4E-17	7.6E-17	3.7E-16	1.7E-15	7.1E-15	2.8E-14	1.0E-13	3.5E-13	1.2E-12	3.6E-12
1.1E-11	3.0E-11	8.2E-11	2.1E-10	5.4E-10	1.3E-09	3.0E-09	6.9E-09	1.5E-08	3.2E-08	6.7E-08	1.3E-07	2.7E-07	5.1E-07
9.7E-07	1.8E-06	3.2E-06	5.7E-06	9.9E-06	1.7E-05	2.9E-05	4.7E-05	7.7E-05	2.0E-04	4.7E-04	1.1E-03	2.4E-03	5.0E-03
1.2E-02	2.7E-02	5.7E-02	1.2E-01	2.3E-01	4.3E-01	7.8E-01	1.4E+00						
Si-32		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	7.1E-20	1.4E-18	2.2E-17	2.9E-16	3.1E-15	2.9E-14	2.3E-13	1.6E-12	9.7E-12	5.4E-11	2.7E-10
1.2E-09	5.0E-09	1.9E-08	6.9E-08	2.3E-07	7.3E-07	2.2E-06	6.1E-06	1.6E-05	4.2E-05	1.0E-04	2.4E-04	5.4E-04	1.2E-03
2.5E-03	5.1E-03	1.0E-02	1.9E-02	3.7E-02	6.7E-02	1.2E-01	2.1E-01	3.6E-01	6.0E-01	9.8E-01	2.5E+00	6.0E+00	1.3E+01
2.9E+01	5.8E+01	1.1E+02	2.1E+02	3.7E+02	6.3E+02	1.0E+03	1.7E+03	2.6E+03	4.0E+03	5.9E+03	8.6E+03	1.2E+04	1.7E+04
2.3E+04	3.1E+04	4.1E+04	5.3E+04	6.8E+04	8.6E+04	1.1E+05	1.3E+05	1.6E+05	1.9E+05	2.3E+05	2.7E+05	3.1E+05	3.6E+05
4.1E+05	4.7E+05	5.3E+05	5.9E+05	6.5E+05	7.2E+05	7.9E+05	8.6E+05	9.4E+05	1.1E+06	1.2E+06	1.3E+06	1.5E+06	1.6E+06
1.7E+06	1.7E+06	1.7E+06	1.7E+06	1.7E+06	1.6E+06	1.5E+06	1.4E+06						
Sm-151		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
1.5E-20	1.0E-19	6.1E-19	3.2E-18	1.5E-17	6.6E-17	2.6E-16	9.6E-16						
Sn-121m		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Sn-126		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Sr-90		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	2.9E-19	3.8E-17	2.1E-15	6.2E-14	1.1E-12	1.2E-11	9.6E-11	5.9E-10	2.8E-09	1.1E-08	3.8E-08	1.1E-07
2.9E-07	6.7E-07	1.4E-06	2.8E-06	5.0E-06	8.6E-06	1.4E-05	2.1E-05	3.1E-05	4.3E-05	5.8E-05	7.5E-05	9.4E-05	1.2E-04
1.4E-04	1.6E-04	1.8E-04	2.0E-04	2.2E-04	2.4E-04	2.5E-04	2.6E-04	2.6E-04	2.6E-04	2.6E-04	2.5E-04	2.4E-04	2.3E-04
2.2E-04	2.1E-04	1.9E-04	1.7E-04	1.6E-04	1.4E-04	1.3E-04	1.1E-04	9.8E-05	8.6E-05	7.4E-05	5.5E-05	4.0E-05	2.8E-05
1.9E-05	1.3E-05	8.9E-06	5.9E-06	3.9E-06	2.5E-06	1.6E-06	1.0E-06	6.3E-07	3.9E-07	2.4E-07	1.5E-07	9.1E-08	5.5E-08
3.3E-08	2.0E-08	1.2E-08	6.9E-09	4.1E-09	2.4E-09	1.4E-09	8.1E-10	4.7E-10	2.7E-10	1.6E-10	9.0E-11	5.2E-11	3.0E-11
1.7E-11	9.6E-12	5.4E-12	3.1E-12	1.7E-12	9.8E-13	5.5E-13	3.1E-13	1.7E-13	5.5E-14	1.7E-14	5.3E-15	1.6E-15	5.0E-16
1.1E-16	2.6E-17	5.8E-18	1.3E-18	2.9E-19	6.4E-20	1.4E-20	0.0E+00						
Tb-157		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Tb-158		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Tc-99		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.3E-20	1.7E-18	5.4E-17	1.1E-15	1.6E-14	1.8E-13	1.5E-12	1.0E-11
5.8E-11	2.8E-10	1.2E-09	4.4E-09	1.5E-08	4.4E-08	1.2E-07	3.2E-07	7.6E-07	1.7E-06	3.6E-06	7.3E-06	1.4E-05	2.6E-05
4.6E-05	7.8E-05	1.3E-04	2.1E-04	3.2E-04	4.9E-04	7.2E-04	1.0E-03	1.5E-03	2.0E-03	2.8E-03	3.7E-03	4.9E-03	6.3E-03
8.1E-03	1.0E-02	1.3E-02	1.6E-02	1.9E-02	2.3E-02	2.7E-02	3.2E-02	3.7E-02	4.3E-02	5.0E-02	6.4E-02	8.0E-02	9.8E-02
1.2E-01	1.3E-01	1.5E-01	1.7E-01	1.8E-01	2.0E-01	2.1E-01	2.1E-01	2.2E-01	2.2E-01	2.2E-01	2.1E-01	2.1E-01	2.0E-01
1.9E-01	1.8E-01	1.6E-01	1.5E-01	1.4E-01	1.3E-01	1.1E-01	1.0E-01	9.2E-02	8.1E-02	7.2E-02	6.3E-02	5.5E-02	4.8E-02
4.2E-02	3.6E-02	3.1E-02	2.6E-02	2.2E-02	1.9E-02	1.6E-02	1.4E-02	1.2E-02	8.1E-03	5.6E-03	3.9E-03	2.7E-03	1.8E-03
1.1E-03	6.6E-04	4.0E-04	2.4E-04	1.4E-04	8.1E-05	4.7E-05	2.7E-05						
Te-123		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.2E-20	3.0E-20	7.1E-20	1.6E-19
3.6E-19	7.7E-19	1.6E-18	3.4E-18	6.8E-18	1.3E-17	2.6E-17	4.8E-17	9.0E-17	2.9E-16	8.9E-16	2.6E-15	6.9E-15	1.8E-14
5.4E-14	1.5E-13	4.1E-13	1.0E-12	2.4E-12	5.5E-12	1.2E-11	2.5E-11						
Th-229		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Th-232		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Ti-44		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Tl-204		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.6E-20
1.3E-19	3.6E-19	8.7E-19	1.8E-18	3.3E-18	5.3E-18	7.7E-18	1.0E-17	1.2E-17	1.4E-17	1.4E-17	1.4E-17	1.3E-17	1.2E-17
9.7E-18	7.8E-18	6.0E-18	4.4E-18	3.2E-18	2.2E-18	1.5E-18	9.6E-19	6.1E-19	3.8E-19	2.3E-19	1.4E-19	8.0E-20	4.5E-20
2.6E-20	1.4E-20	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Tm-170		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						

U-232		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
U-233		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
U-234		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
U-235		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
V-50		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Zr-93		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Ks-20		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
5.8E-20	1.5E-19	1.5E-19	7.4E-20	2.3E-20	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Ks-21		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Ks-22		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Ks-23		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Ks-24		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Ks-25		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

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0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
    Ks-26        0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00  0.0E+00
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PATHRAE-RAD(PC)  Version 2.2d  February 1995
  Date: 12- 6-2007
  Time: 19: 3:19
EnergySolutions Class A South cell side slope sensitivity, lim.conc, vert., part
*****  Mirror Image of Input Files  *****
-- Input File:  ABCDEF.DAT
EnergySolutions Class A South cell side slope sensitivity, lim.conc, vert., part 1, S59La
118,1.,3.,6.,9.,12.,15.,18.,21.,24.,27.,30.,35.,40.,45.,50.,55.,60.,65.,70.,75.,80.,85.,90.,95.,100.,105.,110.,115.,120.,125.,130.,1
65,0,1
1,2
0,1.,1.,5.95E-03,5.95E-03,3.64,0
1558.,0.100,0,0,0.317,3.34E-02,97.4,0
1,0,0,0,0,0
0,1.,1.,3.64,0,1800.,1.,0,0,0
0,0,0,0.0,1.
0,0,0,0,0,0,0
0,0,0,0,0,0,0,0,0,0,0
0,0,0,1,0,0,1
1,0,1,0
0.00595,0.053,0.113,0,0,1.,0,1.,0,0.355


-- Input File:  BRCDCF.DAT
101,Ac-227  0,0,0,0,0,0,0
102,Ag-108m 0,0,0,0,0,0,0
103,Al-26   0,0,0,0,0,0,0
48,Am-241   0,0,0,0,0,0,0
104,Am-242m 0,0,0,0,0,0,0
105,Am-243  0,0,0,0,0,0,0
106,Ba-133  0,0,0,0,0,0,0
107,Be-10   0,0,0,0,0,0,0
108,Bi-207  0,0,0,0,0,0,0
109,Bi-210m 0,0,0,0,0,0,0
110,Bk-247  0,0,0,0,0,0,0
111,C-14    0,0,0,0,0,0,0
112,Ca-41   0,0,0,0,0,0,0
113,Cd-113  0,0,0,0,0,0,0
114,Cd-113m 0,0,0,0,0,0,0
115,Cf-249  0,0,0,0,0,0,0
116,Cf-250  0,0,0,0,0,0,0
117,Cf-251  0,0,0,0,0,0,0
118,Cf-252  0,0,0,0,0,0,0
119,Cl-36   0,0,0,0,0,0,0
120,Cm-243  0,0,0,0,0,0,0
50,Cm-244   0,0,0,0,0,0,0
121,Cm-245  0,0,0,0,0,0,0
122,Cm-246  0,0,0,0,0,0,0
123,Cm-247  0,0,0,0,0,0,0
124,Cm-248  0,0,0,0,0,0,0
125,Co-60   0,0,0,0,0,0,0
126,Cs-135  0,0,0,0,0,0,0
127,Cs-137  0,0,0,0,0,0,0
128,Eu-152  0,0,0,0,0,0,0
129,Eu-154  0,0,0,0,0,0,0
130,Eu-155  0,0,0,0,0,0,0
131,Fe-55   0,0,0,0,0,0,0
132,Fe-60   0,0,0,0,0,0,0
133,Gd-148  0,0,0,0,0,0,0
134,H-3     0,0,0,0,0,0,0
135,Hg-194  0,0,0,0,0,0,0
136,Ho-166m 0,0,0,0,0,0,0
137,I-129   0,0,0,0,0,0,0
138,K-40    0,0,0,0,0,0,0
139,Mn-53   0,0,0,0,0,0,0
140,Na-22   0,0,0,0,0,0,0
141,Nb-91   0,0,0,0,0,0,0
142,Nb-92   0,0,0,0,0,0,0
143,Nb-93m  0,0,0,0,0,0,0
144,Nb-94   0,0,0,0,0,0,0
146,Ni-59   0,0,0,0,0,0,0
147,Ni-63   0,0,0,0,0,0,0
42,Np-237   0,0,0,0,0,0,0
148,Os-194  0,0,0,0,0,0,0
149,Pa-231  0,0,0,0,0,0,0
150,Pb-202  0,0,0,0,0,0,0
151,Pb-210  0,0,0,0,0,0,0
152,Pd-107  0,0,0,0,0,0,0
153,Pm-145  0,0,0,0,0,0,0
154,Pm-147  0,0,0,0,0,0,0
155,Po-208  0,0,0,0,0,0,0
156,Po-209  0,0,0,0,0,0,0
157,Pt-193  0,0,0,0,0,0,0
45,Pu-240   0,0,0,0,0,0,0
46,Pu-241   0,0,0,0,0,0,0
55,Ra-226   0,0,0,0,0,0,0
36,Th-230   0,0,0,0,0,0,0
40,U-236    0,0,0,0,0,0,0
41,U-238    0,0,0,0,0,0,0
-- Input File:  INVNTRY.DAT
101,2.18E+01,1.30E+08,0,0,0,0,0
102,4.18E+02,4.69E+07,0,0,0,0,0
103,7.40E+05,3.72E-02,0,0,0,0,0
48,4.32E+02,1.80E-02,0,0,0,0,0
104,1.41E+02,1.80E-02,0,0,0,0,0
105,7.37E+03,1.80E-02,0,0,0,0,0
106,1.05E+01,4.61E+08,0,0,0,0,0
107,1.51E+06,3.96E+04,0,0,0,0,0
108,3.16E+01,9.66E+07,0,0,0,0,0
109,3.04E+06,1.02E+03,0,0,0,0,0
110,1.40E+03,1.64E-10,0,0,0,0,0
111,5.73E+03,1.30E+01,0,0,0,0,0
112,1.03E+05,2.39E-06,0,0,0,0,0
113,9.30E+15,7.75E-07,0,0,0,0,0
114,1.41E+01,4.04E+08,0,0,0,0,0
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115,3.51E+02,1.80E-02,0,0,0,0,0
116,1.31E+01,9.00E-04,0,0,0,0,0
117,8.98E+02,1.80E-02,0,0,0,0,0
118,2.65E+00,7.92E+02,0,0,0,0,0
119,3.01E+05,4.87E-07,0,0,0,0,0
120,2.91E+01,1.80E-02,0,0,0,0,0
50,1.81E+01,1.80E-02,0,0,0,0,0
121,8.50E+03,1.80E-02,0,0,0,0,0
122,4.73E+03,1.80E-02,0,0,0,0,0
123,1.56E+07,1.80E-02,0,0,0,0,0
124,3.40E+05,1.80E-02,0,0,0,0,0
125,5.27E+00,7.92E+02,0,0,0,0,0
126,2.30E+06,2.07E+03,0,0,0,0,0
127,3.01E+01,1.13E+00,0,0,0,0,0
128,1.35E+01,3.11E+08,0,0,0,0,0
129,8.59E+00,4.87E+08,0,0,0,0,0
130,4.76E+00,7.92E+02,0,0,0,0,0
131,2.73E+00,7.92E+02,0,0,0,0,0
132,1.50E+06,7.15E+03,0,0,0,0,0
133,7.46E+01,5.80E+07,0,0,0,0,0
134,1.23E+01,4.50E+01,0,0,0,0,0
135,4.44E+02,6.38E+06,0,0,0,0,0
136,1.20E+03,3.24E+06,0,0,0,0,0
137,1.57E+07,1.20E-07,0,0,0,0,0
138,1.28E+09,8.10E-05,0,0,0,0,0
139,3.74E+06,3.24E+03,0,0,0,0,0
140,2.60E+00,7.92E+02,0,0,0,0,0
141,6.80E+02,1.04E+07,0,0,0,0,0
142,3.47E+07,2.02E+02,0,0,0,0,0
143,1.61E+01,4.74E+08,0,0,0,0,0
144,2.03E+04,2.34E-02,0,0,0,0,0
146,7.60E+04,2.52E+01,0,0,0,0,0
147,1.00E+02,3.96E+00,0,0,0,0,0
42,2.14E+06,1.80E-02,0,0,0,0,0
148,6.00E+00,5.53E+08,0,0,0,0,0
149,3.28E+04,8.46E+04,0,0,0,0,0
150,5.25E+04,6.12E+03,0,0,0,0,0
151,2.23E+01,1.37E+08,0,0,0,0,0
152,6.50E+06,9.18E+02,0,0,0,0,0
153,1.77E+01,2.52E+08,0,0,0,0,0
154,2.62E+00,7.92E+02,0,0,0,0,0
155,2.90E+00,7.92E+02,0,0,0,0,0
156,1.02E+02,3.02E+07,0,0,0,0,0
157,5.00E+01,6.66E+07,0,0,0,0,0
55,1.60E+03,1.80E-02,0,0,0,0,0
45,6.56E+03,1.80E-02,0,0,0,0,0
46,1.44E+01,6.30E-01,0,0,0,0,0
36,7.54E+04,3.71E+04,0,0,0,0,0
40,2.34E+07,1.16E+02,0,0,0,0,0
41,4.47E+09,6.05E-01,0,0,0,0,0
-- Input File:  RQSITE.DAT
101,7.29E-04,4.5,4.5
102,1.21E-03,2.7,2.7
103,2.20E-04,15.0,15.0
48,3.19E-03,1.0,1.0
104,3.19E-03,1.0,1.0
105,3.19E-03,1.0,1.0
106,3.29E-04,10.0,10.0
107,1.30E-03,2.5,2.5
108,3.19E-03,1.0,1.0
109,3.19E-03,1.0,1.0
110,8.78E-02,0.001,0.001
111,3.86E-04,8.52,8.52
112,3.81E-02,0.05,0.05
113,3.19E-03,1.0,1.0
114,3.19E-03,1.0,1.0
115,1.62E-03,2.0,2.0
116,1.62E-03,2.0,2.0
117,1.62E-03,2.0,2.0
118,1.62E-03,2.0,2.0
119,8.44E-02,0.0025,0.0025
120,3.54E-05,93.3,93.3
50,3.54E-05,93.3,93.3
121,3.54E-05,93.3,93.3
122,3.54E-05,93.3,93.3
123,3.54E-05,93.3,93.3
124,3.54E-05,93.3,93.3
125,8.93E-06,370.0,370.0
126,2.48E-05,133.0,133.0
127,2.48E-05,133.0,133.0
128,5.06E-04,6.5,6.5
129,5.06E-04,6.5,6.5
130,5.06E-04,6.5,6.5
131,2.30E-03,1.4,1.4
132,2.30E-03,1.4,1.4
133,5.06E-04,6.5,6.5
134,4.31E-02,0.04,0.04
135,3.29E-04,10.0,10.0
136,1.30E-03,2.5,2.5
137,2.11E-02,0.12,0.12
138,1.77E-02,0.15,0.15
139,5.14E-04,6.4,6.4
140,3.19E-03,1.0,1.0
141,2.02E-03,1.6,1.6
142,2.02E-03,1.6,1.6
143,2.02E-03,1.6,1.6
144,2.02E-03,1.6,1.6
146,3.29E-04,10.0,10.0
147,3.29E-04,10.0,10.0
42,1.09E-03,3.0,3.0
148,7.29E-04,4.5,4.5
149,5.97E-04,5.5,5.5
150,1.74E-04,19.0,19.0
151,1.74E-04,19.0,19.0
152,5.63E-03,0.55,0.55
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153,5.06E-04,6.5,6.5
154,5.06E-04,6.5,6.5
155,3.66E-04,9.0,9.0
156,3.66E-04,9.0,9.0
157,3.53E-03,0.9,0.9
45,3.29E-04,10.0,10.0
46,3.29E-04,10.0,10.0
36,3.29E-04,10.0,10.0
55,3.29E-04,9.99,9.99
40,5.48E-04,6.0,6.0
41,5.48E-04,6.0,6.0
-- Input File:  UPTAKE.DAT
5.95E-03,3.55E-01,1.558
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0,0,0,0,0
0,0,0,0,0,730.,0
101,0.00E+00,0.0,0.0,0,0,0,0
102,0.00E+00,0.0,0.0,0,0,0,0
103,0.00E+00,0.0,0.0,0,0,0,0
48,0.00E+00,0.0,0.0,0,0,0,0
104,0.00E+00,0.0,0.0,0,0,0,0
105,0.00E+00,0.0,0.0,0,0,0,0
106,0.00E+00,0.0,0.0,0,0,0,0
107,0.00E+00,0.0,0.0,0,0,0,0
108,0.00E+00,0.0,0.0,0,0,0,0
109,0.00E+00,0.0,0.0,0,0,0,0
110,0.00E+00,0.0,0.0,0,0,0,0
111,0.00E+00,0.0,0.0,0,0,0,0
112,0.00E+00,0.0,0.0,0,0,0,0
113,0.00E+00,0.0,0.0,0,0,0,0
114,0.00E+00,0.0,0.0,0,0,0,0
115,0.00E+00,0.0,0.0,0,0,0,0
116,0.00E+00,0.0,0.0,0,0,0,0
117,0.00E+00,0.0,0.0,0,0,0,0
118,0.00E+00,0.0,0.0,0,0,0,0
119,0.00E+00,0.0,0.0,0,0,0,0
120,0.00E+00,0.0,0.0,0,0,0,0
50,0.00E+00,0.0,0.0,0,0,0,0
121,0.00E+00,0.0,0.0,0,0,0,0
122,0.00E+00,0.0,0.0,0,0,0,0
123,0.00E+00,0.0,0.0,0,0,0,0
124,0.00E+00,0.0,0.0,0,0,0,0
125,0.00E+00,0.0,0.0,0,0,0,0
126,0.00E+00,0.0,0.0,0,0,0,0
127,0.00E+00,0.0,0.0,0,0,0,0
128,0.00E+00,0.0,0.0,0,0,0,0
129,0.00E+00,0.0,0.0,0,0,0,0
130,0.00E+00,0.0,0.0,0,0,0,0
131,0.00E+00,0.0,0.0,0,0,0,0
132,0.00E+00,0.0,0.0,0,0,0,0
133,0.00E+00,0.0,0.0,0,0,0,0
134,0.00E+00,0.0,0.0,0,0,0,0
135,0.00E+00,0.0,0.0,0,0,0,0
136,0.00E+00,0.0,0.0,0,0,0,0
137,0.00E+00,0.0,0.0,0,0,0,0
138,0.00E+00,0.0,0.0,0,0,0,0
139,0.00E+00,0.0,0.0,0,0,0,0
140,0.00E+00,0.0,0.0,0,0,0,0
141,0.00E+00,0.0,0.0,0,0,0,0
142,0.00E+00,0.0,0.0,0,0,0,0
143,0.00E+00,0.0,0.0,0,0,0,0
144,0.00E+00,0.0,0.0,0,0,0,0
146,0.00E+00,0.0,0.0,0,0,0,0
147,0.00E+00,0.0,0.0,0,0,0,0
42,0.00E+00,0.0,0.0,0,0,0,0
148,0.00E+00,0.0,0.0,0,0,0,0
149,0.00E+00,0.0,0.0,0,0,0,0
150,0.00E+00,0.0,0.0,0,0,0,0
151,0.00E+00,0.0,0.0,0,0,0,0
152,0.00E+00,0.0,0.0,0,0,0,0
153,0.00E+00,0.0,0.0,0,0,0,0
154,0.00E+00,0.0,0.0,0,0,0,0
155,0.00E+00,0.0,0.0,0,0,0,0
156,0.00E+00,0.0,0.0,0,0,0,0
157,0.00E+00,0.0,0.0,0,0,0,0
45,0.00E+00,0.0,0.0,0,0,0,0
46,0.00E+00,0.0,0.0,0,0,0,0
55,0.00E+00,0.0,0.0,0,0,0,0
36,0.00E+00,0.0,0.0,0,0,0,0
40,0.00E+00,0.0,0.0,0,0,0,0
41,0.00E+00,0.0,0.0,0,0,0,0
1
                     TOTAL EQUIVALENT UPTAKE FACTORS FOR PATHRAE
            UT(J,1)   UT(J,2)   UT(J,3)   UT(J,4)   UT(J,5)   UT(J,6)
             RIVER     WELL     EROSION   BATHTUB  SPILLAGE    FOOD
NUCLIDE      L/YR      L/YR      L/YR      L/YR      L/YR      KG/YR
  Ac-227    0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Ag-108m   0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  •
  •
  •
  Po-209    0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Pt-193    0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
**********  PATHRAE INPUT SUMMARY  **********
THERE ARE 80 ISOTOPES IN THE DOSE FACTOR LIBRARY
NUMBER OF TIMES FOR CALCULATION IS118
YEARS TO BE CALCULATED ARE ...
     1.00     3.00     6.00     9.00    12.00
    15.00    18.00    21.00    24.00    27.00
    30.00    35.00    40.00    45.00    50.00
    55.00    60.00    65.00    70.00    75.00
    80.00    85.00    90.00    95.00   100.00
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    105.00    110.00    115.00    120.00    125.00
    130.00    135.00    140.00    145.00    150.00
    155.00    160.00    165.00    170.00    175.00
    180.00    185.00    190.00    195.00    200.00
    205.00    210.00    215.00    220.00    225.00
    230.00    235.00    240.00    245.00    250.00
    255.00    260.00    265.00    270.00    275.00
    280.00    285.00    290.00    295.00    300.00
    310.00    320.00    330.00    340.00    350.00
    360.00    370.00    380.00    390.00    400.00
    410.00    420.00    430.00    440.00    450.00
    460.00    470.00    480.00    490.00    500.00
    510.00    520.00    530.00    540.00    550.00
    560.00    570.00    580.00    590.00    600.00
    610.00    620.00    630.00    640.00    650.00
    660.00    670.00    680.00    690.00    700.00
    720.00    740.00    760.00    780.00    800.00
    825.00    850.00    875.00    900.00    925.00
    950.00    975.00   1000.00
THERE ARE  65 ISOTOPES IN THE INVENTORY FILE
THE VALUE OF IFLAG IS 0
NUMBER OF PATHWAYS IS  1
         PATHWAY            TYPE OF USAGE
                          FOR UPTAKE FACTORS
  1  GROUNDWATER TO RIVER         2
TIME OF OPERATION OF WASTE FACILITY IN YEARS                        0.
LENGTH OF REPOSITORY (M)                                            1.
WIDTH OF REPOSITORY (M)                                             1.
RIVER FLOW RATE (M**3/YR)                                           5.95E-03
STREAM FLOW RATE (M**3/YR)                                          5.95E-03
DISTANCE TO RIVER (M)                                               4.
OPERATIONAL SPILLAGE FRACTION                                       0.00E+00
DENSITY OF AQUIFER (KG/M**3)                                     1558.
LONGITUDINAL DISPERSIVITY (M)                                       1.00E-01
LATERAL DISPERSION COEFFICIENT -- Y AXIS (M**2/YR)                  0.00E+00
NUMBER OF MESH POINTS FOR DISPERSION CALCULATION                    1
FLAG FOR GAMMA PATHWAY OPTIONS                                      0
FLAG FOR GAMMA BUILDUP CALCULATION                                  0
FLAG FOR ATMOSPHERIC PATHWAY                                        0
COVER THICKNESS OVER WASTE (M)                                       .00
THICKNESS OF WASTE IN PITS (M)                                      1.00
TOTAL WASTE VOLUME (M**3)                                           1.000E+00
DISTANCE TO WELL -- X COORDINATE (M)                                4.
DISTANCE TO WELL -- Y COORDINATE (M)                                0.
DENSITY OF WASTE (KG/M**3)                                       1800.
FRACTION OF FOOD CONSUMED THAT IS GROWN ON SITE                     1.000
FRACTION OF YEAR SPENT IN DIRECT RADIATION FIELD                     .000
DEPTH OF PLANT ROOT ZONE (M)                                         .000
AREAL DENSITY OF PLANTS (KG/M**2)                                    .000
AVERAGE DUST LOADING IN AIR (KG/M**3)                               0.00E+00
ANNUAL ADULT BREATHING RATE (M**3/YR)                               0.
FRACTION OF YEAR EXPOSED TO DUST                                     .000
CANISTER LIFETIME (YEARS)                                           0.
INVENTORY SCALING FACTOR                                            1.00E+00
HEIGHT OF ROOMS IN RECLAIMER HOUSE (CM)                             0.
AIR CHANGE RATE IN RECLAIMER HOUSE (CHANGES/SEC)                    0.00E+00
RADON EMANATING POWER OF THE WASTE                                  0.00E+00

DIFFUSION COEFF. OF RADON IN WASTE (CM**2/SEC)                      0.00E+00
DIFFUSION COEFF. OF RN IN CONCRETE (CM**2/SEC)                      0.00E+00
THICKNESS OF CONCRETE SLAB FLOOR (CM)                                .0
DIFFUSION COEFF. OF RADON IN COVER (CM**2/SEC)                      0.00E+00
ATMOSPHERIC STABILITY CLASS                                         0
AVERAGE WIND SPEED (M/S)                                             .00
FRACTION OF TIME WIND BLOWS TOWARD RECEPTOR                          .0000
RECEPTOR DISTANCE FOR ATMOSPHERIC PATHWAY (M)                        .0
DUST RESUSPENSION RATE FOR OFFSITE TRANSPORT (M**3/S)               0.00E+00
DEPOSITION VELOCITY (M/S)                                            .0000
STACK HEIGHT (M)                                                     .0
STACK INSIDE DIAMETER (M)                                            .00
STACK GAS VELOCITY (M/S)                                             .0
HEAT EMISSION RATE FROM BURNING (CAL/S)                             0.00E+00
DECAY CHAIN FLAGS                                   0   0   0   1   0   0   1
FLAG FOR INPUT SUMMARY PRINTOUT                                     1
FLAG FOR DIRECTION OF TRENCH FILLING                                1
FLAG FOR GROUNDWATER PATHWAY OPTIONS                                0
AMOUNT OF WATER PERCOLATING THROUGH WASTE ANNUALLY (M)              5.95E-03
DEGREE OF SOIL SATURATION                                            .317
RESIDUAL SOIL SATURATION                                             .033
PERMEABILITY OF VERTICAL ZONE (M/YR)                               97.40
SOIL NUMBER                                                          .000
POROSITY OF AQUIFER                                                  .11
POROSITY OF UNSATURATED ZONE                                         .36
DISTANCE FROM AQUIFER TO WASTE (M)                                   .0
AVERAGE VERTICAL GROUNDWATER VELOCITY (M/YR)                        5.29E 02
HORIZONTAL VELOCITY OF AQUIFER (M/YR)                                .1
LENGTH OF PERFORATED WELL CASING (M)                                1.000
SURFACE EROSION RATE (M/YR)                                         0.000E+00
LEACH RATE SCALING FACTOR                                           1.000E+00
ANNUAL RUNOFF OF PRECIPITATION (M)                                  0.00E+00
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NUCLIDE	INGESTION DOSE FACTORS (MREM/PCI)	INHALATION DOSE FACTORS (MREM/PCI)	DIRECT GAMMA DOSE FACTORS (MREM-M2/PCI-YR)	HALF LIFE (YR)
Ac-227	0.000E+00	0.000E+00	0.000E+00	2.180E+01
Ag-108m	0.000E+00	0.000E+00	0.000E+00	4.180E+02
Al-26	0.000E+00	0.000E+00	0.000E+00	7.400E+05
Am-242m	0.000E+00	0.000E+00	0.000E+00	1.410E+02
Am-243	0.000E+00	0.000E+00	0.000E+00	7.370E+03
Ba-133	0.000E+00	0.000E+00	0.000E+00	1.050E+01
Be-10	0.000E+00	0.000E+00	0.000E+00	1.510E+06
Bi-207	0.000E+00	0.000E+00	0.000E+00	3.160E+01
Bi-210m	0.000E+00	0.000E+00	0.000E+00	3.040E+06
Bk-247	0.000E+00	0.000E+00	0.000E+00	1.400E+03
C-14	0.000E+00	0.000E+00	0.000E+00	5.730E+03
Ca-41	0.000E+00	0.000E+00	0.000E+00	1.030E+05

Cd-113	0.000E+00	0.000E+00	0.000E+00	9.300E+15
Cd-113m	0.000E+00	0.000E+00	0.000E+00	1.410E+01
Cf-249	0.000E+00	0.000E+00	0.000E+00	3.510E+02
Cf-250	0.000E+00	0.000E+00	0.000E+00	1.310E+01
Cf-251	0.000E+00	0.000E+00	0.000E+00	8.980E+02
Cf-252	0.000E+00	0.000E+00	0.000E+00	2.650E+00
Cl-36	0.000E+00	0.000E+00	0.000E+00	3.010E+05
Cm-243	0.000E+00	0.000E+00	0.000E+00	2.910E+01
Cm-245	0.000E+00	0.000E+00	0.000E+00	8.500E+03
Cm-246	0.000E+00	0.000E+00	0.000E+00	4.730E+03
Cm-247	0.000E+00	0.000E+00	0.000E+00	1.560E+07
Cm-248	0.000E+00	0.000E+00	0.000E+00	3.400E+05
Co-60	0.000E+00	0.000E+00	0.000E+00	5.270E+00
Cs-135	0.000E+00	0.000E+00	0.000E+00	2.300E+06
Cs-137	0.000E+00	0.000E+00	0.000E+00	3.010E+01
Eu-152	0.000E+00	0.000E+00	0.000E+00	1.350E+01
Eu-154	0.000E+00	0.000E+00	0.000E+00	8.590E+00
Eu-155	0.000E+00	0.000E+00	0.000E+00	4.760E+00
Fe-55	0.000E+00	0.000E+00	0.000E+00	2.730E+00
Fe-60	0.000E+00	0.000E+00	0.000E+00	1.500E+06
Gd-148	0.000E+00	0.000E+00	0.000E+00	7.460E+01
H-3	0.000E+00	0.000E+00	0.000E+00	1.230E+01
Hg-194	0.000E+00	0.000E+00	0.000E+00	4.440E+02
Th-230	0.000E+00	0.000E+00	0.000E+00	7.540E+04
U-236	0.000E+00	0.000E+00	0.000E+00	2.340E+07
U-238	0.000E+00	0.000E+00	0.000E+00	4.470E+09
Np-237	0.000E+00	0.000E+00	0.000E+00	2.140E+06
Pu-240	0.000E+00	0.000E+00	0.000E+00	6.560E+03
Pu-241	0.000E+00	0.000E+00	0.000E+00	1.440E+01
Am-241	0.000E+00	0.000E+00	0.000E+00	4.320E+02
Cm-244	0.000E+00	0.000E+00	0.000E+00	1.810E+01
Ra-226	0.000E+00	0.000E+00	0.000E+00	1.600E+03
Ho-166m	0.000E+00	0.000E+00	0.000E+00	1.200E+03
I-129	0.000E+00	0.000E+00	0.000E+00	1.570E+07
K-40	0.000E+00	0.000E+00	0.000E+00	1.280E+09
Mn-53	0.000E+00	0.000E+00	0.000E+00	3.740E+06
Na-22	0.000E+00	0.000E+00	0.000E+00	2.600E+00
Nb-91	0.000E+00	0.000E+00	0.000E+00	6.800E+02
Nb-92	0.000E+00	0.000E+00	0.000E+00	3.470E+07
Nb-93m	0.000E+00	0.000E+00	0.000E+00	1.610E+01
Nb-94	0.000E+00	0.000E+00	0.000E+00	2.030E+04
Ni-59	0.000E+00	0.000E+00	0.000E+00	7.600E+04
Ni-63	0.000E+00	0.000E+00	0.000E+00	1.000E+02
Os-194	0.000E+00	0.000E+00	0.000E+00	6.000E+00
Pa-231	0.000E+00	0.000E+00	0.000E+00	3.280E+04
Pb-202	0.000E+00	0.000E+00	0.000E+00	5.250E+04
Pb-210	0.000E+00	0.000E+00	0.000E+00	2.230E+01
Pd-107	0.000E+00	0.000E+00	0.000E+00	6.500E+06
Pm-145	0.000E+00	0.000E+00	0.000E+00	1.770E+01
Pm-147	0.000E+00	0.000E+00	0.000E+00	2.620E+00
Po-208	0.000E+00	0.000E+00	0.000E+00	2.900E+00
Po-209	0.000E+00	0.000E+00	0.000E+00	1.020E+02
Pt-193	0.000E+00	0.000E+00	0.000E+00	5.000E+01

NUCLIDE	VOLATILITY FRACTION	GAMMA ENERGY (MEV)	GAMMA ATTENUATION (1/M)
Ac-227	0.000E+00	0.000E+00	0.000E+00
Ag-108m	0.000E+00	0.000E+00	0.000E+00
•			
•			
•			
Po-209	0.000E+00	0.000E+00	0.000E+00
Pt-193	0.000E+00	0.000E+00	0.000E+00

NUCLIDE	INPUT LEACH RATE (1/YR)	FINAL LEACH RATE (1/YR)	SOLUBILITY (MOLE/L)	INPUT INVENTORY (CI)
Ac-227	7.290E-04	7.290E-04	0.000E+00	1.300E+08
Ag-108m	1.210E-03	1.210E-03	0.000E+00	4.690E+07
Al-26	2.200E-04	2.200E-04	0.000E+00	3.720E-02
Am-242m	3.190E-03	3.190E-03	0.000E+00	1.800E-02
Am-243	3.190E-03	3.190E-03	0.000E+00	1.800E-02
Ba-133	3.290E-04	3.290E-04	0.000E+00	4.610E+08
Be-10	1.300E-03	1.300E-03	0.000E+00	3.960E+04
Bi-207	3.190E-03	3.190E-03	0.000E+00	9.660E+07
Bi-210m	3.190E-03	3.190E-03	0.000E+00	1.020E+03
Bk-247	8.780E-02	8.780E-02	0.000E+00	1.640E-10
C-14	3.860E-04	3.860E-04	0.000E+00	1.300E+01
Ca-41	3.810E-02	3.810E-02	0.000E+00	2.390E-06
Cd-113	3.190E-03	3.190E-03	0.000E+00	7.750E-07
Cd-113m	3.190E-03	3.190E-03	0.000E+00	4.040E+08
Cf-249	1.620E-03	1.620E-03	0.000E+00	1.800E-02
Cf-250	1.620E-03	1.620E-03	0.000E+00	9.000E-04
Cf-251	1.620E-03	1.620E-03	0.000E+00	1.800E-02
Cf-252	1.620E-03	1.620E-03	0.000E+00	7.920E+02
Cl-36	8.440E-02	8.440E-02	0.000E+00	4.870E-07
Cm-243	3.540E-05	3.540E-05	0.000E+00	1.800E-02
Cm-245	3.540E-05	3.540E-05	0.000E+00	1.800E-02
Cm-246	3.540E-05	3.540E-05	0.000E+00	1.800E-02
Cm-247	3.540E-05	3.540E-05	0.000E+00	1.800E-02
Cm-248	3.540E-05	3.540E-05	0.000E+00	1.800E-02
Co-60	8.930E-06	8.930E-06	0.000E+00	7.920E+02
Cs-135	2.480E-05	2.480E-05	0.000E+00	2.070E+03
Cs-137	2.480E-05	2.480E-05	0.000E+00	1.130E+00
Eu-152	5.060E-04	5.060E-04	0.000E+00	3.110E+08
Eu-154	5.060E-04	5.060E-04	0.000E+00	4.870E+08
Eu-155	5.060E-04	5.060E-04	0.000E+00	7.920E+02
Fe-55	2.300E-03	2.300E-03	0.000E+00	7.920E+02
Fe-60	2.300E-03	2.300E-03	0.000E+00	7.150E+03
Gd-148	5.060E-04	5.060E-04	0.000E+00	5.800E+07
H-3	4.310E-02	4.310E-02	0.000E+00	4.500E+01
Hg-194	3.290E-04	3.290E-04	0.000E+00	6.380E+06
Th-230	3.290E-04	3.290E-04	0.000E+00	3.710E+04
U-236	5.480E-04	5.480E 04	0.000E+00	1.160E+02
U-238	5.480E-04	5.480E-04	0.000E+00	6.050E-01
Np-237	1.090E-03	1.090E-03	0.000E+00	1.800E-02

Pu-240	3.290E-04	3.290E-04	0.000E+00	1.800E-02
Pu-241	3.290E-04	3.290E-04	0.000E+00	6.300E-01
Am-241	3.190E-03	3.190E-03	0.000E+00	1.800E-02
Cm-244	3.540E-05	3.540E-05	0.000E+00	1.800E-02
Ra-226	3.290E-04	3.290E-04	0.000E+00	1.800E-02
Ho-166m	1.300E-03	1.300E-03	0.000E+00	3.240E+06
I-129	2.110E-02	2.110E-02	0.000E+00	1.200E-07
K-40	1.770E-02	1.770E-02	0.000E+00	8.100E-05
Mn-53	5.140E-04	5.140E-04	0.000E+00	3.240E+03
Na-22	3.190E-03	3.190E-03	0.000E+00	7.920E+02
Nb-91	2.020E-03	2.020E-03	0.000E+00	1.040E+07
Nb-92	2.020E-03	2.020E-03	0.000E+00	2.020E+02
Nb-93m	2.020E-03	2.020E-03	0.000E+00	4.740E+08
Nb-94	2.020E-03	2.020E-03	0.000E+00	2.340E-02
Ni-59	3.290E-04	3.290E-04	0.000E+00	2.520E+01
Ni-63	3.290E-04	3.290E-04	0.000E+00	3.960E+00
Os-194	7.290E-04	7.290E-04	0.000E+00	5.530E+08
Pa-231	5.970E-04	5.970E-04	0.000E+00	8.460E+04
Pb-202	1.740E-04	1.740E-04	0.000E+00	6.120E+03
Pb-210	1.740E-04	1.740E-04	0.000E+00	1.370E+08
Pd-107	5.630E-03	5.630E-03	0.000E+00	9.180E+02
Pm-145	5.060E-04	5.060E-04	0.000E+00	2.520E+08
Pm-147	5.060E-04	5.060E-04	0.000E+00	7.920E+02
Po-208	3.660E-04	3.660E-04	0.000E+00	7.920E+02
Po-209	3.660E-04	3.660E-04	0.000E+00	3.020E+07
Pt-193	3.530E-03	3.530E-03	0.000E+00	6.660E+07

NUCLIDE	AQUIFER SORPTION	AQUIFER RETARDATION	VERTICAL SORPTION	VERTICAL RETARDATION
Ac-227	4.500E+00	6.304E+01	4.500E+00	6.330E+01
Ag-108m	2.700E+00	3.823E+01	2.700E+00	3.838E+01
Al-26	1.500E+01	2.078E+02	1.500E+01	2.087E+02
Am-242m	1.000E+00	1.479E+01	1.000E+00	1.484E+01
Am-243	1.000E+00	1.479E+01	1.000E+00	1.484E+01
Ba-133	1.000E+01	1.389E+02	1.000E+01	1.394E+02
Be-10	2.500E+00	3.547E+01	2.500E+00	3.561E+01
Bi-207	1.000E+00	1.479E+01	1.000E+00	1.484E+01
Bi-210m	1.000E+00	1.479E+01	1.000E+00	1.484E+01
Bk-247	1.000E-03	1.014E+00	1.000E-03	1.014E+00
C-14	8.520E+00	1.185E+02	8.520E+00	1.190E+02
Ca-41	5.000E-02	1.689E+00	5.000E-02	1.692E+00
Cd-113	1.000E+00	1.479E+01	1.000E+00	1.484E+01
Cd-113m	1.000E+00	1.479E+01	1.000E+00	1.484E+01
Cf-249	2.000E+00	2.858E+01	2.000E+00	2.869E+01
Cf-250	2.000E+00	2.858E+01	2.000E+00	2.869E+01
Cf-251	2.000E+00	2.858E+01	2.000E+00	2.869E+01
Cf-252	2.000E+00	2.858E+01	2.000E+00	2.869E+01
Cl-36	2.500E-03	1.034E+00	2.500E-03	1.035E+00
Cm-243	9.330E+01	1.287E+03	9.330E+01	1.293E+03
Cm-245	9.330E+01	1.287E+03	9.330E+01	1.293E+03
Cm-246	9.330E+01	1.287E+03	9.330E+01	1.293E+03
Cm-247	9.330E+01	1.287E+03	9.330E+01	1.293E+03
Cm-248	9.330E+01	1.287E+03	9.330E+01	1.293E+03
Co-60	3.700E+02	5.102E+03	3.700E+02	5.123E+03
Cs-135	1.330E+02	1.835E+03	1.330E+02	1.842E+03
Cs-137	1.330E+02	1.835E+03	1.330E+02	1.842E+03
Eu-152	6.500E+00	9.062E+01	6.500E+00	9.099E+01
Eu-154	6.500E+00	9.062E+01	6.500E+00	9.099E+01
Eu-155	6.500E+00	9.062E+01	6.500E+00	9.099E+01
Fe-55	1.400E+00	2.030E+01	1.400E+00	2.038E+01
Fe-60	1.400E+00	2.030E+01	1.400E+00	2.038E+01
Gd-148	6.500E+00	9.062E+01	6.500E+00	9.099E+01
H-3	4.000E-02	1.552E+00	4.000E-02	1.554E+00
Hg-194	1.000E+01	1.389E+02	1.000E+01	1.394E-02
Th-230	1.000E+01	1.389E+02	1.000E+01	1.394E+02
U-236	6.000E+00	8.373E+01	6.000E+00	8.407E-01
U-238	6.000E+00	8.373E+01	6.000E+00	8.407E+01
Np-237	3.000E+00	4.236E+01	3.000E+00	4.253E+01
Pu-240	1.000E+01	1.389E+02	1.000E+01	1.394E+02
Pu-241	1.000E+01	1.389E+02	1.000E+01	1.394E+02
Am-241	1.000E+00	1.479E+01	1.000E+00	1.484E+01
Cm-244	9.330E+01	1.287E+03	9.330E+01	1.293E+03
Ra-226	9.990E+00	1.387E+02	9.990E+00	1.393E+02
Ho-166m	2.500E+00	3.547E+01	2.500E+00	3.561E+01
I-129	1.200E-01	2.655E+00	1.200E-01	2.661E+00
K-40	1.500E-01	3.068E+00	1.500E-01	3.077E+00
Mn-53	6.400E+00	8.924E+01	6.400E+00	8.961E+01
Na-22	1.000E+00	1.479E+01	1.000E+00	1.484E+01
Nb-91	1.600E+00	2.306E+01	1.600E+00	2.315E+01
Nb-92	1.600E+00	2.306E+01	1.600E+00	2.315E+01
Nb-93m	1.600E+00	2.306E+01	1.600E+00	2.315E+01
Nb-94	1.600E+00	2.306E+01	1.600E+00	2.315E+01
Ni-59	1.000E+01	1.389E+02	1.000E+01	1.394E+02
Ni-63	1.000E+01	1.389E+02	1.000E+01	1.394E+02
Os-194	4.500E+00	6.304E+01	4.500E+00	6.330E+01
Pa-231	5.500E+00	7.683E+01	5.500E+00	7.715E+01
Pb-202	1.900E+01	2.630E+02	1.900E+01	2.640E+02
Pb-210	1.900E+01	2.630E+02	1.900E+01	2.640E-02
Pd-107	5.500E-01	8.583E+00	5.500E-01	8.615E+00
Pm-145	6.500E+00	9.062E+01	6.500E+00	9.099E-01
Pm-147	6.500E+00	9.062E+01	6.500E+00	9.099E+01
Po-208	9.000E+00	1.251E+02	9.000E+00	1.256E+02
Po-209	9.000E+00	1.251E+02	9.000E+00	1.256E+02
Pt-193	9.000E-01	1.341E+01	9.000E-01	1.346E-01

BIOACCUMULATION FACTORS

NUCLIDE	SOIL-PLANT Bv	SOIL-PLANT Br	FORAGE-MILK Fm (D/L)	FORAGE-MEAT Ff (D/KG)
Ac-227	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Ag-108m	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Al-26	0.000E+00	0.000E+00	0.000E+00	0.000E+00
•				
•				
•				
Po-209	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pt-193	0.000E+00	0.000E+00	0.000E+00	0.000E+00

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                                              PATHWAY  1
                                        GROUNDWATER TO RIVER
NUCLIDE CONCENTRATIONS IN RIVER  (Ci/m**3)
  NUCLIDE/TIME        1.        3.        6.        9.        12.       15.       18.       21.       24.       27.       30.       35.
40.       45.       50.       55.       60.       65.       70.       75.       80.       85.       90.       95.       100.      105.
110.      115.      120.      125.      130.      135.      140.      145.      150.      155.      160.      165.      170.      175.
180.      185.      190.      195.      200.      205.      210.      215.      220.      225.      230.      235.      240.      245.
250.      255.      260.      265.      270.      275.      280.      285.      290.      295.      300.      310.      320.      330.
340.      350.      360.      370.      380.      390.      400.      410.      420.      430.      440.      450.      460.      470.
480.      490.      500.      510.      520.      530.      540.      550.      560.      570.      580.      590.      600.      610.
620.      630.      640.      650.      660.      670.      680.      690.      700.      720.      740.      760.      780.      800.
825.      850.      875.      900.      925.      950.      975.      1000.
     Ac-227         0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
     Ag-108m        0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   2.2E-20   1.4E-19   8.0E-19   4.2E-18   2.1E-17   9.6E-17   4.1E-16   1.6E-15
6.2E-15   2.2E-14   7.5E-14   2.4E-13   7.5E-13   2.2E-12   6.2E-12   1.7E-11   4.4E-11   1.1E-10   2.7E-10   6.5E-10   1.5E-09   3.3E-09
7.2E-09   1.5E-08   3.1E-08   6.3E-08   1.2E-07   2.4E-07   4.5E-07   8.4E-07   1.5E-06   4.8E-06   1.4E-05   3.9E-05   1.0E-04   2.5E-04
7.2E-04   1.9E-03   4.9E-03   1.2E-02   2.7E-02   5.7E-02   1.2E-01   2.3E-01
     Al-26          0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
     Am-242m        0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   2.6E-20   8.8E-20   2.8E-19   8.3E-19   2.4E-18   6.5E-18   1.7E-17
4.2E-17   1.0E-16   2.4E-16   5.3E-16   1.2E-15   2.4E-15   5.0E-15   1.0E-14   1.9E-14   3.7E-14   6.8E-14   2.2E-13   6.5E-13   1.8E-12
4.6E-12   1.1E-11   2.6E-11   5.6E-11   1.2E-10   2.3E-10   4.4E-10   8.0E-10   1.4E-09   2.4E-09   4.1E-09   6.6E-09   1.0E-08   1.6E-08
2.4E-08   3.6E-08   5.1E-08   7.3E-08   1.0E-07   1.4E-07   1.9E-07   2.5E-07   3.2E-07   4.1E-07   5.3E-07   6.6E-07   8.2E-07   1.0E-06
1.2E-06   1.5E-06   1.8E-06   2.1E-06   2.4E-06   2.8E-06   3.2E-06   3.7E-06   4.2E-06   5.3E-06   6.5E-06   7.9E-06   9.3E-06   1.1E-05
1.3E-05   1.4E-05   1.6E-05   1.7E-05   1.8E-05   1.9E-05   2.0E-05   2.0E-05
     Am-243         0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   2.0E-20   7.4E-20   2.5E-19   8.2E-19   2.5E-18   7.4E-18   2.1E-17   5.5E-17
1.4E-16   3.5E-16   8.3E-16   1.9E-15   4.3E-15   9.2E-15   1.9E-14   3.9E-14   7.9E-14   1.5E-13   2.9E-13   9.8E-13   3.0E-12   8.8E-12
2.4E-11   6.0E-11   1.5E-10   3.3E-10   7.2E-10   1.5E-09   3.0E-09   5.8E-09   1.1E-08   1.9E-08   3.4E-08   5.8E-08   9.6E-08   1.5E-07
2.4E-07   3.8E-07   5.7E-07   8.5E-07   1.2E-06   1.8E-06   2.5E-06   3.5E-06   4.8E-06   6.5E-06   8.6E-06   1.1E-05   1.5E-05   1.9E-05
2.4E-05   3.1E-05   3.8E-05   4.8E-05   5.8E-05   7.1E-05   8.6E-05   1.0E-04   1.2E-04   1.7E-04   2.3E-04   3.1E-04   4.0E-04   5.1E-04
6.7E-04   8.6E-04   1.1E-03   1.3E-03   1.6E-03   1.9E-03   2.2E-03   2.5E-03
     Ba-133         0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
     Be-10          0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   5.3E-20   2.7E-19   1.3E-18   5.8E-18   2.4E-17   9.3E-17   3.4E-16
1.2E-15   3.9E-15   1.2E-14   3.7E-14   1.1E-13   2.9E-13   7.8E-13   2.0E-12   4.9E-12   1.2E-11   2.7E-11   6.1E-11   1.3E-10   2.8E-10
5.9E-10   1.2E-09   2.4E-09   4.6E-09   8.7E-09   1.6E-08   2.9E-08   5.3E-08   9.3E-08   2.7E-07   7.6E-07   2.0E-06   4.9E-06   1.2E-05
3.2E-05   8.3E-05   2.0E-04   4.6E-04   1.0E-03   2.1E-03   4.3E-03   8.3E-03
     Bi-207         0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   8.4E-20   7.1E-19   5.2E-18   3.4E-17
2.0E-16   1.0E-15   4.9E-15   2.1E-14   8.6E-14   3.2E-13   1.1E-12   3.6E-12   1.1E-11   3.2E-11   8.9E-11   2.3E-10   5.8E-10   1.4E-09
3.2E-09   7.1E-09   1.5E-08   3.1E-08   6.3E-08   1.2E-07   2.3E-07   4.2E-07   7.5E-07   1.3E-06   2.2E-06   6.0E-06   1.5E-05   3.5E-05
7.6E-05   1.6E-04   3.0E-04   5.5E-04   9.6E-04   1.6E-03   2.6E-03   4.0E-03   6.0E-03   8.7E-03   1.2E-02   1.7E-02   2.2E-02   2.9E-02
3.7E-02   4.6E-02   5.6E-02   6.6E-02   7.8E-02   9.0E-02   1.0E-01   1.1E-01   1.2E-01   1.4E-01   1.5E-01   1.5E-01   1.6E-01   1.7E-01
1.7E-01   1.7E-01   1.7E-01   1.7E-01   1.7E-01   1.7E-01   1.6E-01   1.6E-01   1.5E-01   1.4E-01   1.2E-01   1.0E-01   8.6E-02   7.0E-02
5.4E-02   4.0E-02   2.9E-02   2.1E-02   1.4E-02   9.8E-03   6.5E-03   4.3E-03
     Bi-210m        0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   1.7E-20
1.1E-19   6.3E-19   3.3E-18   1.6E-17   7.3E-17   3.0E-16   1.2E-15   4.3E-15   1.5E-14   4.8E-14   1.5E-13   4.3E-13   1.2E-12   3.2E-12
8.2E-12   2.0E-11   4.8E-11   1.1E-10   2.5E-10   5.4E-10   1.1E-09   2.3E-09   4.6E-09   8.9E-09   1.7E-08   5.7E-08   1.8E-07   5.1E-07
1.4E-06   3.5E-06   8.5E-06   1.9E-05   4.2E-05   8.8E-05   1.8E-04   3.4E-04   6.4E-04   1.1E-03   2.0E-03   3.4E-03   5.7E-03   9.2E-03
1.4E-02   2.2E-02   3.4E-02   5.1E-02   7.4E-02   1.1E-01   1.5E-01   2.1E-01   2.9E-01   3.9E-01   5.2E-01   6.8E-01   8.9E-01   1.1E+00
1.5E+00   1.8E+00   2.3E+00   2.9E+00   3.5E+00   4.3E+00   5.2E+00   6.2E+00   7.4E+00   1.0E+01   1.4E+01   1.9E+01   2.4E+01   3.1E+01
4.1E+01   5.3E+01   6.6E+01   8.1E+01   9.8E+01   1.2E+02   1.3E+02   1.5E+02
     Bk-247         0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   1.6E-19   1.6E-17   5.1E-16   7.7E-15   2.2E-13
2.5E-12   1.4E-11   5.0E-11   1.3E-10   2.5E-10   3.9E-10   5.2E-10   6.0E-10   6.3E-10   6.0E-10   5.2E-10   4.3E-10   3.4E-10   2.5E-10
1.8E-10   1.3E-10   8.6E-11   5.7E-11   3.7E-11   2.3E-11   1.5E-11   8.9E-12   5.4E-12   3.2E-12   1.9E-12   1.1E-12   6.5E-13   3.7E-13
2.1E-13   1.2E-13   6.9E-14   3.9E-14   2.2E-14   1.2E-14   6.6E-15   3.7E-15   2.0E-15   1.1E-15   6.0E-16   3.3E-16   1.8E-16   9.6E-17
5.2E-17   2.8E-17   1.5E-17   8.0E-18   4.3E-18   2.3E-18   1.2E-18   6.5E-19   3.5E-19   1.9E-19   9.8E-20   2.8E-20   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
     C-14           0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
```

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Ca-41		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.6E-20	2.1E-18	1.0E-15
1.0E-13	3.3E-12	4.9E-11	4.3E-10	2.5E-09	1.0E-08	3.4E-08	9.2E-08	2.1E-07	4.2E-07	7.4E-07	1.2E-06	1.8E-06	2.5E-06
3.2E-06	3.9E-06	4.6E-06	5.1E-06	5.4E-06	5.6E-06	5.6E-06	5.4E-06	5.0E-06	4.6E-06	4.2E-06	3.7E-06	3.2E-06	2.7E-06
2.2E-06	1.9E-06	1.5E-06	1.2E-06	9.7E-07	7.7E-07	6.0E-07	4.7E-07	3.6E-07	2.8E-07	2.1E-07	1.6E-07	1.2E-07	8.9E-08
6.6E-08	4.9E-08	3.6E-08	2.6E-08	1.9E-08	1.4E-08	1.0E-08	7.4E-09	5.3E-09	3.8E-09	2.8E-09	1.4E-09	7.1E-10	3.6E-10
1.8E-10	8.8E-11	4.3E-11	2.1E-11	1.0E-11	5.0E-12	2.4E-12	1.2E-12	5.6E-13	2.7E-13	1.3E-13	6.0E-14	2.9E-14	1.3E-14
6.3E-15	3.0E-15	1.4E-15	6.6E-16	3.1E-16	1.4E-16	6.7E-17	3.1E-17	1.5E-17	6.8E-18	3.1E-18	1.5E-18	6.7E-19	3.1E-19
1.4E-19	6.7E-20	3.1E-20	1.4E-20	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Cd-113		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	1.5E-20	3.7E-20	8.4E-20	1.9E-19	4.1E-19	8.5E-19	1.7E-18	3.5E-18	6.8E-18	1.3E-17	4.3E-17	1.3E-16	3.9E-16
1.1E-15	2.7E-15	6.5E-15	1.5E-14	3.2E-14	6.7E-14	1.3E-13	2.6E-13	4.8E-13	8.7E-13	1.5E-12	2.6E-12	4.3E-12	7.0E-12
1.1E-11	1.7E-11	2.6E-11	3.8E-11	5.6E-11	8.0E-11	1.1E-10	1.6E-10	2.2E-10	2.9E-10	3.9E-10	5.2E-10	6.7E-10	8.7E-10
1.1E-09	1.4E-09	1.8E-09	2.2E-09	2.7E-09	3.3E-09	3.9E-09	4.7E-09	5.7E-09	7.9E-09	1.1E-08	1.4E-08	1.8E-08	2.4E-08
3.1E-08	4.0E-08	5.0E-08	6.2E-08	7.4E-08	8.8E-08	1.0E-07	1.2E-07						
Cd-113m		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.3E-20	2.1E-19	1.2E-18
6.1E-18	2.8E-17	1.2E-16	4.4E-16	1.5E-15	5.0E-15	1.5E-14	4.4E-14	1.2E-13	3.0E-13	7.1E-13	1.6E-12	3.6E-12	7.4E-12
1.5E-11	2.9E-11	5.4E-11	9.7E-11	1.7E-10	2.9E-10	4.7E-10	7.5E-10	1.2E-09	1.8E-09	2.6E-09	5.4E-09	1.0E-08	1.8E-08
3.0E-08	4.7E-08	6.9E-08	9.7E-08	1.3E-07	1.7E-07	2.0E-07	2.4E-07	2.7E-07	3.0E-07	3.2E-07	3.3E-07	3.4E-07	3.4E-07
3.2E-07	3.1E-07	2.8E-07	2.6E-07	2.3E-07	2.0E-07	1.8E-07	1.5E-07	1.3E-07	1.0E-07	8.5E-08	6.8E-08	5.4E-08	4.3E-08
3.4E-08	2.6E-08	2.0E-08	1.5E-08	1.1E-08	8.4E-09	6.2E-09	4.6E-09	3.3E-09	1.7E-09	8.9E-10	4.4E-10	2.1E-10	1.0E-10
4.0E-11	1.5E-11	5.5E-12	2.0E-12	6.9E-13	2.4E-13	8.1E-14	2.7E-14						
Cf-249		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.0E-20	1.0E-19	3.3E-19	1.0E-18	2.9E-18	8.0E-18
2.1E-17	5.3E-17	1.3E-16	3.0E-16	6.9E-16	1.5E-15	3.2E-15	6.6E-15	1.3E-14	2.6E-14	4.9E-14	9.1E-14	1.7E-13	2.9E-13
5.1E-13	8.8E-13	1.5E-12	2.4E-12	3.9E-12	6.3E-12	9.8E-12	1.5E-11	2.3E-11	5.2E-11	1.1E-10	2.2E-10	4.3E-10	8.1E-10
1.7E-09	3.3E-09	6.3E-09	1.1E-08	2.0E-08	3.3E-08	5.3E-08	8.4E-08						
Cf-250		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Cf-251		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.4E-20	5.0E-20	1.7E-19	5.6E-19	1.7E-18	5.0E-18	1.4E-17
3.8E-17	9.6E-17	2.4E-16	5.6E-16	1.3E-15	2.9E-15	6.1E-15	1.3E-14	2.6E-14	5.1E-14	9.9E-14	1.9E-13	3.4E-13	6.1E-13
1.1E-12	1.9E-12	3.2E-12	5.3E-12	8.7E-12	1.4E-11	2.2E-11	3.5E-11	5.4E-11	1.2E-10	2.7E-10	5.6E-10	1.1E-09	2.1E-09
4.6E-09	9.3E-09	1.8E-08	3.4E-08	6.0E-08	1.0E-07	1.7E-07	2.8E-07						
Cf-252		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Cl-36		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.8E-19	2.2E-16	2.4E-14	8.3E-13	1.4E-11	4.3E-10
5.1E-09	3.1E-08	1.2E-07	3.2E-07	6.4E-07	1.1E-06	1.5E-06	1.8E-06	1.9E-06	1.9E-06	1.7E-06	1.4E-06	1.2E-06	8.9E-07
6.6E-07	4.7E-07	3.3E-07	2.2E-07	1.5E-07	9.4E-08	6.0E-08	3.8E-08	2.3E-08	1.4E-08	8.5E-09	5.1E-09	3.0E-09	1.8E-09
1.0E-09	6.0E-10	3.4E-10	2.0E-10	1.1E-10	6.3E-11	3.6E-11	2.0E-11	1.1E-11	6.2E-12	3.5E-12	1.9E-12	1.1E-12	5.8E-13
3.2E-13	1.8E-13	9.6E-14	5.2E-14	2.8E-14	1.5E-14	8.4E-15	4.6E-15	2.5E-15	1.3E-15	7.2E-16	2.1E-16	6.0E-17	1.7E-17
5.0E-18	1.4E-18	4.1E-19	1.2E-19	3.3E-20	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Cm-243		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Cm-245		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Cm-246		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						

Cm-247		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Cm-248		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Co-60		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Cs-135		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Cs-137		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Eu-152		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Eu-154		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Eu-155		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Fe-55		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Fe-60		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.8E-20	7.7E-20	3.1E-19
1.1E-18	4.1E-18	1.4E-17	4.4E-17	1.4E-16	4.0E-16	1.1E-15	3.1E-15	8.2E-15	2.1E-14	5.2E-14	2.9E-13	1.4E-12	6.5E-12
2.7E-11	1.0E-10	3.5E-10	1.2E-09	3.5E-09	1.0E-08	2.8E-08	7.2E-08	1.8E-07	4.2E-07	9.4E-07	2.1E-06	4.3E-06	8.8E-06
1.7E-05	3.3E-05	6.1E-05	1.1E-04	1.9E-04	3.4E-04	5.6E-04	9.3E-04	1.5E-03	2.4E-03	3.7E-03	5.7E-03	8.6E-03	1.3E-02
1.9E-02	2.7E-02	3.9E-02	5.4E-02	7.6E-02	1.0E-01	1.4E-01	1.9E-01	2.5E-01	4.4E-01	7.3E-01	1.2E+00	1.8E+00	2.8E+00
4.6E+00	7.2E+00	1.1E+01	1.6E+01	2.3E+01	3.3E+01	4.5E+01	6.0E+01						
Gd-148		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
H-3		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.4E-17	1.7E-14	4.0E-12	2.9E-10	6.1E-08
2.9E-06	5.1E-05	4.4E-04	2.3E-03	8.3E-03	2.2E-02	4.7E-02	8.3E-02	1.3E-01	1.7E-01	2.0E-01	2.3E-01	2.3E-01	2.2E-01
1.9E-01	1.6E-01	1.3E-01	1.0E-01	7.5E-02	5.3E-02	3.7E-02	2.5E-02	1.7E-02	1.1E-02	6.7E-03	4.2E-03	2.6E-03	1.5E-03
9.2E-04	5.4E-04	3.1E-04	1.8E-04	1.0E-04	5.8E-05	3.3E-05	1.8E-05	1.0E-05	5.5E-06	3.0E-06	1.6E-06	8.8E-07	4.7E-07
2.5E-07	1.3E-07	7.1E-08	3.8E-08	2.0E-08	1.0E-08	5.5E-09	2.9E-09	1.5E-09	7.8E-10	4.0E-10	1.1E-10	2.9E-11	7.5E-12
2.0E-12	5.1E-13	1.3E-13	3.4E-14	8.7E-15	2.2E-15	5.6E-16	1.4E-16	3.6E-17	9.0E-18	2.3E-18	5.7E-19	1.4E-19	3.5E-20

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Hg-194		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Th-230		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
U-236		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
U-238		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Np-237		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.2E-20	3.0E-20	7.6E-20
1.8E-19	4.3E-19	9.9E-19	2.2E-18	4.8E-18	1.0E-17	2.1E-17	4.3E-17	8.5E-17	3.2E-16	1.1E-15	3.5E-15	1.1E-14	3.1E-14
1.1E-13	3.4E-13	1.0E-12	2.9E-12	7.5E-12	1.9E-11	4.5E-11	1.0E-10						
Pu-240		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Pu 241		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Am-241		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.9E-20	7.2E-20	2.6E-19	8.8E-19	2.8E-18	8.6E-18	2.5E-17	6.9E-17	1.8E-16
4.7E-16	1.1E-15	2.7E-15	6.2E-15	1.4E-14	2.9E-14	6.1E-14	1.2E-13	2.5E-13	4.7E-13	8.9E-13	3.0E-12	9.1E-12	2.6E-11
6.9E-11	1.7E-10	4.1E-10	9.2E-10	2.0E-09	4.0E-09	8.0E-09	1.5E-08	2.8E-08	4.9E-08	8.5E-08	1.4E-07	2.3E-07	3.7E-07
5.7E-07	8.7E-07	1.3E-06	1.9E-06	2.7E-06	3.9E-06	5.4E-06	7.3E-06	9.9E-06	1.3E-05	1.7E-05	2.3E-05	2.9E-05	3.7E-05
4.6E-05	5.7E-05	7.1E-05	8.6E-05	1.0E-04	1.3E-04	1.5E-04	1.8E-04	2.1E-04	2.8E-04	3.7E-04	4.7E-04	5.9E-04	7.3E-04
9.3E-04	1.2E-03	1.4E-03	1.6E-03	1.9E-03	2.2E-03	2.4E-03	2.7E-03						
Cm-244		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Ra-226		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Ho-166m		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.5E-20	1.0E-19	6.1E-19	3.4E-18	1.7E-17	8.3E-17	3.7E-16	1.5E-15	5.9E-15	2.1E-14
7.4E-14	2.4E-13	7.6E-13	2.3E-12	6.4E-12	1.8E-11	4.6E-11	1.2E-10	2.9E-10	6.9E-10	1.6E-09	3.5E-09	7.7E-09	1.6E-08
3.4E-08	6.8E-08	1.3E-07	2.6E-07	4.9E-07	9.0E-07	1.6E-06	2.9E-06	5.1E-06	1.5E-05	4.0E-05	1.0E-04	2.6E-04	6.0E-04
1.6E-03	4.1E-03	9.9E-03	2.3E-02	4.9E-02	1.0E-01	2.0E-01	3.8E-01						
I-129		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	7.1E-19	2.9E-17	6.1E-16	7.9E-15	6.9E-14	4.3E-13	2.1E-12	8.4E-12	2.8E-11	8.0E-11	2.0E-10	4.6E-10
9.5E-10	1.8E-09	3.2E-09	5.4E-09	8.6E-09	1.3E-08	1.9E-08	2.6E-08	3.5E-08	4.6E-08	5.8E-08	7.1E-08	8.6E-08	1.0E-07

1.1E-07	1.3E-07	1.4E-07	1.5E-07	1.6E-07	1.7E-07	1.7E-07	1.8E-07	1.8E-07	1.8E-07	1.7E-07	1.7E-07	1.6E-07	1.5E-07
1.4E-07	1.3E-07	1.2E-07	1.1E-07	1.0E-07	9.2E-08	8.3E-08	7.4E-08	6.6E-08	5.8E-08	5.1E-08	3.9E-08	2.9E-08	2.2E-08
1.6E-08	1.1E-08	8.0E-09	5.7E-09	3.9E-09	2.7E-09	1.9E-09	1.3E-09	8.6E-10	5.7E-10	3.8E-10	2.5E-10	1.7E-10	1.1E-10
7.2E-11	4.7E-11	3.1E-11	2.0E-11	1.3E-11	8.2E-12	5.3E-12	3.4E-12	2.2E-12	1.4E-12	8.7E-13	5.5E-13	3.5E-13	2.2E-13
1.4E-13	8.7E-14	5.5E-14	3.4E-14	2.2E-14	1.3E-14	8.4E-15	5.3E-15	3.3E-15	1.3E-15	4.9E-16	1.9E-16	7.2E-17	2.7E-17
8.2E-18	2.4E-18	7.2E-19	2.1E-19	6.3E-20	1.9E-20	0.0E+00	0.0E+00						
K-40		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	6.4E-19	5.0E-17	1.8E-15	3.7E-14	4.7E-13	4.2E-12	2.8E-11	1.5E-10	6.3E-10	2.3E-09	7.0E-09	1.9E-08
4.7E-08	1.1E-07	2.2E-07	4.2E-07	7.5E-07	1.3E-06	2.1E-06	3.2E-06	4.8E-06	6.9E-06	9.6E-06	1.3E-05	1.7E-05	2.2E-05
2.7E-05	3.3E-05	4.0E-05	4.7E-05	5.4E-05	6.1E-05	6.8E-05	7.5E-05	8.2E-05	8.8E-05	9.3E-05	9.7E-05	1.0E-04	1.0E-04
1.0E-04	1.0E-04	1.0E-04	1.0E-04	9.8E-05	9.5E-05	9.1E-05	8.7E-05	8.2E-05	7.7E-05	7.2E-05	6.2E-05	5.3E-05	4.3E-05
3.5E-05	2.8E-05	2.2E-05	1.7E-05	1.3E-05	1.0E-05	7.8E-06	5.8E-06	4.3E-06	3.2E-06	2.3E-06	1.7E-06	1.2E-06	8.7E-07
6.2E-07	4.4E-07	3.1E-07	2.2E-07	1.6E-07	1.1E-07	7.6E-08	5.3E-08	3.6E-08	2.5E-08	1.7E-08	1.2E-08	8.1E-09	5.5E-09
3.8E-09	2.6E-09	1.7E-09	1.2E-09	8.0E-10	5.4E-10	3.6E-10	2.5E-10	1.6E-10	7.4E-11	3.3E-11	1.5E-11	6.6E-12	2.9E-12
1.0E-12	3.7E-13	1.3E-13	4.7E-14	1.7E-14	5.8E-15	2.0E-15	7.2E-16						
Mn-53		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Na-22		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Nb-91		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.9E-20
1.7E-19	7.3E-19	2.9E-18	1.1E-17	3.9E-17	1.3E-16	4.4E-16	1.4E-15	4.2E-15	1.2E-14	3.4E-14	2.4E-13	1.5E-12	8.3E-12
4.1E-11	1.9E-10	7.9E-10	3.0E-09	1.1E-08	3.6E-08	1.1E-07	3.3E-07	9.4E-07	2.5E-06	6.3E-06	1.5E-05	3.6E-05	8.0E-05
1.7E-04	3.6E-04	7.4E-04	1.4E-03	2.8E-03	5.2E-03	9.4E-03	1.7E-02	2.9E-02	4.9E-02	8.1E-02	1.3E-01	2.1E-01	3.3E-01
5.2E-01	7.9E-01	1.2E+00	1.7E+00	2.5E+00	3.7E+00	5.2E+00	7.3E+00	1.0E+01	1.9E+01	3.4E+01	6.0E+01	1.0E+02	1.6E+02
2.8E+02	4.8E+02	7.8E+02	1.2E+03	1.9E+03	2.7E+03	3.9E+03	5.5E+03						
Nb-92		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E-20	3.6E-20	1.1E-19	3.2E-19	8.9E-19	6.4E-18	4.0E-17	2.3E-16
1.1E-15	5.2E-15	2.2E-14	8.6E-14	3.1E-13	1.0E-12	3.3E-12	9.9E-12	2.8E-11	7.5E-11	1.9E-10	4.7E-10	1.1E-09	2.5E-09
5.5E-09	1.2E-08	2.4E-08	4.7E-08	9.1E-08	1.7E-07	3.2E-07	5.6E-07	9.9E-07	1.7E-06	2.8E-06	4.7E-06	7.6E-06	1.2E-05
1.9E-05	2.9E-05	4.4E-05	6.6E-05	9.7E-05	1.4E-04	2.0E-04	2.9E-04	4.1E-04	7.7E-04	1.4E-03	2.5E-03	4.3E-03	7.1E-03
1.3E-02	2.2E-02	3.7E-02	6.0E-02	9.3E-02	1.4E-01	2.1E-01	3.0E-01						
Nb-93m		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.1E-20	5.9E-20	1.6E-19	4.0E-19	9.7E-19	2.3E-18	5.2E-18	2.4E-17	9.8E-17	3.6E-16
1.2E-15	3.5E-15	9.6E-15	2.4E-14	5.7E-14	1.3E-13	2.6E-13	5.0E-13	9.2E-13	1.6E-12	2.7E-12	4.3E-12	6.5E-12	9.6E-12
1.4E-11	1.9E-11	2.5E-11	3.2E-11	4.1E-11	5.0E-11	5.9E-11	6.9E-11	7.8E-11	8.7E-11	9.5E-11	1.0E-10	1.1E-10	1.1E-10
1.1E-10	1.1E-10	1.1E-10	1.1E-10	1.0E-10	9.8E-11	9.2E-11	8.5E-11	7.8E-11	6.3E-11	4.9E-11	3.6E-11	2.6E-11	1.8E-11
1.1E-11	6.7E-12	3.8E-12	2.1E-12	1.1E-12	5.7E-13	2.9E-13	1.4E-13						
Nb-94		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.6E-20
1.3E-19	6.0E-19	2.5E-18	9.8E-18	3.5E-17	1.2E-16	3.8E-16	1.1E-15	3.2E-15	8.6E-15	2.2E-14	5.4E-14	1.3E-13	2.9E-13
6.3E-13	1.3E-12	2.7E-12	5.4E-12	1.0E-11	2.0E-11	3.6E-11	6.4E-11	1.1E-10	1.9E-10	3.2E-10	5.3E-10	8.6E-10	1.4E-09
2.1E-09	3.3E-09	5.0E-09	7.5E-09	1.1E-08	1.6E-08	2.3E-08	3.3E-08	4.6E-08	8.7E-08	1.6E-07	2.8E-07	4.8E-07	8.0E-07
1.4E-06	2.5E-06	4.2E-06	6.7E-06	1.0E-05	1.6E-05	2.3E-05	3.3E-05						
Ni-59		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Ni-63		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Os-194		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Pa-231		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	1.8E-20	1.3E-19	7.9E-19	4.5E-18	2.3E-17	1.1E-16						

Pb-202		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Pb-210		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Pd-107		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.4E-19
4.5E-18	6.6E-17	7.8E-16	7.4E-15	6.0E-14	4.1E-13	2.4E-12	1.3E-11	5.9E-11	2.5E-10	9.4E-10	3.3E-09	1.1E-08	3.2E-08
9.2E-08	2.4E 07	6.2E-07	1.5E-06	3.4E-06	7.5E-06	1.6E-05	3.2E-05	6.3E-05	1.2E-04	2.2E-04	3.9E-04	6.8E-04	1.1E-03
1.9E-03	3.1E-03	4.9E-03	7.6E-03	1.2E-02	1.7E-02	2.6E-02	3.7E-02	5.3E-02	7.5E-02	1.0E-01	1.9E-01	3.4E-01	5.9E-01
9.6E-01	1.5E+00	2.3E+00	3.5E+00	5.0E+00	7.1E+00	9.8E+00	1.3E+01	1.7E+01	2.3E+01	2.9E+01	3.6E+01	4.5E+01	5.5E+01
6.6E+01	7.9E+01	9.3E+01	1.1E+02	1.2E+02	1.4E+02	1.6E+02	1.8E+02	2.0E+02	2.2E+02	2.4E+02	2.6E+02	2.8E+02	3.0E+02
3.2E+02	3.4E+02	3.5E+02	3.7E+02	3.8E+02	3.9E+02	4.0E+02	4.0E+02	4.1E+02	4.1E+02	4.1E+02	4.0E+02	3.8E+02	3.6E+02
3.3E+02	2.9E+02	2.6E+02	2.2E+02	1.9E+02	1.6E+02	1.3E+02	1.1E+02						
Pm-145		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Pm-147		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Po-208		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Po-209		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Pt-193		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.1E-20	2.8E-19	3.0E-18	2.8E-17	2.3E-16	1.6E-15	9.9E-15	5.5E-14
2.8E-13	1.3E-12	5.4E-12	2.1E-11	7.6E-11	2.6E-10	8.1E-10	2.4E-09	6.9E-09	1.8E-08	4.7E-08	1.2E-07	2.7E-07	6.2E-07
1.3E-06	2.8E-06	5.8E-06	1.1E-05	2.2E-05	4.1E-05	7.4E-05	1.3E-04	2.3E-04	3.8E-04	6.3E-04	1.6E-03	3.9E-03	8.8E-03
1.9E-02	3.7E-02	7.1E-02	1.3E-01	2.2E-01	3.7E-01	6.0E-01	9.4E-01	1.4E+00	2.1E+00	3.0E+00	4.1E+00	5.6E+00	7.4E+00
9.6E+00	1.2E+01	1.5E+01	1.9E+01	2.3E+01	2.7E+01	3.2E+01	3.7E+01	4.2E+01	4.8E+01	5.3E+01	5.9E+01	6.4E+01	7.0E+01
7.4E+01	7.9E+01	8.3E+01	8.7E+01	9.0E+01	9.3E+01	9.5E+01	9.6E+01	9.7E+01	9.7E+01	9.4E+01	9.0E+01	8.4E+01	7.8E+01
6.8E+01	5.9E+01	4.9E+01	4.1E+01	3.3E+01	2.6E+01	2.0E+01	1.5E+01						

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PATHRAE-RAD(PC)  Version 2.2d  February 1995
  Date: 11-30-2007
  Time: 17:37:41
EnergySolutions Class A South cell side slope sensitivity, lim.conc., vert., par
*****  Mirror Image of Input Files  *****
-- Input File:  ABCDEF.DAT
EnergySolutions Class A South cell side slope sensitivity, lim.conc., vert., part 2, S59Lb
118,1.,3.,6.,9.,12.,15.,18.,21.,24.,27.,30.,35.,40.,45.,50.,55.,60.,65.,70.,75.,80.,85.,90.,95.,100.,105.,110.,115.,120.,125.,130.,1
35,0,1
1,2
0,1.,1.,5.95E-03,5.95E-03,3.64,0
1558.,0.100,0,0,0.317,3.34E-02,97.4,0
1,0,0,0,0,0
0,1.,1.,3.64,0,1800.,1.,0,0,0
0,0,0,0.0,1.
0,0,0,0,0,0,0
0,0,0,0,0,0,0,0,0,0,0
0,0
1,0,1,0
0.00595,0.053,0.113,0,0,1.,0,1.,0,0.355

-- Input File:  BRCDCF.DAT
 158,Pu-236   0,0,0,0,0,0,0
 159,Pu-238   0,0,0,0,0,0,0
 160,Pu-239   0,0,0,0,0,0,0
 161,Pu-242   0,0,0,0,0,0,0
 162,Pu-244   0,0,0,0,0,0,0
 163,Ra-228   0,0,0,0,0,0,0
 164,Re-187   0,0,0,0,0,0,0
 165,Se-79    0,0,0,0,0,0,0
 166,Si-32    0,0,0,0,0,0,0
 167,Sm-151   0,0,0,0,0,0,0
 168,Sn-121m  0,0,0,0,0,0,0
 169,Sn-126   0,0,0,0,0,0,0
 170,Sr-90    0,0,0,0,0,0,0
 171,Tb-157   0,0,0,0,0,0,0
 172,Tb-158   0,0,0,0,0,0,0
 173,Tc-99    0,0,0,0,0,0,0
 174,Te-123   0,0,0,0,0,0,0
 175,Th-229   0,0,0,0,0,0,0
 176,Th-232   0,0,0,0,0,0,0
 177,Ti-44    0,0,0,0,0,0,0
 178,Tl-204   0,0,0,0,0,0,0
 179,Tm-170   0,0,0,0,0,0,0
 180,U-232    0,0,0,0,0,0,0
 181,U-233    0,0,0,0,0,0,0
 182,U-234    0,0,0,0,0,0,0
 183,U-235    0,0,0,0,0,0,0
 184,V-50     0,0,0,0,0,0,0
 185,Zr-93    0,0,0,0,0,0,0
 186,Ks-20    0,0,0,0,0,0,0
 187,Ks-21    0,0,0,0,0,0,0
 188,Ks-22    0,0,0,0,0,0,0
 189,Ks-23    0,0,0,0,0,0,0
 190,Ks-24    0,0,0,0,0,0,0
 191,Ks-25    0,0,0,0,0,0,0
 192,Ks-26    0,0,0,0,0,0,0
 -- Input File:  INVNTRY.DAT
 158,2.86E+00,9.00E-04,0,0,0,0,0
 159,8.77E+01,1.80E-02,0,0,0,0,0
 160,2.41E+04,1.80E-02,0,0,0,0,0
 161,3.73E+05,1.80E-02,0,0,0,0,0
 162,8.08E+07,9.00E-04,0,0,0,0,0
 163,5.75E+00,4.90E+08,0,0,0,0,0
 164,4.35E+10,1.87E-06,0,0,0,0,0
 165,6.50E+04,1.25E+05,0,0,0,0,0
 166,1.72E+02,1.17E+08,0,0,0,0,0
 167,9.00E+01,4.74E+07,0,0,0,0,0
 168,5.50E+01,9.68E+07,0,0,0,0,0
 169,1.00E+05,5.11E+04,0,0,0,0,0
 170,2.88E+01,1.44E-04,0,0,0,0,0
 171,7.10E+01,2.70E+07,0,0,0,0,0
 172,1.80E+02,2.70E+07,0,0,0,0,0
 173,2.11E+05,5.26E-06,0,0,0,0,0
 174,1.00E+13,5.24E-04,0,0,0,0,0
 175,7.88E+03,3.83E+05,0,0,0,0,0
 176,1.41E+10,1.98E-01,0,0,0,0,0
 177,6.30E+01,2.81E+08,0,0,0,0,0
 178,3.78E+00,7.92E+02,0,0,0,0,0
 179,3.52E-01,7.92E+02,0,0,0,0,0
 180,6.89E+01,3.97E+07,0,0,0,0,0
 181,1.59E+05,1.35E-01,0,0,0,0,0
 182,2.46E+05,1.12E+04,0,0,0,0,0
 183,7.04E+08,3.42E-03,0,0,0,0,0
 184,1.40E+17,9.20E-08,0,0,0,0,0
 185,1.53E+06,4.53E+03,0,0,0,0,0
 186,1.00E+00,7.92E+02,0,0,0,0,0
 187,1.00E+00,7.92E+02,0,0,0,0,0
 188,1.00E+00,7.92E+02,0,0,0,0,0
 189,1.00E+00,7.92E+02,0,0,0,0,0
 190,4.00E+00,7.92E+02,0,0,0,0,0
 191,4.00E+00,7.92E+02,0,0,0,0,0
 192,2.00E+00,7.92E+02,0,0,0,0,0
 -- Input File:  RQSITE.DAT
 158,3.29E-04,10.0,10.0
 159,3.29E-04,10.0,10.0
 160,3.29E-04,10.0,10.0
 161,3.29E-04,10.0,10.0
 162,3.29E-04,10.0,10.0
 163,3.29E-04,10.0,10.0
 164,2.96E-02,0.075,0.075
 165,3.19E-03,1.0,1.0
 166,8.55E-03,0.35,0.35
 167,1.33E-03,2.45,2.45
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168,6.61E-05,50.0,50.0
169,6.61E-05,50.0,50.0
170,3.81E-02,0.05,0.05
171,5.06E-04,6.5,6.5
172,5.06E-04,6.5,6.5
173,2.25E-02,0.11,0.11
174,2.57E-03,1.25,1.25
175,3.29E-04,10.0,10.0
176,3.29E-04,10.0,10.0
177,3.29E-04,10.0,10.0
178,1.77E-02,0.15,0.15
179,5.06E-04,6.5,6.5
180,5.48E-04,6.0,6.0
181,5.48E-04,6.0,6.0
182,5.48E-04,6.0,6.0
183,5.48E-04,6.0,6.0
184,3.29E-04,10.0,10.0
185,3.29E-04,10.0,10.0
186,8.78E-02,0.001,0.001
187,7.08E-02,0.01,0.01
188,2.42E-02,0.1,0.1
189,3.19E-03,1.0,1.0
190,6.61E-05,50.0,50.0
191,3.30E-05,100.0,100.0
192,3.19E-03,1.0,1.0
-- Input File:  UPTAKE.DAT
5.95E-03,3.55E-01,1.558
0,0,0,0,0
0,0,0
0,0,0,0
0,0,0,0,0
0,0,0,0,0,730.,0
158,0.00E+00,0.0,0.0,0.0,0,0,0,0
159,0.00E+00,0.0,0.0,0.0,0,0,0,0
160,0.00E+00,0.0,0.0,0.0,0,0,0,0
161,0.00E+00,0.0,0.0,0.0,0,0,0,0
162,0.00E+00,0.0,0.0,0.0,0,0,0,0
163,0.00E+00,0.0,0.0,0.0,0,0,0,0
164,0.00E+00,0.0,0.0,0.0,0,0,0,0
165,0.00E+00,0.0,0.0,0.0,0,0,0,0
166,0.00E+00,0.0,0.0,0.0,0,0,0,0
167,0.00E+00,0.0,0.0,0.0,0,0,0,0
168,0.00E+00,0.0,0.0,0.0,0,0,0,0
169,0.00E+00,0.0,0.0,0.0,0,0,0,0
170,0.00E+00,0.0,0.0,0.0,0,0,0,0
171,0.00E+00,0.0,0.0,0.0,0,0,0,0
172,0.00E+00,0.0,0.0,0.0,0,0,0,0
173,0.00E+00,0.0,0.0,0.0,0,0,0,0
174,0.00E+00,0.0,0.0,0.0,0,0,0,0
175,0.00E+00,0.0,0.0,0.0,0,0,0,0
176,0.00E+00,0.0,0.0,0.0,0,0,0,0
177,0.00E+00,0.0,0.0,0.0,0,0,0,0
178,0.00E+00,0.0,0.0,0.0,0,0,0,0
179,0.00E+00,0.0,0.0,0.0,0,0,0,0
180,0.00E+00,0.0,0.0,0.0,0,0,0,0
181,0.00E+00,0.0,0.0,0.0,0,0,0,0
182,0.00E+00,0.0,0.0,0.0,0,0,0,0
183,0.00E+00,0.0,0.0,0.0,0,0,0,0
184,0.00E+00,0.0,0.0,0.0,0,0,0,0
185,0.00E+00,0.0,0.0,0.0,0,0,0,0
186,0.00E+00,0.0,0.0,0.0,0,0,0,0
187,0.00E+00,0.0,0.0,0.0,0,0,0,0
188,0.00E+00,0.0,0.0,0.0,0,0,0,0
189,0.00E+00,0.0,0.0,0.0,0,0,0,0
190,0.00E+00,0.0,0.0,0.0,0,0,0,0
191,0.00E+00,0.0,0.0,0.0,0,0,0,0
192,0.00E+00,0.0,0.0,0.0,0,0,0,0
1
                        TOTAL EQUIVALENT UPTAKE FACTORS FOR PATHRAE
              UT(J,1)    UT(J,2)    UT(J,3)    UT(J,4)    UT(J,5)    UT(J,6)
               RIVER      WELL      EROSION    BATHTUB   SPILLAGE     FOOD
NUCLIDE         L/YR       L/YR       L/YR       L/YR       L/YR      KG/YR
  Pu-236      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Pu-238      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  •
  •
  •
  Ks-25       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Ks-26       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
**********  PATHRAE INPUT SUMMARY  **********
THERE ARE 80 ISOTOPES IN THE DOSE FACTOR LIBRARY
NUMBER OF TIMES FOR CALCULATION IS118
YEARS TO BE CALCULATED ARE ...
     1.00      3.00      6.00      9.00     12.00
    15.00     18.00     21.00     24.00     27.00
    30.00     35.00     40.00     45.00     50.00
    55.00     60.00     65.00     70.00     75.00
    80.00     85.00     90.00     95.00    100.00
   105.00    110.00    115.00    120.00    125.00
   130.00    135.00    140.00    145.00    150.00
   155.00    160.00    165.00    170.00    175.00
   180.00    185.00    190.00    195.00    200.00
   205.00    210.00    215.00    220.00    225.00
   230.00    235.00    240.00    245.00    250.00
   255.00    260.00    265.00    270.00    275.00
   280.00    285.00    290.00    295.00    300.00
   310.00    320.00    330.00    340.00    350.00
   360.00    370.00    380.00    390.00    400.00
   410.00    420.00    430.00    440.00    450.00
   460.00    470.00    480.00    490.00    500.00
   510.00    520.00    530.00    540.00    550.00
   560.00    570.00    580.00    590.00    600.00
   610.00    620.00    630.00    640.00    650.00
   660.00    670.00    680.00    690.00    700.00
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   720.00    740.00    760.00    780.00    800.00
   825.00    850.00    875.00    900.00    925.00
   950.00    975.00   1000.00
THERE ARE  35 ISOTOPES IN THE INVENTORY FILE
THE VALUE OF IFLAG IS 0
NUMBER OF PATHWAYS IS  1
          PATHWAY            TYPE OF USAGE
                            FOR UPTAKE FACTORS
   1  GROUNDWATER TO RIVER          2
TIME OF OPERATION OF WASTE FACILITY IN YEARS                        0.
LENGTH OF REPOSITORY (M)                                            1.
WIDTH OF REPOSITORY (M)                                             1.
RIVER FLOW RATE (M**3/YR)                                           5.95E-03
STREAM FLOW RATE (M**3/YR)                                          5.95E-03
DISTANCE TO RIVER (M)                                               4.
OPERATIONAL SPILLAGE FRACTION                                       0.00E+00
DENSITY OF AQUIFER (KG/M**3)                                     1558.
LONGITUDINAL DISPERSIVITY (M)                                       1.00E-01
LATERAL DISPERSION COEFFICIENT -- Y AXIS (M**2/YR)                  0.00E+00
NUMBER OF MESH POINTS FOR DISPERSION CALCULATION                    1
FLAG FOR GAMMA PATHWAY OPTIONS                                      0
FLAG FOR GAMMA BUILDUP CALCULATION                                  0
FLAG FOR ATMOSPHERIC PATHWAY                                        0
COVER THICKNESS OVER WASTE (M)                                       .00
THICKNESS OF WASTE IN PITS (M)                                      1.00
TOTAL WASTE VOLUME (M**3)                                           1.000E+00
DISTANCE TO WELL -- X COORDINATE (M)                                4.
DISTANCE TO WELL -- Y COORDINATE (M)                                0.
DENSITY OF WASTE (KG/M**3)                                       1800.
FRACTION OF FOOD CONSUMED THAT IS GROWN ON SITE                     1.000
FRACTION OF YEAR SPENT IN DIRECT RADIATION FIELD                     .000
DEPTH OF PLANT ROOT ZONE (M)                                         .000
AREAL DENSITY OF PLANTS (KG/M**2)                                    .000
AVERAGE DUST LOADING IN AIR (KG/M**3)                               0.00E+00
ANNUAL ADULT BREATHING RATE (M**3/YR)                               0.
FRACTION OF YEAR EXPOSED TO DUST                                     .000
CANISTER LIFETIME (YEARS)                                           0.
INVENTORY SCALING FACTOR                                            1.00E+00
HEIGHT OF ROOMS IN RECLAIMER HOUSE (CM)                             0.
AIR CHANGE RATE IN RECLAIMER HOUSE (CHANGES/SEC)                    0.00E+00
RADON EMANATING POWER OF THE WASTE                                  0.00E+00
DIFFUSION COEFF. OF RADON IN WASTE (CM**2/SEC)                      0.00E+00
DIFFUSION COEFF. OF RN IN CONCRETE (CM**2/SEC)                      0.00E+00
THICKNESS OF CONCRETE SLAB FLOOR (CM)                                .0
DIFFUSION COEFF. OF RADON IN COVER (CM**2/SEC)                      0.00E+00
ATMOSPHERIC STABILITY CLASS                                         0
AVERAGE WIND SPEED (M/S)                                             .00
FRACTION OF TIME WIND BLOWS TOWARD RECEPTOR                          .0000
RECEPTOR DISTANCE FOR ATMOSPHERIC PATHWAY (M)                        .0
DUST RESUSPENSION RATE FOR OFFSITE TRANSPORT (M**3/S)               0.00E+00
DEPOSITION VELOCITY (M/S)                                            .0000
STACK HEIGHT (M)                                                     .0
STACK INSIDE DIAMETER (M)                                            .00
STACK GAS VELOCITY (M/S)                                             .0
HEAT EMISSION RATE FROM BURNING (CAL/S)                             0.00E+00
DECAY CHAIN FLAGS                                    0   0   0   0   0   0   0
FLAG FOR INPUT SUMMARY PRINTOUT                                     1
FLAG FOR DIRECTION OF TRENCH FILLING                                1
FLAG FOR GROUNDWATER PATHWAY OPTIONS                                0
AMOUNT OF WATER PERCOLATING THROUGH WASTE ANNUALLY (M)              5.95E-03
DEGREE OF SOIL SATURATION                                            .317
RESIDUAL SOIL SATURATION                                             .033
PERMEABILITY OF VERTICAL ZONE (M/YR)                               97.40
SOIL NUMBER                                                          .000
POROSITY OF AQUIFER                                                  .11
POROSITY OF UNSATURATED ZONE                                         .36
DISTANCE FROM AQUIFER TO WASTE (M)                                   .0
AVERAGE VERTICAL GROUNDWATER VELOCITY (M/YR)                        5.29E-02
HORIZONTAL VELOCITY OF AQUIFER (M/YR)                                .1
LENGTH OF PERFORATED WELL CASING (M)                                1.000
SURFACE EROSION RATE (M/YR)                                         0.000E+00
LEACH RATE SCALING FACTOR                                           1.000E+00
ANNUAL RUNOFF OF PRECIPITATION (M)                                  0.00E+00
                     INGESTION       INHALATION      DIRECT GAMMA
                   DOSE FACTORS     DOSE FACTORS     DOSE FACTORS        HALF
  NUCLIDE           (MREM/PCI)       (MREM/PCI)    (MREM-M2/PCI-YR)    LIFE (YR)
   Pu-236           0.000E+00        0.000E+00        0.000E+00       2.860E+00
   Pu-238           0.000E+00        0.000E+00        0.000E+00       8.770E+01
   Pu-239           0.000E+00        0.000E+00        0.000E+00       2.410E+04
   Pu-242           0.000E+00        0.000E+00        0.000E+00       3.730E+05
   Pu-244           0.000E+00        0.000E+00        0.000E+00       8.080E+07
   Ra-228           0.000E+00        0.000E+00        0.000E+00       5.750E+00
   Re-187           0.000E+00        0.000E+00        0.000E+00       4.350E+10
   Se-79            0.000E+00        0.000E+00        0.000E+00       6.500E+04
   Si-32            0.000E+00        0.000E+00        0.000E+00       1.720E+02
   Sm-151           0.000E+00        0.000E+00        0.000E+00       9.000E+01
   Sn-121m          0.000E+00        0.000E+00        0.000E+00       5.500E+01
   Sn-126           0.000E+00        0.000E+00        0.000E+00       1.000E+05
   Sr-90            0.000E+00        0.000E+00        0.000E+00       2.880E+01
   Tb-157           0.000E+00        0.000E+00        0.000E+00       7.100E+01
   Tb-158           0.000E+00        0.000E+00        0.000E+00       1.800E+02
   Tc-99            0.000E+00        0.000E+00        0.000E+00       2.110E+05
   Te-123           0.000E+00        0.000E+00        0.000E+00       1.000E+13
   Th-229           0.000E+00        0.000E+00        0.000E+00       7.880E+03
   Th-232           0.000E+00        0.000E+00        0.000E+00       1.410E+10
   Ti-44            0.000E+00        0.000E+00        0.000E+00       6.300E+01
   Tl-204           0.000E+00        0.000E+00        0.000E+00       3.780E+00
   Tm-170           0.000E+00        0.000E+00        0.000E+00       3.520E-01
   U-232            0.000E+00        0.000E+00        0.000E+00       6.890E+01
   U-233            0.000E+00        0.000E+00        0.000E+00       1.590E+05
   U-234            0.000E+00        0.000E+00        0.000E+00       2.460E+05
   U-235            0.000E+00        0.000E+00        0.000E+00       7.040E+08
   V-50             0.000E+00        0.000E+00        0.000E+00       1.400E+17
   Zr-93            0.000E+00        0.000E+00        0.000E+00       1.530E+06
   Ks-20            0.000E+00        0.000E+00        0.000E+00       1.000E+00
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Ks-21	0.000E+00	0.000E+00	0.000E+00	1.000E+00
Ks-22	0.000E+00	0.000E+00	0.000E+00	1.000E+00
Ks-23	0.000E+00	0.000E+00	0.000E+00	1.000E+00
Ks-24	0.000E+00	0.000E+00	0.000E+00	4.000E+00
Ks-25	0.000E+00	0.000E+00	0.000E+00	4.000E+00
Ks-26	0.000E+00	0.000E+00	0.000E+00	2.000E+00

NUCLIDE	VOLATILITY FRACTION	GAMMA ENERGY (MEV)	GAMMA ATTENUATION (1/M)
Pu-236	0.000E+00	0.000E+00	0.000E+00
Pu-238	0.000E+00	0.000E+00	0.000E+00
•			
•			
•			
Ks-25	0.000E+00	0.000E+00	0.000E+00
Ks-26	0.000E+00	0.000E+00	0.000E+00

NUCLIDE	INPUT LEACH RATE (1/YR)	FINAL LEACH RATE (1/YR)	SOLUBILITY (MOLE/L)	INPUT INVENTORY (CI)
Pu-236	3.290E-04	3.290E-04	0.000E+00	9.000E-04
Pu-238	3.290E-04	3.290E-04	0.000E+00	1.800E-02
Pu-239	3.290E-04	3.290E-04	0.000E+00	1.800E-02
Pu-242	3.290E-04	3.290E-04	0.000E+00	1.800E-02
Pu-244	3.290E-04	3.290E-04	0.000E+00	9.000E-04
Ra-228	3.290E-04	3.290E-04	0.000E+00	4.900E+08
Re-187	2.960E-02	2.960E-02	0.000E+00	1.870E-06
Se-79	3.190E-03	3.190E-03	0.000E+00	1.250E+05
Si-32	8.550E-03	8.550E-03	0.000E+00	1.170E+08
Sm-151	1.330E-03	1.330E-03	0.000E+00	4.740E+07
Sn-121m	6.610E-05	6.610E-05	0.000E+00	9.680E+07
Sn-126	6.610E-05	6.610E-05	0.000E+00	5.110E+04
Sr-90	3.810E-02	3.810E-02	0.000E+00	1.440E-04
Tb-157	5.060E-04	5.060E-04	0.000E+00	2.700E+07
Tb-158	5.060E-04	5.060E-04	0.000E+00	2.700E+07
Tc-99	2.250E-02	2.250E-02	0.000E+00	5.260E-06
Te-123	2.570E-03	2.570E-03	0.000E+00	5.240E-04
Th-229	3.290E-04	3.290E-04	0.000E+00	3.830E+05
Th-232	3.290E-04	3.290E-04	0.000E+00	1.980E-01
Ti-44	3.290E-04	3.290E-04	0.000E+00	2.810E+08
Tl-204	1.770E-02	1.770E-02	0.000E+00	7.920E+02
Tm-170	5.060E-04	5.060E-04	0.000E+00	7.920E+02
U-232	5.480E-04	5.480E-04	0.000E+00	3.970E+07
U-233	5.480E-04	5.480E-04	0.000E+00	1.350E-01
U-234	5.480E-04	5.480E-04	0.000E+00	1.120E+04
U-235	5.480E-04	5.480E-04	0.000E+00	3.420E-03
V-50	3.290E-04	3.290E-04	0.000E+00	9.200E-08
Zr-93	3.290E-04	3.290E-04	0.000E+00	4.530E+03
Ks-20	8.780E-02	8.780E-02	0.000E+00	7.920E+02
Ks-21	7.080E-02	7.080E-02	0.000E+00	7.920E+02
Ks-22	2.420E-02	2.420E-02	0.000E+00	7.920E+02
Ks-23	3.190E-03	3.190E-03	0.000E+00	7.920E+02
Ks-24	6.610E-05	6.610E-05	0.000E+00	7.920E+02
Ks-25	3.300E-05	3.300E-05	0.000E+00	7.920E+02
Ks-26	3.190E-03	3.190E-03	0.000E+00	7.920E+02

NUCLIDE	AQUIFER SORPTION	AQUIFER RETARDATION	VERTICAL SORPTION	VERTICAL RETARDATION
Pu-236	1.000E+01	1.389E+02	1.000E+01	1.394E+02
Pu-238	1.000E+01	1.389E+02	1.000E+01	1.394E+02
Pu-239	1.000E+01	1.389E+02	1.000E+01	1.394E+02
Pu-242	1.000E+01	1.389E+02	1.000E+01	1.394E+02
Pu-244	1.000E+01	1.389E+02	1.000E+01	1.394E+02
Ra-228	1.000E+01	1.389E+02	1.000E+01	1.394E+02
Re-187	7.500E-02	2.034E+00	7.500E-02	2.038E+00
Se-79	1.000E+00	1.479E+01	1.000E+00	1.484E+01
Si-32	3.500E-01	5.826E+00	3.500E-01	5.846E+00
Sm-151	2.450E+00	3.478E+01	2.450E+00	3.492E+01
Sn-121m	5.000E+01	6.904E+02	5.000E+01	6.932E+02
Sn-126	5.000E+01	6.904E+02	5.000E+01	6.932E+02
Sr-90	5.000E-02	1.689E+00	5.000E-02	1.692E+00
Tb-157	6.500E+00	9.062E+01	6.500E+00	9.099E+01
Tb-158	6.500E+00	9.062E+01	6.500E+00	9.099E+01
Tc-99	1.100E-01	2.517E+00	1.100E-01	2.523E+00
Te-123	1.250E+00	1.823E+01	1.250E+00	1.831E+01
Th-229	1.000E+01	1.389E+02	1.000E+01	1.394E+02
Th-232	1.000E+01	1.389E+02	1.000E+01	1.394E+02
Ti-44	1.000E+01	1.389E+02	1.000E+01	1.394E+02
Tl-204	1.500E-01	3.068E+00	1.500E-01	3.077E+00
Tm-170	6.500E+00	9.062E+01	6.500E+00	9.099E+01
U-232	6.000E+00	8.373E+01	6.000E+00	8.407E+01
U-233	6.000E+00	8.373E+01	6.000E+00	8.407E+01
U-234	6.000E+00	8.373E+01	6.000E+00	8.407E+01
U-235	6.000E+00	8.373E+01	6.000E+00	8.407E+01
V-50	1.000E+01	1.389E+02	1.000E+01	1.394E+02
Zr-93	1.000E+01	1.389E+02	1.000E+01	1.394E+02
Ks-20	1.000E-03	1.014E+00	1.000E-03	1.014E+00
Ks-21	1.000E-02	1.138E+00	1.000E-02	1.138E+00
Ks-22	1.000E-01	2.379E+00	1.000E-01	2.384E+00
Ks-23	1.000E+00	1.479E+01	1.000E+00	1.484E+01
Ks-24	5.000E+01	6.904E+02	5.000E+01	6.932E+02
Ks-25	1.000E+02	1.380E+03	1.000E+02	1.385E+03
Ks-26	1.000E+00	1.479E+01	1.000E+00	1.484E+01

BIOACCUMULATION FACTORS

NUCLIDE	SOIL-PLANT Bv	SOIL-PLANT Br	FORAGE-MILK Fm (D/L)	FORAGE-MEAT Ff (D/KG)
Pu-236	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pu-238	0.000E+00	0.000E+00	0.000E+00	0.000E+00
•				
•				
•				
Ks-26	0.000E+00	0.000E+00	0.000E+00	0.000E+00

PATHWAY 1
GROUNDWATER TO RIVER

NUCLIDE CONCENTRATIONS IN RIVER (Ci/m**3)

NUCLIDE/TIME		1.	3.	6.	9.	12.	15.	18.	21.	24.	27.	30.	35.
40.	45.	50.	55.	60.	65.	70.	75.	80.	85.	90.	95.	100.	105.
110.	115.	120.	125.	130.	135.	140.	145.	150.	155.	160.	165.	170.	175.
180.	185.	190.	195.	200.	205.	210.	215.	220.	225.	230.	235.	240.	245.
250.	255.	260.	265.	270.	275.	280.	285.	290.	295.	300.	310.	320.	330.
340.	350.	360.	370.	380.	390.	400.	410.	420.	430.	440.	450.	460.	470.
480.	490.	500.	510.	520.	530.	540.	550.	560.	570.	580.	590.	600.	610.
620.	630.	640.	650.	660.	670.	680.	690.	700.	720.	740.	760.	780.	800.
825.	850.	875.	900.	925.	950.	975.	1000.						
Pu-236		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Pu-238		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Pu-239		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Pu-242		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Pu-244		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Ra-228		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Re-187		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.1E-19
8.7E-17	6.5E-15	1.9E-13	3.0E-12	2.8E-11	1.8E-10	8.2E-10	3.0E-09	9.2E-09	2.4E-08	5.3E-08	1.1E-07	2.0E-07	3.3E-07
5.2E-07	7.7E-07	1.1E-06	1.4E-06	1.8E-06	2.2E-06	2.6E-06	2.9E-06	3.2E-06	3.4E-06	3.6E-06	3.6E-06	3.6E-06	3.5E-06
3.3E-06	3.1E-06	2.9E-06	2.6E-06	2.4E-06	2.1E-06	1.8E-06	1.6E-06	1.4E-06	1.2E-06	9.8E-07	8.2E-07	6.9E-07	5.7E-07
4.6E-07	3.8E-07	3.1E-07	2.5E-07	2.0E-07	1.6E-07	1.3E-07	1.0E-07	7.9E-08	6.2E-08	4.8E-08	2.9E-08	1.8E-08	1.0E-08
6.1E-09	3.6E-09	2.1E-09	1.2E-09	6.8E-10	3.8E-10	2.2E-10	1.2E-10	6.8E-11	3.8E-11	2.1E-11	1.2E-11	6.3E-12	3.5E-12
1.9E-12	1.0E-12	5.6E-13	3.0E-13	1.6E-13	8.9E-14	4.8E-14	2.6E-14	1.4E-14	7.4E-15	4.0E-15	2.1E-15	1.1E-15	6.1E-16
3.2E-16	1.7E-16	9.1E-17	4.8E-17	2.6E-17	1.4E-17	7.2E-18	3.8E-18	2.0E-18	5.6E-19	1.6E-19	4.3E-20	1.2E-20	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Se-79		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.4E-20	2.8E-19	2.0E-18
1.3E-17	7.6E-17	4.1E-16	2.0E-15	8.9E-15	3.7E-14	1.4E-13	5.2E-13	1.8E-12	5.8E-12	1.8E-11	5.2E-11	1.5E-10	3.9E-10
1.0E-09	2.5E-09	5.9E-09	1.4E-08	3.0E-08	6.5E-08	1.4E-07	2.8E-07	5.6E-07	1.1E-06	2.1E-06	7.0E-06	2.2E-05	6.3E-05
1.7E-04	4.3E-04	1.0E-03	2.4E-03	5.2E-03	1.1E-02	2.2E-02	4.2E-02	7.8E-02	1.4E-01	2.5E-01	4.2E-01	6.9E-01	1.1E+00
1.8E+00	2.7E+00	4.1E+00	6.2E+00	9.0E+00	1.3E+01	1.8E+01	2.5E+01	3.5E+01	4.7E+01	6.3E+01	8.3E+01	1.1E+02	1.4E+02
1.8E+02	2.2E+02	2.8E+02	3.5E+02	4.3E+02	5.2E+02	6.3E+02	7.6E+02	9.1E+02	1.3E+03	1.7E+03	2.3E+03	3.0E+03	3.8E+03
5.0E+03	6.4E+03	8.0E+03	9.9E+03	1.2E+04	1.4E+04	1.6E+04	1.9E+04						
Si-32		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.7E-19	6.6E-17	1.1E-14	8.5E-13	3.9E-11	1.1E-09	2.2E-08	3.1E-07	3.4E-06	2.9E-05
2.0E-04	1.1E-03	5.7E-03	2.4E-02	9.3E-02	3.2E-01	1.0E+00	2.8E+00	7.5E+00	1.9E+01	4.3E+01	9.4E+01	1.9E+02	3.8E+02
7.2E+02	1.3E+03	2.3E+03	3.9E+03	6.3E+03	1.0E+04	1.6E+04	2.3E+04	3.4E+04	5.0E+04	7.0E+04	9.6E+04	1.3E+05	1.7E+05
2.3E+05	3.0E+05	3.8E+05	4.8E+05	5.9E+05	7.3E+05	8.9E+05	1.1E+06	1.3E+06	1.5E+06	1.8E+06	2.3E+06	3.0E+06	3.8E+06
4.6E+06	5.5E+06	6.5E+06	7.4E+06	8.3E+06	9.2E+06	9.9E+06	1.1E+07	1.1E+07	1.1E+07	1.2E+07	1.2E+07	1.2E+07	1.2E+07
1.1E+07	1.1E+07	1.0E+07	9.7E+06	9.0E+06	8.4E+06	7.7E+06	7.0E+06	6.4E+06	5.7E+06	5.1E+06	4.5E+06	4.0E+06	3.5E+06
3.1E+06	2.7E+06	2.3E+06	2.0E+06	1.7E+06	1.5E+06	1.2E+06	1.0E+06	8.8E+05	6.2E+05	4.3E+05	3.0E+05	2.0E+05	1.4E+05
8.4E+04	5.0E+04	3.0E+04	1.7E+04	1.0E+04	5.8E+03	3.3E+03	1.9E+03						
Sm-151		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.3E-20	3.8E-19	2.1E-18	1.0E-17	4.8E-17	2.1E-16	8.3E-16	3.1E-15	1.1E-14	3.6E-14
1.1E-13	3.4E-13	9.5E-13	2.6E-12	6.7E-12	1.7E-11	4.0E-11	9.4E-11	2.1E-10	4.6E-10	9.6E-10	2.0E-09	3.9E-09	7.6E-09
1.4E-08	2.7E-08	4.8E-08	8.5E-08	1.5E-07	2.5E-07	4.2E-07	6.9E-07	1.1E-06	2.7E-06	6.3E-06	1.4E-05	2.9E-05	5.8E-05
1.3E-04	2.7E-04	5.2E-04	9.8E-04	1.7E-03	3.0E-03	4.8E-03	7.6E-03						
Sn-121m		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Sn-126		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Sr-90		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.0E-19	6.1E-17	2.7E-14
2.3E-12	6.6E-11	9.0E-10	6.9E-09	3.5E-08	1.3E-07	3.8E-07	9.1E-07	1.8E-06	3.2E-06	5.1E-06	7.4E-06	9.7E-06	1.2E-05
1.4E-05	1.5E-05	1.5E-05	1.5E-05	1.4E-05	1.3E-05	1.2E-05	9.9E-06	8.2E-06	6.7E-06	5.3E-06	4.2E-06	3.2E-06	2.4E-06
1.8E-06	1.3E-06	9.4E-07	6.7E-07	4.8E-07	3.3E-07	2.3E-07	1.6E-07	1.1E-07	7.4E-08	5.0E-08	3.3E-08	2.2E-08	1.5E-08
9.7E-09	6.4E-09	4.2E-09	2.7E-09	1.8E-09	1.1E-09	7.3E-10	4.7E-10	3.0E-10	1.9E-10	1.2E-10	4.9E-11	1.9E-11	7.7E-12
3.0E-12	1.2E-12	4.5E-13	1.7E-13	6.7E-14	2.5E-14	9.6E-15	3.6E-15	1.4E-15	5.2E-16	1.9E-16	7.2E-17	2.7E-17	1.0E-17
3.7E-18	1.4E-18	5.0E-19	1.9E-19	6.8E-20	2.5E-20	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Tb-157		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Tb-158		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E-20						
Tc-99		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
1.6E-20	3.7E-18	2.8E-16	9.1E-15	1.6E-13	1.8E-12	1.4E-11	7.6E-11	3.3E-10	1.2E-09	3.7E-09	9.8E-09	2.3E-08	4.9E-08
9.6E-08	1.7E-07	3.0E-07	4.7E-07	7.2E-07	1.0E-06	1.4E-06	1.9E-06	2.5E-06	3.1E-06	3.8E-06	4.5E-06	5.2E-06	5.9E-06
6.6E-06	7.1E-06	7.5E-06	7.9E-06	8.1E-06	8.2E-06	8.2E-06	8.0E-06	7.8E-06	7.5E-06	7.1E-06	6.7E-06	6.2E-06	5.7E-06
5.3E-06	4.8E-06	4.3E-06	3.8E-06	3.4E-06	3.0E-06	2.6E-06	2.3E-06	2.0E-06	1.7E-06	1.5E-06	1.1E-06	7.8E-07	5.5E-07
3.9E-07	2.7E-07	1.8E-07	1.2E-07	8.2E-08	5.5E-08	3.6E-08	2.4E-08	1.5E-08	1.0E-08	6.4E-09	4.1E-09	2.6E-09	1.7E-09
1.1E-09	6.7E-10	4.2E-10	2.6E-10	1.6E-10	1.0E-10	6.3E-11	3.9E-11	2.4E-11	1.5E-11	9.2E-12	5.7E-12	3.5E-12	2.1E-12
1.3E-12	7.9E-13	4.8E-13	2.9E-13	1.8E-13	1.1E-13	6.6E-14	4.0E-14	2.4E-14	8.7E-15	3.2E-15	1.1E-15	4.1E-16	1.5E-16
4.1E-17	1.1E-17	3.2E-18	8.7E-19	2.4E-19	6.5E-20	1.8E-20	0.0E+00						
Te-123		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.2E-20	3.1E-20	7.7E-20	1.8E-19	4.2E-19	9.5E-19	4.4E-18	1.8E-17	7.0E-17
2.5E-16	8.1E-16	2.5E-15	7.0E-15	1.9E-14	4.9E-14	1.2E-13	2.7E-13	6.1E-13	1.3E-12	2.7E-12	5.3E-12	1.0E-11	1.9E-11
3.5E-11	6.1E-11	1.1E-10	1.8E-10	2.9E-10	4.7E-10	7.4E-10	1.2E-09	1.8E-09	2.6E-09	3.9E-09	5.6E-09	8.0E-09	1.1E-08
1.6E-08	2.2E-08	2.9E-08	4.0E-08	5.3E-08	6.9E-08	9.0E-08	1.2E-07	1.5E-07	2.4E-07	3.7E-07	5.5E-07	8.1E-07	1.2E-06
1.7E-06	2.6E-06	3.6E-06	5.0E-06	6.8E-06	8.9E-06	1.2E-05	1.5E-05						
Th-229		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Th-232		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Ti-44		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Tl-204		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
2.3E-20	7.7E-18	6.5E-16	2.0E-14	2.9E-13	2.4E-12	1.2E-11	4.4E-11	1.2E-10	2.5E-10	4.2E 10	6.0E-10	7.4E-10	8.1E-10
8.0E-10	7.1E-10	5.9E-10	4.5E-10	3.3E-10	2.2E-10	1.4E-10	8.9E-11	5.3E-11	3.0E-11	1.7E-11	9.1E-12	4.8E-12	2.5E-12
1.2E-12	6.0E-13	2.9E-13	1.3E-13	6.2E-14	2.8E-14	1.3E-14	5.6E-15	2.4E-15	1.0E-15	4.4E-16	1.8E-16	7.5E-17	3.1E-17
1.2E-17	5.0E-18	2.0E-18	7.7E-19	3.0E-19	1.2E-19	4.5E-20	1.7E-20	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Tm-170		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						

U-232		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
U-233		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
U-234		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.0E-20	5.8E-20						
U-235		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
V-50		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Zr-93		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Ks 20		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.1E-18	6.0E-15	3.7E-13	4.5E 12	1.8E-11	3.5E-11	3.2E-11
1.1E-11	2.0E-12	2.2E-13	1.8E-14	1.1E-15	5.3E-17	2.2E-18	8.0E·20	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00						
Ks-21		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.2E-17	3.2E-15	7.3E-14	4.9E-13	1.4E-12	2.2E-12
1.1E-12	2.9E-13	4.4E-14	4.5E-15	3.5E-16	2.2E-17	1.1E-18	5.0E-20	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
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Ks-22		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
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Ks-23		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
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Ks-24		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
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Ks-25		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
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Whetstone Associates

ATTACHMENT 4
ENERGY*SOLUTIONS*
CLASS A SOUTH CELL
INFILTRATION & TRANSPORT MODELING
ELECTRONIC DATA FILES

Prepared for

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Document 4101L.071207

December 2007

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STEVEN M. NEWTON & ASSOCIATES

CLASS A SOUTH/11E.(2) EMBANKMENTBARRIER WALL STABILITY EVALUATION

May 20, 2009

Energy*Solutions*, LLC.
423 West, 300 South, Suite 200
Salt Lake City, Utah 84101

Attention: Mr. Sean McCandless

Subject: Class A South/11e(2) Embankment Barrier Wall Stability Evaluation, Clive Utah Facility

Introduction

At your request, Steven M. Newton & Associates, P.C. has completed a technical review of long term stability and cover performance associated with constructing a proposed vertical clay barrier wall within the referenced waste disposal embankment located at the Clive Utah facility. This letter presents the conclusions and supporting discussions of our technical review.

Barrier Wall Configuration and Location Within the Embankment

Energy Solutions has proposed to construct a barrier wall within the currently permitted 11e(2) embankment, to enable them to place Class A waste within the embankment footprint. The reconfigured embankment is referred to hereafter as the Class A South/11e(2) embankment.

The proposed barrier will be a vertical clay wall that is anticipated to be approximately 12 feet thick, and will extend vertically across the embankment in a north-south direction. The barrier wall will be located approximately 820 feet west of the toe of the east slope and will be integrally connected to the bottom clay liner and the top clay cover systems. As constructed the wall will provide a continuous physical and hydraulic barrier for waste isolation between the two sides of the embankment.

The barrier wall material will be placed in controlled and compacted lifts, to at least 95 percent of standard Proctor density. As described below, the compacted clay material will be of compatible density and strength when compared to the waste materials that will be placed on both sides of the barrier. The maximum height of the clay will be approximately 55 feet, and the height at the slope break-over point will be approximately 38 feet.

Stability Evaluation

Technical Approach and Stability Conclusions

The location and geometry of the barrier wall within the embankment is very relevant in selecting the method of stability analysis. With respect to the Class A South/11e(2) embankment, the wall will be a very thin soil material component that in one orientation will be deep with the embankment (far from potential failure surfaces as identified in various permit documents), and in the other orientation will be perpendicular to and project to the face of the embankment slope.

Since slope stability analyses look at various sections (slices) through the embankment, an analysis of a slice that is located close to and is parallel with the barrier wall material will produce a different stability result than for a slice that is located parallel to and wholly within the barrier wall material. If the barrier wall is sufficiently narrow, its stability will largely be affected by its connection to and the behavior of the adjacent materials, due to side friction issues. With the exception of sophisticated finite element analyses, industry standard slope stability programs ignore side friction and base the calculated factors of safety on the condition that a wide block of soil (a whole series of slices) will move as one unit. In this particular case the width of the barrier wall is so narrow that it cannot move independently of the adjacent compacted materials. To do so the barrier clay would need to shear along both sides of a narrow slot where it is in firm contact with the adjacent material, which has already been shown[1,2] to be stable.

The minimum shear strength assigned to the compacted clay barrier material is the same as that for the compacted liner and cover clays, because both materials are from the same source and will be placed to the same standards. It is important to note that the shear strength of the barrier material is higher than the adjacent waste materials[3], at least within the upper 26 feet of the embankment where confining stresses are moderate to low. Below approximately 26 feet in depth the barrier materials cohesive shear strength may be lower than the total shear strength of the adjacent materials. However, the barrier material will be effectively confined, and the friction component of the barrier material shear strength is being totally ignored.

[1] The 1991 stability analysis for the 11e(2) embankment is documented in Appendix K of the 11e(2) License Renewal Application, NRC Docket No. 40-8989, License SMC-1559, dated February 17 2006.
[2] A modern stability analysis for the Class A embankment is documented in Section 3 of the AMEC "Report, Combined Embankment Study", dated December 13, 2005
[3] The comparison is made to the shear strength value that was assigned to the waste material layer in the reference no. 2 stability analyses. As is typical, a low bound (conservative) value was assigned to represent the wide range of possible waste types that may be received and placed within the embankments.

In addition, the friction along both sides of the barrier wall is a significant resisting force that is being ignored. If it were to be included it would provide approximately 50 to 200 percent additional resisting force, which substantially increases the stability factor of safety.

On the basis of the barrier wall being constructed with suitable high strength material, and more importantly because of the walls limited extent and particular orientation within the embankment, we conclude that stability of the Class A South/11e(2) embankment will be effectively unchanged by the addition of the proposed barrier wall.

Supporting Discussion of the Stability Review

The commonly used stability analysis models are not capable of modeling a very narrow vertical feature within an embankment because side friction forces are ignored in the equations. Instead, engineers must evaluate this non-standard configuration on the basis of applicable soil mechanics principals, empirical data, and in conjunction with applicable stability analyses that have been performed for the overall embankment.

The conclusions presented above are supported by the review of the stability analyses performed for the Class A embankment, which was exhaustively reanalyzed in 2005 (see reference no. 2 above). This section describes why the stability analyses performed for the Class A embankment are suitable to the Class A South/11e(2) case, so as to be considered relevant and representative for use in evaluating the proposed barrier wall. The factors that were reviewed included modeling approach, foundation conditions, embankment geometry, material properties, and other site specific modeling parameters.

Modeling Approach. Slope stability analyses are performed with two-dimensional computer models that calculate driving and resisting forces within selected slices of the embankment. Inputs include overall geometry, soil layer configurations, material properties, phreatic surface, and a seismic coefficient. Appropriate sections of the embankment are selected for analysis, and the computer evaluates thousands of potential failure surfaces and presents those with the lowest factor of safety. This approach is used universally within the profession and is applicable for all embankments at the Clive Utah facility.

The stability analyses performed in 2005 for the Class A embankment are considered to be more comprehensive and are based on substantially more site specific data than the 1991 analyses performed for the 11e(2) embankment. The soil and waste material parameters were based on a wider number of samples subject to detailed field and laboratory testing. As described below, the embankment geometry, foundation conditions and material properties are very similar and the results of the 2005analyses are considered to be representative of both embankments.

Comparison of Foundation Conditions. As with all subsurface foundation soil representations, a simplified set of soil layers was prepared for computer modeling purposes, and this approach was used for the original 11e(2) stability analyses and for the 2005 Class A embankment stability modeling.

The general soil conditions within Section 32 have been documented in many studies over the years, beginning with the DOE investigation for the Vitro tailings. The subsurface conditions references cited herein[4,5] were reviewed to evaluate the similarity of the foundation soils below the Class A and the 11e(2) embankments. Because the site is an ancient lake bottom, far from rivers or shallow bedrock features, the depositional environment within this general area produced relatively consistent layers of foundation soils across the site. The same general layers and orientations that are present below the Class A embankment footprint are also present below the 11e(2) embankment footprint.

A comparison of the elevations or thicknesses of these layers is summarized below. The comparison indicates a nearly identical system of layers beneath both embankments. Based on our experience with stability modeling, there will be no discernable differences in the stability analyses results by making the subtle changes to the foundation soil layers as shown below.

Unit ID	Unit Description	Class A Emb.	11e(2) Emb.
4	Upper Clays (Thickness of the Layer)	7’ to 13’ bgs	7’ to 14’ bgs
3	Silty Sands (Top Elevation)	4258 to 4266	4256 to 4265
2	Clays & Silts (Top Elevation)	4243 to 4252	4243 to 4251
1	Interbedded sand, silt & clay	Too deep to matter in the analysis.	

Comparison of Embankment Geometry. The final geometry of the Class A embankment and the proposed Class A South/11e(2) embankment will be virtually identical in all practical respects, and are considered as equivalent from an engineering analysis standpoint. While the lateral dimensions of both embankments will be slightly different, the cover system layers are sufficiently similar to not affect the stability results. The principal side and top slope geometry, and the height of the embankments are essentially the same, as shown below.

[4] See Appendix D of Envirocare of Utah, Inc., Application for Renewal, RML # UT2300249, Rev.6, March 16, 1998
[5] See Appendix D of the AMEC “Report, Combined Embankment Study”, dated December 13, 2005

Embankment Configuration	Class A	Class A/11e(2)
Elevation at Crest	4324	4323
Waste Height at Top of 5h:1v Slope (Slope Breakover)	32.0 (but modeled to 50 feet)	37.1
Elevation of Top of Clay Liner	4265	4262 to 4266
Top Slope (%)	2% min, 4% max	2.3 % Typical
Side Slope (h:v)	5:1	5:1

Comparison of Material Properties. The source of materials for the liner and cover systems is the same for both embankments. The liner, waste placement, and cover construction procedures are also the same, as are the Construction Quality Assurance (CQA) requirements. The material properties assigned to the waste portion of the embankments were conservatively set to account for a wide range of material types. As a result the engineering parameters used in the Class A embankment stability analyses are equally applicable for materials used to construct the Class A South/11e(2) embankment.

Material properties	Class A	Class A So./11e(2)
Cover System Materials	Same parameters for both embankments	
Waste Materials Types	Various mixtures of clays, silts, sands, gravels, with up to 50% debris.	Various mixtures of clays, silts, sands, gravels, with up to 50% debris.
Waste Materials Layers	Placed in 12 to 24 inch thick layers compacted to an equivalent of a minimum of 90% of standard Proctor.	Placed in 12 to 24 inch thick layers compacted to an equivalent of a minimum of 90% of standard Proctor.
Waste Material Properties	Stability analyses used strength values that were selected to be conservative for the lower strength type of wastes.	Same approach applies to the Class A South/11e(2) analyses.
Bottom Liner Materials	Same for both embankments	

Comparison of Other Parameters. The stability models require input for seismic coefficients and the phreatic surface. Seismic coefficients by their nature would apply in the same manner to all of the embankments on the site. The phreatic surface represents a simplified approximation of the water table surface beneath or within the embankments. No groundwater will be present in the embankments. The groundwater gradient beneath Section 32 is very flat, on the order of one foot per thousand feet. This small difference will not produce any meaningful change in the stability analyses results. It should also be noted that the lowest factors of safety, for both the static and pseudostatic cases, were for potential failure surfaces that were well above the water table.

Conclusions of the Class A Embankment Stability Models. During 2005 a rigorous set of stability analyses were performed for the Class A embankment to incorporate up-to-date seismic coefficient development and to evaluate increasing the height of the Class A embankment. The results of those analyses[6] indicated that the embankment exceeded all of the applicable stability criteria, and in fact would meet the criteria even with an increase in the embankment height of 40 feet above the currently permitted design.

Conclusion for the Class A South/11e(2) Embankment. Based in the fact that the *Class A South/*11e(2) embankment is of the same basic design as the Class A embankment, and in the same setting, and with the same waste material type and placement requirements, the 2005 modeling is considered relevant and representative to the Class A South/11e(2) embankment. As would be expected, the current permits were approved based on the demonstrated stability of both embankments. For the special condition of installing a narrow barrier wall as described at the beginning of this report, and due to the technical reasons described above, the overall stability of the Class A South/11e(2) embankment will be unaffected by the addition of this limited and isolated feature.

Settlement and Long Term Cover Performance Evaluation

General Approach and Settlement Conclusions

Successful long-term cover performance depends on keeping total and differential settlements across the embankment within tolerable limits. The goal is to prevent gross settlement that would adversely affect proper shedding of water from the top slope, and to prevent differential settlement that would cause localized stress cracking and compromise the integrity of the radon barrier.

[6] See Tables 3.2 and 3.3 of the AMEC "Report, Combined Embankment Study", dated December 13, 2005

Previous studies[7] for the Class A and the 11e(2) embankments demonstrate that the cover systems will meet all of the performance objectives. Those analyses were based on the anticipated variety of wastes that will be received and placed within both embankments. The success in meeting the total and differential settlement performance criteria is due primarily to the low embankment heights and the degree of compaction that is required during waste placement.

The engineering parameters used in the previous analyses were selected to encompass a variety of wastes types that range from granular soils to clay soils, with varying amounts of compressible or incompressible debris. The proposed barrier wall material will be silty clay and this fits within the range of compressible to incompressible debris, which are cases that have previously been analyzed (see AMEC in reference no. 7).

As discussed above, the isolated and very narrow but tall aspect of the barrier wall within the overall embankment precludes the use of typical geotechnical analyses. The remainder of this section describes the approach for estimating and minimizing settlement of the barrier material.

Settlement Process. Consolidation of the clay barrier material is the predominant mechanism that may produce settlement at the upper surface of the embankment. Consolidation occurs as the overlying pressure forces excess water from microscopic pores within the clay material, resulting in the load being shifted to the soil skeleton. As the load is shifted to the soil skeleton the structure compresses, but in an ever decreasing rate. The degree to which this process occurs is dependent on the initial condition of the clay, the properties of the clay, and the magnitude of the applied load. The degree to which settlement of the barrier clay creates an adverse condition for the cover system will depend on how much it settles compared to the adjacent materials.

Previous Settlement Analyses. The Combined Embankment Study presented a detailed analysis of settlement for the current embankment height and for a series of potentially higher embankments. As described earlier, from an engineering and performance standpoint the embankment designs and waste placement requirements for the Class A and the Class A South/11e(2) cells are basically the same. As a result the settlement analyses for the Class A embankment are directly comparable for the condition where the Class A South/11e(2) embankment will have essentially the same height.

The 2005 report presented anticipated settlement factors for compressible debris, and these were used to calculate the crest height settlements as presented below.

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[7] See Section 3 of the Radioactive Material License Renewal Application, Rev 2, dated June 20, 2005; and Section 4 of the "Report, Combined Embankment Study", AMEC, December 13, 2005

Settlement Estimate Basis	Settlement per foot of embankment height (ft/ft)[8]	Predicted settlement[9] (based on an assumed maximum crest height of 60 feet)
Calculated	0.0090	0.54 feet
Monitor Data (averages)	0.0058	0.34 feet
Monitor Data (maximum)	0.012	0.72 feet

Table 1 of Appendix B-1 of the Combined Embankment Study report also presented a summary of site characterization and laboratory test data, which included a series of consolidation tests. These tests provide parameters that can be used for predicting short and long term settlements of the native clay materials. The data from those tests is summarized below.

Boring No.	Depth (feet)	Cc	Cr	Pc (psf)	OCR
SC -1	40	0.180	0.040	9500	2.4
SC -7	5	0.120	0.012	1400	2.5
SC -7	35	0.216	0.030	6200	1.8
SC -8	29	0.228	0.034	4000	1.4
SC -10	10	0.240	0.048	6000	5.4
SLC 84	6	0.441	0.009	4000	7.2
GW-16	4	0.500	0.007	2000	3.9
GW-19A	6	0.160	0.021	4000	6.3
GW-18	31	0.100	0.020	6200	1.8
GW-17A	8.3	0.100	0.020	1600	1.7
DH-1	5	0.130	0.010	4600	8
DH-1	30.5	0.130	0.025	4000	1.4
DH-1	40	0.125	0.020	4200	1
DH-1	45	0.080	0.020	6000	1.3
DH-1	60	0.080	0.020	6000	1.2
B-2	30.5	0.220	0.010	3200	1.1
B-2	49.5	0.125	0.004	6000	1.3
	Average	0.187	0.021	4641	2.9
	Std Dev	0.119	0.012		
	Ave + 1 SD	0.306	0.033		

Where Cc= Coefficient of Compressibility, Cr= Coefficient of Recompression, Pc= Preconsolidation Pressure, and OCR= Overconsolidation ratio.

[8] From Section 4.3.1 of the Combined Embankment Study
[9] The predictions are based on monitoring data, which does not include secondary consolidation affects.

Barrier Wall Settlement Analysis. Settlement of the barrier wall material will occur as it is being constructed and continue after cover construction. Settlement of the narrow clay chimney will be somewhat lessened by its bridging contact with the adjacent waste material, particularly if the adjacent waste contains little clay or compressible debris. Because the barrier wall feature is so narrow, conventional settlement analyses do not apply. A very conservative analytical approach was used to calculate potential settlement of the wall as though it were a very wide deposit of clay. Actual settlement of the narrow wall is expected to be a fraction of that that was estimated using a broad deposit approach.

The conservative settlement calculations were based on using the following assumptions:

- The clay wall was assumed to be infinitely wide, in all directions, and up to 60 feet deep.
- A uniform load of 1,000 pounds per square foot was applied to an area 1000 foot square, to represent the cover system. The resulting load influence factors ranged from 1.0 at the surface to 0.94 at the bottom of the hypothetical 60 foot deep clay unit.
- A second case was developed using a long linear load (wall load) based on a width of 15 feet. The resulting load influence factors ranged from 1.0 to 0.15 for the surface and bottom of the clay unit respectfully.
- A wet unit weight of 123 pounds per cubic foot was used to calculate the insitu effective stress.
- The preconsolidation pressure was set to 4,600 psf, which was the average determined from the consolidation tests. This is considered reasonable considering that the barrier clay will be compacted in maximum one foot lifts to a minimum of 95 percent of standard Proctor, which effectively increases its preconsolidation pressure.
- Conservative compression coefficients were selected by using the average test values plus one standard deviation, as shown in the table above (Cr= 0.033 and Cc= 0.306).
- A coefficient of secondary compression was conservatively selected to be 0.020[10]

Based on these values and the conservative approach used, the predicted barrier material primary and secondary settlements are would be as follows:

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[10] "Soil Mechanics", Lambe & Whitman, 1968, Table 27.2. This value represents the upper end of the range for normally consolidated clays.

Case Analyzed	Estimated Primary Settlement (feet)	Estimated Secondary Settlement (feet)	Estimated Combined Settlement (feet)
Barrier Height of 36 feet at the Breakover of the 5h:1v Slope	0.44[a] 0.19[b]	0.18[a] 0.12[b]	0.62[a] 0.31[b]
Barrier Height of 60 feet at the Maximum Crest elevation	0.93[a] 0.29[b]	0.21[a] 0.13[b]	1.14[a] 0.42[b]

a) based on the broad deposit approach, b) based on the linear feature approach

The predicted barrier material settlement is comparable to settlements predicted for the remainder of the embankment, when secondary consolidation is factored in. Taking these numbers at their face value and using the worst case, a differential settlement of approximately 0.80 feet (1.14-0.34) could occur at the crest resulting from primary and secondary consolidation. However, a large fraction of the settlement occurs as the wall and the wastes are being placed in the embankment, and the rate of settlement decreases rapidly with time. Only the remainder will materialize after the final cover is placed. Estimating settlements using the linear feature approach results in only 0.08 feet of combined differential settlement (0.42-0.34)

As anecdotal evidence, the LARW embankment contains several full height 15 foot wide clay barrier walls near the center of the embankment. Annual inspections since 1999 have provided no indications of settlement of the cover system over these walls.

Discussions, Recommendations, and Conclusion. The potential settlements described above are considered bounds, based on the variety of conservative but appropriate assumptions used in the analyses. The worst case situation would be to place incompressible materials adjacent to the barrier wall, but this activity is prohibited by established waste placement procedures. Regardless of the types of materials placed adjacent to the barrier wall, the degree of future settlement can reasonably be predicted once waste placement is completed and monitoring started.

Energy*Solutions* has an established and approved program of motoring embankment settlements prior to placement of the final cover. We recommend installing a set of monuments directly over the center of the clay barrier so the actual settlement progress can be verified and corrective measures can be taken before cover placement is completed. Under normal circumstances a majority of the primary settlement will likely have occurred before the final cover is placed. Under abnormal conditions where the embankment and cover system are to be completed quickly, a temporary line of surcharge material can be placed over the barrier to accelerate the primary consolidation phase. Preloading/surcharging is a well understood and widely used construction technique.

Two issues were identified at the beginning of this discussion; prevent gross settlement that would adversely affect proper shedding of water from the top slope; and prevent differential settlement that would cause localized stress cracking and compromise the integrity of the radon barrier. A majority of settlement will occur prior to cover construction. Barrier wall settlement would not affect water flow from the embankment because water does not flow across the alignment of the barrier.

The issue of excessive settlement causing potential stress cracking in the radon barrier can easily be identified and addressed at the time of final cover placement, if needed. The settlement-monitoring program will enable engineers to be able to predict the remaining amount and time frame for potential settlement. If future settlement appeared to be a potential concern, any one of a number of several safeguards can be put into place to correct the situation. Those could include delaying the cover, applying a surcharge to accelerate the rate of settlement of the wall, or thickening and crowning the radon barrier to account for the anticipated future settlement.

Respectfully submitted,

Steven M. Newton & Associates, P.C.

Steven M. Newton, P.E.
President

Utah Professional Engineer No. 160182

6

CL-LM-PR-001, REV 0

EQUIPMENT AND FACILITY LABELING REQUIREMENT

ENERGYSOLUTIONS

CL-LM-PR-001

Equipment and Facility Labeling Requirement

Revision 0

Authored By: [signature] 11/29/07
Brian Kirkwood, LLRW Operations Compliance Manager — Date

Reviewed By: Curtis R. Kirk 11/30/07
Curtis Kirk, Quality Assurance Manager — Date

Approved By: Rick Olen for Mark Ledoux 11/30/07
Mark Ledoux, Corporate Radiation Safety Officer — Date

Approved By: [signature] 11/30/07
Dave Squires, Director of LLRW Operations — Date

☒ New
☐ Title Change
☐ Revision
☐ Rewrite

Effective Date: DEC 5 2007

Table of Contents

1. PURPOSE AND SCOPE

1.1. Purpose

This procedure is designed to provide consistent methods for labeling waste handling equipment and facilities in accordance with regulatory requirements.

1.2. Scope

This procedure applies to all LLRW and 11e.(2) waste material unloaded or stored at waste handling facilities.

2. REFERENCES

2.1. Groundwater Quality Discharge Permit, as amended

2.2. Radioactive Material License 2300249, Condition 51, as amended

3. GENERAL

3.1. Definitions

3.1.1. ***11e.(2) Waste*** – 11e.(2) waste is defined as"…tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content" as defined in section 11e.(2) of the U.S. Atomic Energy Act of 1954, as amended.

3.1.2. ***LLRW Waste*** - Low-Level Radioactive Waste as defined in UAC R313-15-1008. LLRW includes waste formerly described as LLRW, mobile waste, and NORM/NARM. Although LLRW includes Class A, B, and C, Radiactive Material License UT2300249 limits waste received by EnergySolutions to Class A LLRW.

3.2. Responsibilities

3.2.1. Facility Operators are responsible for verifying compliance with this procedure and for labeling facilities with "11e.(2) Waste Management" signs prior to handling 11e.(2) waste material.

3.2.2. Equipment Operators are responsible for verifying compliance with this procedure and for labeling equipment with "11e.(2) Waste Management" signs prior to handling 11e.(2) waste material.

3.3. Precautions and Limitations

3.3.1. Equipment Operators should use the designated clean-out areas when equipment clean-out is required due to excessive build-up of waste material.

Note: Designated clean-out areas are established in the LLRW waste embankment for LLRW clean-out and in the 11e.(2) embankment for 11e.(2) clean-out.

3.4. **Document Control and Records**

3.4.1. Completed Daily worksheets shall be turned into the LLRW Cells Waste Tracker on a daily basis

3.4.2. The LLRW Cells Waste Tracker shall use the daily worksheets to complete forms, CL-CE-PR-002-F1, Equipment and Facility Release Form (Attachment 1).

3.4.3. Completed Equipment and Facility Release Forms shall be reviewed by the LLRW Operations Compliance Manager.

3.4.4. Upon review and signature from the LLRW Operations Compliance Manager, the forms shall be forwarded to Document Control.

4. REQUIREMENTS AND GUIDANCE

4.1. **Safety**

4.1.1. Ensure equipment is shut down and appropriate means are used to prevent unexpected movement of equipment or components prior to manually removing soil and debris from equipment.

4.2. **Compliance**

4.2.1. Only one waste type may be managed at a time at the LLRW East Truck Unloading Area, each Intermodal Unloading Facility bay, Rotary Dump Facility, and Rail Rollover Facility.

4.2.2. 11e.(2) material may be unloaded but not stored at the East Truck Unloading Facility.

4.2.3. Prior to changing waste types (LLRW to 11e.(2) or 11e.(2) to LLRW), all equipment used to manage waste shall be cleaned of bulk material residue to the limit of 500 grams per square foot average, with a maximum limit of 100 lbs.

4.2.4. Prior to changing waste types (LLRW to 11e.(2) or 11e.(2) to LLRW), each facility used to manage waste shall be cleaned of bulk material residue to the limit of 500 grams per square foot average, with a maximum limit of 100 lbs.

4.3. **Procedure**

4.3.1. Prior to changing waste types in a bulk waste handling facility, the facility foreman shall ensure the area is free of waste material in accordance with 4.2.4 of this procedure.

4.3.2. Prior to changing waste types in bulk waste handling equipment, the equipment operator shall ensure truck beds, tires, tracks, buckets, rippers, (or any other typical soil waste or debris collection occurs) is free of waste material in accordance with 4.2.3 of this procedure.

4.3.3. Upon verification of step 4.2.3 or 4.2.5, the Equipment Operator or facility foreman shall indicate a passing inspection on their daily worksheets.

Note: Truck Drivers use the Daily Truck Load sheet, Equipment Operators use the Daily Equipment Sheet and Facility Operators use CL-LM-PR-001, Equipment and Facility Release Form.

4.3.4. When the equipment or facility is verified and documented to be free of LLRW waste material for the purpose of managing 11e.(2) waste material, the facility or equipment shall be labeled with a sign indicating approval to manage 11e.(2) waste.

5. ATTACHMENTS AND FORMS

5.1. Attachment 1, Example of CL-LM-PR-001-F1, Equipment and Facility Release Form

5.2. Attachment 2, Example of Daily Truck Load Worksheet

5.3. Attachment 3, Example of Daily Equipment Form

ATTACHMENT 1
Example of CL-LM-PR-001-F1, Equipment and Facility Release Form

ENERGYSOLUTIONS

CL-LM-PR-001-F1
Revision 0

Equipment and Facility Release Form

For vehicles and Equipment: Visually check portion(s) of the vehicle/equipment which carry the waste, i.e., the buckets and beds, cleaned to a limit of 500 grams per square foot. No more than 100 pounds over entire piece of equipment.
For Facilities: Verify all facility surfaces are free of residual waste material. Verify all waste water tanks and sumps are empty. Contact Water Management if needed

DATE	TIME	VEHICLE or FACILITY ID	RELEASED FROM: (Circle one)	RELEASED TO (Circle one)	SIGNATURE
			LLRW / 11e.(2)	LLRW / 11e.(2)	
			LLRW / 11e.(2)	LLRW / 11e.(2)	
			LLRW / 11e.(2)	LLRW / 11e.(2)	
			LLRW / 11e.(2)	LLRW / 11e.(2)	
			LLRW / 11e.(2)	LLRW / 11e.(2)	
			LLRW / 11e.(2)	LLRW / 11e.(2)	
			LLRW / 11e.(2)	LLRW / 11e.(2)	
			LLRW / 11e.(2)	LLRW / 11e.(2)	
			LLRW / 11e.(2)	LLRW / 11e.(2)	
			LLRW / 11e.(2)	LLRW / 11e.(2)	
			LLRW / 11e.(2)	LLRW / 11e.(2)	
			LLRW / 11e.(2)	LLRW / 11e.(2)	
			LLRW / 11e.(2)	LLRW / 11e.(2)	

LLRW Operations Compliance Manager Signature Date

Attachment 2
Example of Daily Truck Load Sheet

Daily Truck Load Sheet				Date: ________	Page ___ of ___	+ Clean & Inspect Truck Bed Before 11e(2)	+ Clean & Inspect Truck Bed After 11e(2)
Name:				Truck #:			
Load	Time Loaded	Gen. #	Material Type (Use Material list below)	From Location: (Use Location List below)	To Location: (Use Location List below)		
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							

Material Type
1–Clean Fill
2–Clay
3–Waste
4–Other

Location List		
A–Class A Transfer	E–Intermodal Bay 1	I–Stockpile
B–11e.(2) Transfer	F–Intermodal Bay 2	J–Digging Track
C–Rollover (old)	G–Intermodal Bay 3	K–Container Pad
D–Rotary (new)	H–Intermodal Bay 4	K–Loading Dock

Gen #:			Gen #:
# Loads:			# Loads:
To Location:		Driver Signature / Date	To Location:

Attachment 3
Example of Daily Equipment Sheet

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Think
Safety

Daily Equipment Sheet	Date: ______________
Operator:	Equipment #:

Work Area

Type of Work

Check List

☐ Exposed DAW (Contact Supervisor)	☐ Equipment clean prior to managing 11e.(2) material
☐ Tools properly marked	☐ Equipment clean after managing 11e.(2) material
☐ Equipment Safe to Operate (If no, contact supervisor)	☐ Tracks Clean
☐	☐

Problems

Summary of Daily Activity

Operator Signature: Date:

DOCUMENT SUMMARY FORM

Please provide the following information for new/revised documents.
Forward the completed form, approved document, and electronic file, to Document Control.

Document No.: **CL-LM-PR-001** Revision No.: **0**

Title: **Equipment and Facility Labeling Requirements**

If this is a revision, summarize the reason(s) for the revision.
New Procedure

☐ Yes ☒ No	This document requires evaluation per the requirements of a license. If yes, attach evaluation results.
☐ Yes ☒ No	This document requires regulatory agency approval before implementation. If yes, contact Document Control.

Type of revision: ☐ Contains technical changes ☐ Contains only administrative changes

Distribution for new document or changes to distribution for revised document.

New Document

Source: ES-AD-PR-001, Rev.0, *Document Preparation*

ENERGYSOLUTIONS CL-SR-PR-041

Incoming Radioactive Waste Shipment Acceptance

Revision 3

Authored By:	Jake Gardner, Shipping and Receiving Coordinator	Date 10/27/08
Reviewed By:	Curtis Kirk, Quality Assurance Manager	Date 10/27/08
Reviewed By:	Allan Erichsen, Director of Waste Acceptance	Date 10/27/08
Approved By	Mark Ledoux, Corporate Safety Officer	Date 10/29/08
Approved By	Justin Lee, Shipping and Receiving Manager	Date 10/29/08

- [ ] New
- [ ] Title Change
- [x] Revision
- [ ] Rewrite
- [ ] Cancellation

Effective Date OCT 29 2008

Table of Contents

1. PURPOSE AND SCOPE

1.1 Purpose

This procedure provides guidelines for the receipt of radioactive materials, manifest review, and manifest data entry at the Energy*Solutions* Clive Bulk Waste Facility.

1.2 Scope

Package inspections; receipt contamination and radiation surveys; and manifest review and entry are performed on incoming shipments of radioactive material to Energy*Solutions* Clive Facility to ensure Energy*Solutions*, US DOT, and radioactive material possession limits are not exceeded.

2. REFERENCES

2.1 Energy*Solutions*, Clive Facility, Utah Division of Radiation Control Radioactive Material License UT2300249 (as amended)

2.2 Energy*Solutions*, Clive Facility, Utah Division of Radiation Control Radioactive Material License UT 2300478 (as amended)

2.3 Energy*Solutions*, Clive Facility, State-Issued Part B Permit (as amended)

2.4 U.S. Department of Transportation, 49 CFR Parts 172 and 173

2.5 U.S. Nuclear Regulatory Commission, 10 CFR Parts 20, 61 and 71

2.6 U.S Department of Energy, 40 CFR 761, Subpart K

2.7 CL-TN-PR-060, Training Documentation and Storage

2.8 Ground Water Quality Discharge Permit # UGW450005

3. GENERAL

3.1 Definitions

3.1.1 *Shipment* – manifested containers or conveyance containing radioactive waste for disposal.

3.1.2 *Hazardous Waste Report Management Method Codes*- An alpha-numeric code used to signify treatment or land disposal on a UHWM.

3.1.3 *Waste Processor / Collector* – an entity, operating under a commission or Agreement State license, whose principal purpose is to process, repackage, or otherwise treat low-level radioactive material or radioactive waste generated by others prior to eventual transfer of radioactive waste to a licensed low-level radioactive waste land disposal facility.

3.1.4 *Waste Package* – The packaging together with its radioactive contents as presented for transport.

3.1.4.1 "Excepted Package"
A packaging together with its excepted Class 7 (radioactive) materials as specified in 49 CFR 173.421-173.426 and 173.428.

3.1.4.2 "Industrial Package"
A packaging that, together with its low specific activity (LSA) material or surface contaminated object (SCO) contents, meets the requirements of 49 CFR 173.410 and 173.411. Industrial packages are categorized in 49 CFR 173.411 as either:

- "Industrial Package Type 1 (IP-1)";
- "Industrial Package Type 2 (IP-2)"; or
- "Industrial Package Type 3 (IP-3)".

3.1.4.3 "Type A Package"
A packaging that, together with its radioactive contents limited to A1 or A2 as appropriate, meets the requirements of 49 CFR 173.410 and 173.412 and is designed to retain the integrity of containment and shielding required by this part under normal conditions of transport as demonstrated by the tests set forth in 49 CFR 173.465 or 49 CFR173.466, as appropriate. A "Type A Package" does not require Competent Authority approval.

3.1.4.4 "Type B package"
A packaging designed to transport greater than an A1 or A2 quantity of radioactive material that, together with its radioactive contents, is designed to retain the integrity of containment and shielding required by this part when subjected to the normal conditions of transport and hypothetical accident test conditions set forth in 10 CFR Part 71.

3.1.4.5 "Type B(U) Package"
A "Type B Packaging" that, together with its radioactive contents, for international shipments requires unilateral approval only of the package design and of any stowage provisions that may be necessary for heat dissipation.

3.1.4.6 "Type B(M) package"
A "Type B Packaging", together with its radioactive contents, that for international shipments requires multilateral approval of the package design, and may require approval of the conditions of shipment. Type B(M) Packages" are those Type B package designs which have a maximum normal operating pressure of more than 700 kPa/cm2 (100 lb/in2) gauge or a relief device which would allow the release of Class 7 (radioactive) material to the environment under the hypothetical accident conditions specified in 10 CFR part 71.

3.1.4.7 "Fissile Material Package"

A packaging, together with its fissile material contents, which meets the requirements for fissile material packages described in subpart E o f 10 CFR 71. A fissile material package may be a Type AF package, a Type B(U)F package, or a Type B(M)F package.

3.1.5 *Special Nuclear Material (SNM)* – Plutonium, uranium 233, uranium enriched in the isotope 233 or in the isotope 235 or, any material artificially enriched by any of the above isotopes but does not include Source Material.

3.1.6 *Source Material* – Uranium or Thorium, or any combination thereof, in any physical or chemical form or ores which contain by weight one-twentieth of one percent (0.05%) or more of uranium or thorium or any combination thereof.

3.1.7 *11e (2)* - Mill tailing radioactive wastes produced as a result of extraction or concentration of uranium or thorium from any ore processed primarily for its source material content. This definition does not include residues from mining operations or chemical extraction processes

3.1.8 *In-Process Waste* - After a shipment has arrived, if it is not immediately (within one day) moved into a secured area, it will be considered in-process radioactive waste. In-process radioactive waste is radioactive waste that is no longer in transit (in the possession of the carrier) which is under the custody of the Energy*Solutions*, Clive Facility, Radioactive Material Licenses, which is not in a secured area. In order to meet the USNRC requirements of 10 CFR 20 Subpart I and Utah Radiation Control Rules (R313-15-801) this designation has the following requirements:

- The maximum time the shipment may be considered in-process radioactive waste is seven days.
- The Security Guard shall maintain constant surveillance and control access to areas by performing a tour of the areas the shipment is kept a minimum of four times in a 24-hour period. This tour and results shall be documented in the Security Guard logbook.

3.2 Responsibilities

3.2.1 **Director of Waste Acceptance**, or designee, is responsible for overseeing the activities of the Shipping and Receiving Department.

3.2.2 **Shipping and Receiving Manager,** or designee, is responsible for the overall implementation of this procedure, and reviews all documents associated with sample analysis. The SRM is also responsible for ensuring that all appropriate signed shipment forms are returned to the generator in accordance with 3.4.4, 3.4.5 and 3.4.6.

3.2.3 **Shipping and Receiving Coordinators** are responsible for proper inspection and acceptance of radioactive waste shipments.

3.3 Precautions and Limitations

3.3.1 SAFETY

3.3.1.1 Caution should be taken when opening the doors of a trailer or cargo container because the potential exists that contents were not properly braced and may fall.

3.3.1.2 Where practicable, radioactive materials packages shall be handled by mechanical means to reduce exposures and injuries.

3.3.1.3 Individuals involved in unloading shall wear proper PPE and be alert to the movement of the forklifts, lifting gear, and other equipment.

3.3.1.4 No one shall work on or under transportation equipment without informing the driver (if power attached) and without chocking the tires.

3.3.1.5 No individual shall ride or be on moving equipment other than in the designed operating or riding position of that equipment.

3.3.1.6 Care must be taken when placing equipment onto the bed of a trailer to assure that equipment does not fall from the bed of the trailer and that individuals are not injured while picking the equipment up.

3.3.2 PRECAUTIONS

3.3.2.1 Read and comply with the Radiation Work Permit (RWP).

3.3.2.2 Notify Sample Control of all radioactive waste samples.

3.3.2.3 Treatability studies that arrive as manifested shipments shall be assigned a TS Bates number in EWIS.

3.3.3 COMPLIANCE

3.3.3.1 When a Generator sends a shipment of radioactive waste to the Clive Facility prior to receiving a Notice to Transport (EC-1800) from Energy*Solutions*, Energy*Solutions* shall reject the shipment and provide immediate (24-hour) notice of the shipment to the Utah Division of Radiation Control (DRC).

NOTE: Prior to rejecting the shipment initiate a Condition Report (EC-2702) in accordance with ES-AD-PR-008, Condition Reports Procedure and document the non-conformance in the consignee block on the manifest.

3.3.3.2 Ensure all incoming shipments have the proper placarding, labeling and marking required by 49 CFR 172.516, 10 CFR61 and Energy*Solutions* Radioactive Material Licenses UT2300249 and UT2300478.

NOTE: In the event there is a deficiency, notify the SRM and record the deficiency in the Shipment Discrepancy Logbook.

3.3.3.3 A Waste Profile Record (WPR) update or renewal is necessary when one of the following circumstances occur:

- One calendar year has passed since the arrival of the initial shipment of the radioactive waste.
- The Generator notifies Energy*Solutions* that the process for generating their radioactive waste has changed or if reasoning exists to suspect that the process used by the Generator has changed.

3.3.3.4 Radioactive waste shall not be accepted from a Generator when one or more of the following conditions apply:

- The shipping and disposal documents do not agree with the WPR.
- The land disposal record (LDR) not included with manifest.
- The shipment contains PCBs and has liquid not approved by the Environmental Engineer.
- The manifested activity in any one package exceeds Class A limit as defined in Utah Radiation Control Rules R313-15-1008.
- Other prohibited radioactive wastes as identified in the Radioactive Material License (UT2300249) as amended.
- SNM Certification not included with manifest.
- GSAP not current and not on manifest
- Samples must have SNM exemption if applicable

3.3.3.5 In addition to Step 3.3.3.4 shipments of 11e (2) shall not be accepted when the following conditions apply:

- When the average concentration exceeds 4,000 pCi/g for natural uranium or for any radionuclide in the radium-226 series;
- When the average concentration exceeds 60,000pCi/g for thorium-230;

- When the average concentration exceeds 6,000 pCi/g for any radionuclide in the thorium series.

3.3.3.6 Incoming shipments containing an EPA listed Hazardous Radioactive waste shall be managed in accordance with Energy*Solutions*, Clive Facility, State-Issued Part B Permit, as amended.

3.3.3.7 Incoming shipments containing PCBs shall be accepted and managed in accordance with EnergySolutions, Clive Facility, and State-Issued Part B Permit Attachment II-1-10 (as amended) and Appendix I of the Ground Water Quality Discharge Permit.

3.3.3.8 Shipping and Receiving SHALL ENSURE the shipping and disposal documents have accompanied incoming truck shipments.

3.3.3.9 The receipt of all non-radioactive waste shipments containing radioactive materials shall be authorized by the DHP by signature on shipping paperwork.

3.3.3.10 The manifests for rail shipments may be received by mail, fax, or E-mail to the site prior to the shipment arrival.

3.3.3.11 For rejected shipments that are still on transport vehicle, document rejection in consignee box on the 540 form. For Mixed Radioactive waste shipments also fill out the EC-1725, Rejected Waste Record Form (Attachment 5.1).

3.3.3.12 For rejected shipments that have been unloaded, a new manifest will be required. Complete the EC-1725, Rejected Waste Record Form (Attachment 5.1), for Mixed Radioactive waste shipments.

3.3.3.13 Document the rejection in EWIS by checking the rejected block.

3.3.3.14 For shipments placed on "Hold" complete the Hold Log and print "Hold" Labels for the designated facility. The label shall include:

- The Generator Identification Number
- Radioactive waste Stream
- Date the shipment arrived.

3.3.3.15 Any potential DOT violations in accordance with 49 CFR, with an incoming shipment or manifest accompanying the shipment shall be documented in the Shipping Discrepancy Log and on the 540 form.

3.4 Records

3.4.1 Within two working days after arrival of a shipment, the listed documents shall be transmitted to Document Control and Billing:

- Original forms of the signed Uniform Low-Level Radioactive Waste Manifest Forms 540 and 541 for shipments accepted,
- Original forms of the Uniform Low-Level Radioactive Waste Manifest Form 542 (when applicable) of shipments accepted,
- Bill of Ladings if included with manifests,
- Isotope reports of accepted shipments,
- Special Nuclear Material Exemption Certification EC-230 for shipments with manifested SNM,
- Copies of the Uniform Hazardous Waste Manifest for shipments with hazardous waste codes,
- Land Disposal Restriction for shipments with hazardous waste codes,
- A copy of the DOE/NRC Form 741 if include with the shipments,
- The completed EC-18a Revision 3.

NOTE: If the Low-Level Radioactive Waste Manifest Form 540 listed above can not be transmitted to Document Control within two working days after the shipment arrival, Shipping & Receiving shall make arrangements to return the signed Uniform Low-Level Radioactive Waste Manifest Form 540 to the shipper in electronic PDF format within 7 calendar days after shipment acceptance.

3.4.2. Document Control shall ensure the 540, 541 forms are scanned into Onbase and in PDF electronic format within 24 Hrs of receipt of 540/541.

3.4.3. The original DOE/NRC Form 741 shall be sent to the SNM Coordinator listed on the Form 741 within two weeks after receipt of the shipment.

3.4.4. The DOE/NRC Form 741 shall be entered into the Safeguards Management Software upon receipt of the shipment and an encrypted electronic file or floppy disc with the electronic file shall be sent to NNMMSS.

3.4.5. Within 35 calendar days, return a copy of the asbestos radioactive waste shipment record to the generator.

3.4.6. Within one week after receipt of the shipment, the below listed documents shall be sent to the Generator:

- Original forms of the signed Uniform Hazardous Waste Manifest,
- Copy of the signed Uniform Low-Level Radioactive Waste Manifest Form 540,
- A copy of the DOE/NRC Form 741 if included with the shipments

4. REQUIREMENTS AND GUIDANCE

4.1 Shipment Scheduling

4.1.1 Five days prior to a shipment arriving at Energy*Solutions*, Clive Facility, the shipment should be scheduled with the Shipping and Receiving Department.

NOTE: In the event a shipment arrives at the site not scheduled contact Shipping and Receiving Manager.

4.1.2 Three business days prior to the shipment arrival at the Clive Facility, the Generator should furnish the Shipping and Receiving Department with an advance copy of all shipping and disposal documents, including an Isotopic Report with the total activity listed by each isotope. The activity should be listed in standard units (mCi) as well as SI units (MBq).

4.1.2.1 A Uniform Hazardous Waste Manifest is required when the shipment is manifested with hazardous waste codes.

NOTE: If the radioactive waste has been treated to remove the hazard characteristic, Hazardous Waste Codes are not required on the UHWM (applicable to D Hazardous Waste Codes only).

4.1.3 Prior to acceptance of the shipment, Shipping and Receiving Personnel SHALL COMPLETE a file review. This file review shall, at a minimum, consist of the following for each radioactive waste stream:

4.1.3.1 A signed and complete copy of the WPR shall be present in the Site Operating Records.

4.1.3.2 A Notice to Transport (EC-1800) has been issued to the Generator with copies maintained in the Site Operating Record, in accordance to CL-WM-PR-0001, Waste Profile Acceptance Process.

4.1.3.3 A valid Generator Site Access Permit number has been issued.

4.1.3.4 Copy of SNM exemption if applicable.

4.2 Shipment Manifest Review

4.2.1 For all incoming radioactive waste shipments, REVIEW the Uniform Manifest 540 and 541 to ensure it has been completed correctly and VERIFY at a minimum the following items:

4.2.1.1 Valid Generator Site Access Permit Number,

4.2.1.2 Proper shipping name,

4.2.1.3 Number of packages,

4.2.1.4 Container contents are compatible in accordance with 49 CFR 174.81 for rail conveyances and 49 CFR 177.848 for truck conveyances,

4.2.1.5 Gross and net weights,

4.2.1.6 Each container has the activity and concentration for each isotope,

4.2.1.7 Radionuclide listed are within Class A limits,

Note: No changes are permitted to the shipping paperwork without first receiving shipper's approval via email or telecommunication.

4.2.2 Notify the DHP if any of the following isotopes are present: Aluminum-26, Berklium-247, Calcium-41, Californium-250, Chlorine-36, Rhenium-187, Terbium157, Terbium-158.

4.2.3 Perform a radioactive waste class check on each container to ensure that the radioactive waste falls within class A limits. In the event that radioactive waste exceeds class A limits, NOTIFY the SRM.

4.2.4 Type of radioactive waste listed falls within the profile description.

4.2.5 Notify operations personnel of special handling codes assigned by Technical Services.

4.2.6 For shipments designated as from a radioactive waste processor or collector, REVIEW the Uniform Manifest 542 to ensure it has been completed correctly and VERIFY at a minimum the following items:

4.2.6.1 Review the form 542 for States that require a compact letter. These States are as follows: AK, AZ, AR, CA, CO, HI, ID, KS, LA, MT, NE, NM, NV, ND, SD, OK, OR, UT, WY.

Note: The compliance department shall ensure compact expiration dates are entered in to EWIS.

4.2.7 For shipments that have hazardous waste codes, REVIEW the Uniform Hazardous Waste Manifest (UHWM) and Land Disposal Notification and Certification Form (LDR) to ensure it has been completed correctly and VERIFY at a minimum the following items:

4.2.7.1 Ensure there is a EPA ID number listed on the UHWM,

4.2.7.2 The UHWM is signed by the Generator and Transporter.

4.2.7.3 Ensure that the following information is supplied on the UHWM for PCB waste (weight in kgs and Out of Service Date)

4.2.7.4 Ensure that all EPA waste codes are listed for the shipment

4.2.7.5 Ensure that the EPA Hazardous Waste Codes on the LDR form match the EPA Hazardous Waste codes on the UHWM

4.2.7.6 Verify that the LDR is signed and has a Certification statement

4.2.7.7 Ensure the EPA Waste Codes are in the profile.

4.2.8 For shipments with asbestos, ensure the radioactive waste is properly profiled and documented on the manifest in accordance with 40 CFR 61, Subpart M.

4.2.9 For shipments with PCB radioactive waste, ensure the radioactive waste is properly profiled with a PCB Certificate and documented on the manifest in accordance with 40 CFR 761, Subpart K.

4.2.10 For LLRW shipments indicated on the PCB certificate as drained PCB articles generate a 525 incoming shipment acceptance form.

4.2.11 For radioactive waste and radioactive sample shipments that have special nuclear material (SNM) or source material, REVIEW the Special Nuclear Material Exemption Certification EC-230 and DOE/NRC Form 741 have been completed correctly and VERIFY at minimum the following items:

4.2.11.1 Properly documented on the 540 and 541,

4.2.11.2 Check for a NRC Form 741 when a shipment of SNM material is > than 1g or source material from a foreign obligation is > than 1kg,

4.2.11.3 When the shipment contains SNM; ensure that a signed SNM form (EC-230) accompanies the shipment,

4.2.11.4 Sign and date the DOE/NRC Form 741, identify Receiver as "B", and mark form with "Based on Shippers Values".

4.2.12 Incoming radioactive waste shipments that contain "Quantities of Concern" that meet or exceed the following Isotopes shall be handled in accordance with procedure CL-SE-PR-030 "Security Plan for Quantities of Concern":

	Quantity of Concern		100x Quantity of Concern	
	TBq (1)	Ci (2)	TBq (1)	Ci (2)
Am-242	0.6	16.2	60	1621.6
Am-241/Be	0.6	16.2	60	1621.6
Cf-252	0.2	5.4	20	540.5
Cm-244	0.5	13.5	50	1351.4
Co-60	0.3	8.1	30	810.8
Cs-137	1	27	100	2702.7
Gd-153	10	270.2	1000	27027
Ir-92	0.8	21.6	80	2162.2
Pm-147	400	10811	40000	1081081.1
Pu-238	0.6	16.2	60	1621.6
Pu-239/Be	0.6	16.2	60	1621.6
Ra-226	0.4	10.8	40	1081.1
Se-75	2	54.1	200	5405.4
Sr-90	10	270.2	1000	27027
Tm-170	200	5405.4	20000	540540.5
Yb-169	3	81.1	300	8108.1

4.3 **Shipment Inspection**

4.3.1 Review the manifest for required marking, labeling, and placards. Also note significant dose rates.

4.3.2 Visually inspect each package for leaks, holes, and corrosion. Note any discrepancies on the EC-18

4.3.3 Verify that all required DOT marking, labeling, and placarding has been affixed to packages and conveyances as required by 49 CFR.

4.3.4 For Asbestos radioactive waste ensure that the container(s) are properly marked and labeled in accordance with 40 CFR 61, Subpart M.

4.3.5 For PCB radioactive waste, ensure that the container(s) are properly marked and labeled in accordance with 40 CFR 761, Subpart C.

4.4 **Incoming Vehicle and Package Radiation Surveys**

4.4.1. Instruments used for gamma dose rate detection shall be capable of indicating dose rates of at least 0.15 mR/hr.

4.4.2. Instruments used for beta dose rate detection shall have an instrument window with the density not greater than 7 mg/cm^2.

4.4.3. Perform the following for a radiation survey to ensure exposure rates are in compliance with 49 CFR 173.441

4.4.3.1. Measure the contact exposure rate, 1 meter and 2 meter readings

4.4.3.2. Notify the SRM if the contact dose rate exceeds 20 % of manifested dose rate and a contact dose rate greater than 100mR/hr.

4.4.4. Perform the following for a removable contamination survey to ensure contamination levels are in compliance with 49 CFR 173.443.

4.4.4.1. Using a Large Area Swipe survey a representative area of the vehicle and containers.

4.4.4.2. Use a frisker (2360) to verify that surface areas are free from contamination.

4.4.5. Enter in EWIS the highest contact exposure rate for the shipment.

4.4.6. If contamination is detected on a shipment, the Shipping Receiving Coordinator shall check the contamination block in EWIS.

4.4.7. If a shipment is found to have contamination and/or radiation levels above the limits in the following table, the Shipping and Receiving Coordinator shall notify the SRM.

Transport Mode	Contamination Limits	Radiation Limits
Non-exclusive	2,200 dpm/100 cm^2 β-γ and low-toxicity alpha emitters* 220 dpm/100cm^2 all other alpha emitters	200 mRem/hr package surface 10 mRem/hr at one meter from package surface
Exclusive Open	22,000 dpm/100 cm^2 β-γ and low-toxicity alpha emitters* 2,200 dpm/100cm^2 all other alpha emitters	200 mRem/hr package surface 200 mRem/hr vertical planes of vehicle, top, and bottom 10 mRem/hr two meters from vertical planes 2 mRem/hr in cab
Exclusive Closed	22,000 dpm/100 cm^2 β-γ and low-toxicity alpha emitters* 2,200 dpm/100cm^2 all other alpha emitters	1000 mRem/hr package surface 200 mRem/hr vertical planes of vehicle, top, and bottom 10 mRem/hr two meters from vertical planes 2 mRem/hr in cab

* Low-toxicity alpha emitters are: (1) Natural uranium, depleted uranium, and natural thorium; (2) ores, concentrates, or tailings containing U-235, U-238, Th-228, Th-230, and Th-232; or (3) alpha emitters with half-life less than 10 days.

4.4.8. Print EC-18a Rev. 3 from EWIS reports and sign daily.

4.5 Notifications

4.5.1 Immediately notify the SRM of any reportable DOT incidents as defined in 49 CFR 171.15.

4.5.2 Notify the SRM if there are any discrepancies between materials listed on the manifest and the materials received.

4.5.3 Notify the DHP when external contact dose rate is greater than 200 mR/hr on a manifested container, greater than 500 mR/hr on external accessible surfaces of radioactive waste in a container, or greater than 80 mR/hr on contact of unshielded containers with resin.

4.5.4 Document the following discrepancies on NRC Form 540 in the Consignee Block:

4.5.4.1 Record Radioactive waste Description Inadequate

4.5.4.2 Contamination or Leakage Detected

4.5.4.3 Unexpected Exposure Rates Detected

4.5.4.4 Labels, Markings, etc. Inadequate

4.5.4.5 Container Integrity Inadequate

4.5.4.6 Other discrepancies found

4.5.5 The SRM shall notify the shipper and the Director of Waste Acceptance in the following situations.

4.5.5.1 DOT reportable incidents that are defined in 49 CFR 171.15.

4.5.5.2 Delivery of radioactive waste by a consignor or broker that does not possess a valid Utah Site Access Permit Number.

4.5.5.3 Notify the shipper of any shipment, or part of a shipment, that has not arrived within 60 days after receipt of an advance manifest.

4.5.5.4 Notify DRC when a shipment does not arrive within 60 days after manifest is received.

4.5.5.5 If the shipment has been cancelled document by email.

NOTE: At a minimum, incidents defined in 49 CFR 171.15 will require immediate notification of the National Response Center and a hazardous materials incident report, 49 CFR 171.16.

4.6. Shipment Acceptance

4.6.1. Once a shipment is determined to be acceptable complete the following:

4.6.1.1. Sign and Date the NRC Form 540

4.6.1.2. Enter the Bates # in block 9

4.6.1.3. Enter HazardousWaste report management method Codes on Uniform Hazardous Waste Manifest for destruction or treatment.

4.6.1.4. Sign and Date the Asbestos Receipt form if applicable

4.6.1.5. Complete DOE/NRC Form 741 if applicable

4.6.1.6. Make copies of shipment package for DRC and Drivers

4.7. Tracking Labels and Paperwork

NOTE: Upon completion of the above steps and prior to giving custody of the shipment to the Facility Operator, perform the following actions.

4.7.1. For Mixed Radioactive waste and PCB shipments, initiate and complete items1-8 on the Incoming-Shipment Acceptance Procedure and Checklist (EC-0525) and for PCB's the PCB Attachment (EC-0525A).

4.7.2. For shipments that require Special Handling ensure that a separate label is generated with the handling instructions.

4.7.3. Generate labels for the packages in the shipment that have as a minimum the following information:

- The acceptance date;
- The tracking number: Generator Number-Waste Stream Number-Bates number
- The words "Hazardous Waste" if applicable
- The acronym "RES" for Resin if applicable
- The acronym "ASB" for Asbestos if applicable
- The acronym "PCB" with the Out of Service Date (O.O.S) for all PCB shipments.
- The words "Liquid Radioactive Waste" if applicable
- The word "beryllium" if applicable

NOTE: Other information may be included with the above-required information. This information is not required to be printed or written on a label, it may be written directly on the radioactive waste package.

5 ATTACHMENTS AND FORMS

5.1 CL-SR-PR-041 F1 (EC-1725), Rejected Waste Record Form (Example)

5.2 CL-SR-PR-041 F2 (EC-98068), Temporary Bates Log (Example)

5.3 EC-18a, Shipment Report (Example)

5.4 Shipment Hold Log (Example)

5.1 CL-SR-PR-041 F1 (EC-1725) Rejected Waste Form (Example)

ENERGYSOLUTIONS

CL-SR-PR-041-F1
Revision 0

REJECTED WASTE RECORD FORM

Generator # / Waste Stream # ____________________ Shipment # ________

Delivery Date: ________ Rejected Date: ________

Circle appropiate type: MW Treated MW Needing Treatment PCB

EPA I.D. # ____________________ Bates: ____________

Rail / Truck # ____________________ Cont Type: ____________

Attach copy of manifest: Yes No

Reason why the waste was rejected:

____

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Additional Remarks:

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____ ____________

Signature / Title Date

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5.2 CL-SR-PR-041 F2 (EC-98068), Temporary Bates Log (Example)

ENERGYSOLUTIONS

CL-SR-PR-041-F2
Revision 0

TEMPORARY BATES LOG

Bates #	Contract ID	W.S.	Shipment#	Vehicle Type	Vehicle ID	Coordinator Initials

Date / /

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5.3 EC-18a Revison 3 (Example)

Energy *Solutions*
EC-18a revision #3

Gen WS	Dates	Disposal Cell	Vehicle	µR/hr	Contamination	Approve Date	Approve Time	Approve User	Arrived	Accepted	Book	49 CFR Compliant	Actual Dose Rate

Total Shipments:

Signature **Date**

Instruments:

Model: **Serial:** **Cal Due Date:**

Model: **Serial:** **Cal Due Date:** **MDA:**

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5.4 **Shipment Hold Log (Example)**

ENERGYSOLUTIONS

SHIPMENT HOLD LOG

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

MW
LLRW

7

MEMORANDUM TO MIKE LEBARON FROM DAVID WISON DATED JUNE 5, 2009

Memorandum

Environmental Resources Management

102 West 500 South
Suite 650
Salt Lake City, Utah 84101
(801) 595-8400
(801) 595-8484 (fax)

ERM®

To: Mike LeBaron – Energy*Solutions*

From: David S. Wilson, P.E., P.G.

REGISTERED PROFESSIONAL ENGINEER
No. 189076
DAVID S.
WILSON
STATE OF UTAH

Signed and Stamped

Date: June 5, 2009

Subject: Responses to Utah Division of Radiation Control (DRC) Comments 6, 7, 9 and 16 relating to the Class A South/11e.(2) Cell Permit Amendment Request

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I am providing herewith, formal responses to the subject comments provided by the Utah Division of Radiation Control (DRC) relating to Energy*Solutions*' request for amendment of its Radioactive Material License to allow conversion of the western and open portion of the existing 11e.(2) cell into a cell to receive Class A low-level radioactive waste (LLRW). I understand that these responses relating to the environmental monitoring and potential remedial action will be combined with other Energy*Solutions*' responses to the full comment letter received from the DRC dated November 26, 2008.

Response 6 – Environmental Monitoring

Energy*Solutions* has modified the proposed groundwater monitoring system and procedure in response to DRC Comment 6. The modified system will consist of a continuous horizontal well aligned in a north-south direction beneath the proposed clay barrier that divides the Class A and 11e.(2) wastes. The horizontal monitoring well will be positioned two feet east of the west side of the clay barrier and at a depth sufficient to assure monitoring of shallow groundwater under variable depth-to-water conditions. Energy*Solutions* will complete a subsurface investigation along the proposed routing for the horizontal well as part of the design process; the data will be used to assure installation of the well at a proper depth for monitoring purposes. Schematic plan and profile drawings of the horizontal well layout are provided in Attachment 6.1.

The horizontal well will consist of an 8-inch diameter, slotted, plastic pipe (i.e., high density polyethylene [HDPE] or polyvinyl chloride [PVC]). The 8-inch diameter well casing and slotted pipe, utilized for collection lysimeter construction at Energy*Solutions*' Clive facilty, have been proven effective in resisting distortion or damage due to soil/waste settlement. Collection lysimeters installed at the LARW embankment, and which are checked annually via video surveys, have been in place for 15 years without damage or significant distortion to the monitoring system.

The horizontal well pipe will be slotted along the full horizontal length beneath the cells to enable sampling at multiple discrete locations along the boundary between the Class A and 11e.(2) wastes. An air-displacement (bladder) pump and packer assembly will be placed in the horizontal well for groundwater sampling events to collect samples at selected locations. The pump assembly will include ancillary equipment, including a water discharge line, pneumatic lines, cable-wench system, and spring-activated wheels to enable movement of the pump within the horizontal well. Additional schematic (conceptual) diagrams of the pump assembly, and potential equipment cut sheets suitable for this application (pumps and packers), are included in Attachment 6.1.

This monitoring well approach will enable sampling along the clay barrier between the two waste types at a frequency consistent with the spacing of existing vertical wells located 90 feet from the perimeter of the approved (permitted) waste cells. The well spacing evaluation for the vertical wells at the mixed waste embankment was provided previously to the DRC (*Whetstone Associates Inc., December 7, 2007).* ERM has used a proportional well-distance to well-spacing ratio for the existing vertical wells to determine the equivalent distance between sampling points along the proposed horizontal well. Using the horizontal well dimensions described above, and the estimated depth to groundwater at the clay barrier, the proposed spacing for collection of groundwater samples is 60 feet. This results in the collection of 30 samples per event along the 1,775-foot long clay barrier. The equivalency calculations developed to determine this sampling frequency are provided with the figures in Attachment 6.1.

The general groundwater flow direction in this area is from the southwest to the northeast at a rate of about 1 foot per year in the shallow flow regime. The horizontal well is positioned along the west side of the clay barrier such that potential releases from the Class A Cell would be detected by this new well on its east side. The existing vertical wells further east of the 11e.(2) cell would continue to serve as sentinel wells for the 11e.(2) waste. The geographic locations of the horizontal and vertical wells in conjunction with the direction and velocity of groundwater flow provide the primary measure for distinguishing potential releases from the divided Class A South/11e.(2) embankment.

As a secondary measure of evaluation, waste characteristics analyzed during sampling events will enable Energy*Solutions* to discretely distinguish whether potential releases are from the Class A South or 11e.(2) side of the embankment. The lists of parameters for which groundwater sampling and analyses are performed are included in Attachment 6.2. The lists for both waste types included some common analytes: field and inorganic parameters; dissolved metals, and organic parameters. However, the Class A waste includes additional radiological parameters (alpha, beta and gamma emitters) that distinguish it from the 11e.(2) waste. Because the radiological constituents are among the more mobile parameters analyzed, it is unlikely that a release could occur from the Class A South side of the embankment without being detected at the horizontal well, while simultaneously masking detection of an 11e.(2) release at the vertical wells more than 1,000 feet downgradient from the edge of the Class A waste.

Initial groundwater samples will be collected quarterly for the first year after installation from the new horizontal well prior to placement of Class A waste into the divided cell. These initial samples will be used to establish background concentrations for the monitoring parameters. The sampling frequency will then move to the standard frequency for compliance monitoring in accordance with the Ground Water Quality Discharge Permit. These sampling events will be used to establish pre-operational monitoring data along the eastern margin of the new Class A cell. Additionally, existing groundwater and other environmental data can be used to represent the baseline, pre-operational conditions for the divided cell.

Because of the direction of groundwater flow in this area, Energy*Solutions* anticipates that if potential contamination is detected in groundwater at the horizontal well, it is due to a release from the Class A South waste embankment; similarly, potential contamination detected in the vertical wells east of the 11e.(2) waste would be due to a release from the 11e.(2)

embankment. Potential contamination at the vertical wells north of the waste embankments will require specific assessment of the groundwater flow patterns at the time of detection as well as analytical results of the flagged sample(s) to distinguish the source of the release.

Response 7 – Installation of Groundwater Monitoring Wells

The proposed installation and sampling of the horizontal well as described in Response 6 will provide groundwater monitoring results consistent with the regulatory requirements of UAC R313 and R317.

ERM has assessed and determined that the horizontal well can be installed by either directional drilling or horizontal boring from vertical pits. The actual installation method will be based on competitive bidding between qualified drilling contractors, who will be required to meet the prescriptive horizontal well specifications with whichever method they select. The conceptual diagrams presented in Attachment 6.1 show how directional drilling may be applied to complete the installation.

ERM has consulted with Layne Christensen Company (Layne) and Michels Directional Crossings (Michels) regarding the proposed horizontal monitoring well installation. A presentation summary of Layne's capabilities, drilling methods and project experience relevant to the subject of horizontal well installation are provided as Attachment 7.1. A capabilities brochure for Michel's is presented in Attachment 7.2.

These companies offer horizontal, angled, and directional drilling services, and would be considered qualified drilling companies invited to present a bid for this work. The following details were reviewed with these companies relative to the subject horizontal well installation:

- Company History and Qualifications;
- Capabilities – include horizontal, angled and directional drilling;
- Cost-benefit analysis of drilling methods;
- Standard drilling equipment/process for horizontal/angled borings;
- Quality assurance technologies for directional drilling:

  - Surveying technologies

  - Steering technologies

  - Hole geometry and tooling string design; and,

- Project experience (case histories).

The information presented by Layne and Michels demonstrates that the horizontal well can be installed using either horizontal bore methods or directional drilling to meet the following project specifications:

- Depth to groundwater about 25 feet below ground surface (to be confirmed via drilling program along clay barrier).

- Length from south to north of 1,775 feet beneath the waste embankment, plus exit distance if needed for directional drilling (total about 2,000 feet); Layne noted potential limitations of drilling length dependent on pipe diameter based on the "pull-out" capacity of their rigs.

- 8-inch diameter slotted, plastic pipe (Schedule 80 PVC), which has proven effective in the harsh subsurface environment at Clive.

- Radius of curvature for directional drilling – between 6 and 40 degrees, as needed to meet space limitations and equipment placement.

- Acceptable drilling precision (or variation from the specified centerline) is typically within one diameter of the specified horizontal well bore with directional or horizontal drilling (i.e., +/- 8 inches side to side for an 8-inch borehole).

- No man-made well screen is proposed for the horizontal well; instead, a natural filter around the slotted pipe will be developed through pump and surge methods following well installation. Engineering pre-pack materials are available for the proposed pipe diameter, but custom engineering would be required for the full length of the proposed horizontal well.

- Pump assembly with ancillary cables, tubing, etc., as described in Response 6. The tubing will be Teflon lined to minimize the potential for cross contamination between sample collection points. The purging process will clear the discharge line of potential cross-contamination between sample points.

- Permanent sampling ports will be installed along the pump discharge line at 60-foot spacings to facilitate sample collection at the designated locations and to minimize the length of tubing through which the water passes prior to sample collection.

Design and manufacture of the pump assembly will account for the highly saline groundwater conditions at Clive. It is proposed that when sampling is not being performed that the pump assembly be maintained above ground on a pump rack inside a work shed at the edge of the embankment. The pump rack will serve as a work table for routine maintenance and repair of the pump assembly when needed. A supply of spare parts will be maintained at the site, including a spare pump, for response to equipment repair needs.

Groundwater samples will be collected from the horizontal well at the discrete locations by positioning the pump and packer assembly at each location using the cable/wench system. The packers will be inflated to isolate the selected sample location from other water present in the horizontal well pipe. Purging and sampling will be performed in accordance with the Energy*Solutions*' Water Monitoring Quality Assurance Plan (February 14, 2005). Purging will remove standing water from the well and enable fresh groundwater to pass through the well screen to the pump intake for sampling. The volume of the annular space inside the well and between the packers will be used to assure that three well volumes are removed during purging, or that the annular space is fully evacuated prior to sample collection.

The estimated length of well screen to be open to infiltration between the two packers is about 6 feet. The horizontal well will be placed sufficiently deep below the water table (based on the pre-design site investigation) to assure sufficient water can be collected under varying seasonal and annual water table conditions. The procedures for sampling the horizontal well will be similar to those used for the existing vertical wells with the following exception: purge volume calculations will be based on the fixed annular space between the packers rather than a depth-to-water measurement and well cross-sectional area for the vertical wells.

Response 9 – Buffer Zone

Energy*Solutions* understands that the DRC has concerns about the ability to monitor and remedy potential releases along the clay barrier between the waste types. The company has modified the proposed monitoring well design to accommodate a frequency of sampling along the barrier (using the horizontal well) that is equivalent to the spacing between vertical wells at other permitted cells at the facility (see Attachment 6.1, *Evaluation of Sampling Points Along Clay Barrier*). Energy*Solutions* has also widened the clay barrier to 12 feet to assure an equivalent 10-foot spacing between the compliance monitoring point for the Class A waste (i.e., horizontal well) and the edge of the 11e.(2) embankment. Ten feet has been maintained at other waste cells as the distance between the point of compliance wells and the buffer zone boundary.

In the event that a release is detected from the proposed Class A South/11e.(2) through groundwater monitoring, remedial action would be performed along the clay barrier using the same horizontal or directional drilling approach planned for installation of the monitoring well. If groundwater impacts are detected, Energy*Solutions* may discuss with the DRC the option of using the horizontal monitoring well for groundwater recovery. Alternatively, another (second) horizontal well may be installed to a specified location beneath the clay barrier to serve as an extraction remediation well.

Based on the modifications proposed for the clay barrier, including the increased width and underlying horizontal well with increased number of sampling locations, Energy*Solutions* will be able to adequately detect potential releases and implement remedial measures, if needed. The revised dimensions of the clay barrier and sample spacing for the horizontal well have been chosen to provide equivalent detection capabilities approved for other embankments at Clive.

Response 16 – Remedial Action

Energy*Solutions* understands the requirements for demonstrating that remedial action can be performed if complications arise that show releases from one or both sides of the proposed Class A South/11e.(2) embankment. Potential remedial measures that can be implemented within the proposed 10-foot-wide buffer zone include physical containment (e.g., slurry walls), well points or pumping wells, or use of the original (or a second) horizontal well beneath the embankment. The horizontal well option is described further below as the most probable remedial solution. The proposed approach for remediation of affected groundwater via pumping and subsequent treatment is among the most practiced and feasible technologies in use for waste sites.

Impacted groundwater could be pumped from the horizontal well (installed for monitoring) at the location required to provide plume containment. The pump used for detection monitoring may be used for remediation, or a separate pump may be installed for remedial purposes. In either case the remedial pump would need to be temporarily removed during monitoring/sampling events. Depending on the nature of the detected release, Energy*Solutions* may choose to install a separate horizontal boring and well on the east side of the monitoring (horizontal) well, beneath the clay barrier, to install a separate remediation pump.

The proposed use of the horizontal well(s) enables remediation (if needed) for one part of the Class A South/11e.(2) embankment or the other without affecting its overall integrity. All above ground remedial activities would be performed at the south and/or north ends of the embankment, where equipment would be positioned to install a new well and pump. Pumping of the shallow groundwater for remediation is not expected to induce detrimental, additional settlement beneath the embankment liner. The anticipated settlement under the weight of the waste has already been accounted for in the embankment design. The financial assurance for the proposed embankment will account for the potential addition of a supplemental horizontal well and pump system.

Attachment 6.1

Schematic Plans, Profiles and Details

Evaluation of Sampling Points Along Clay Barrier

Groundwater Monitoring & Remedial Response System
Proposed 11e(2)/Class A Combined Embankment
Energy*Solutions* – Clive Facility

ENERGY SOLUTIONS
CLIVE FACILITY

Horizontal Well Sampling Frequency
(equivalent to existing monitoring well spacing ratio)

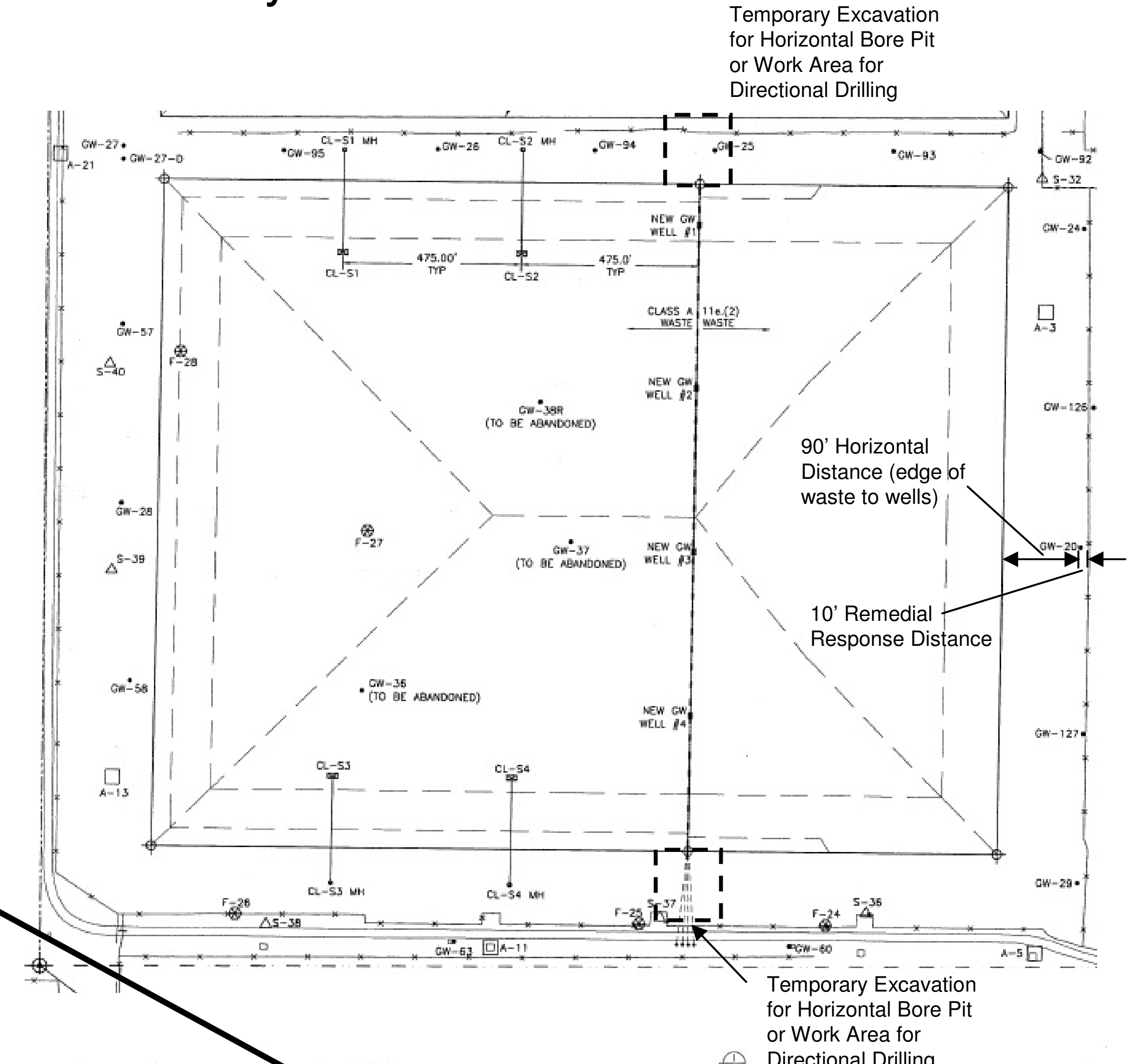
Typical Clive Monitoring Well Configuration

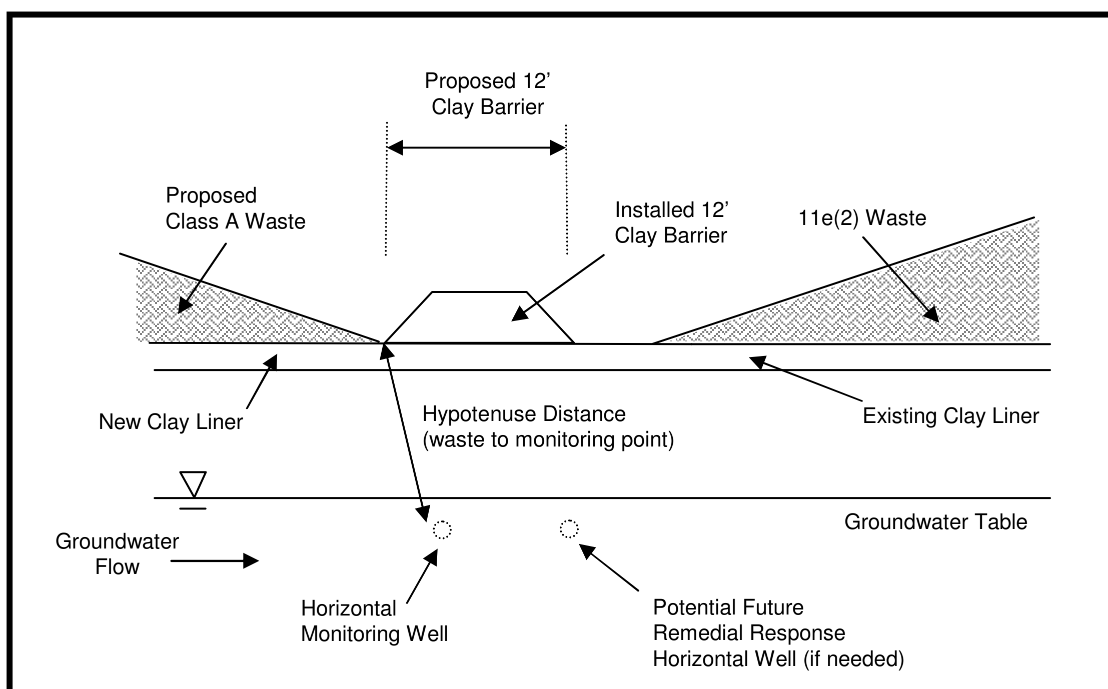
Horizontal Distance (ft):	90.0
Depth to Groundwater (east edge) (ft):	15.1
Hypotnus Distance (ft):	91.3
Remedial Response Distance (ft):	10.0
Well Spacing (ft):	400.0
Distance (Hyp.)-Spacing Ratio (ft):	4.4

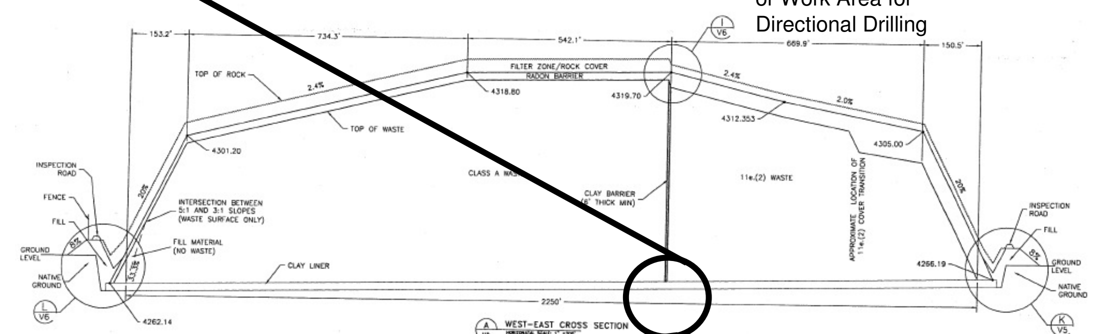
Comparable Horizontal Well Sample Frequency
(Assure consistent 10-foot "Remedial Response Distance")

Proposed Clay Curtain Thickness (ft):	6.0	8.0	10.0	12.0	14.0	16.0	18.0
Hor. Distance to Hor. Well (ft):	2.0	2.0	2.0	2.0	4.0	6.0	8.0
Depth to Groundwater (clay barrier) (ft):	13.6	13.6	13.6	13.6	13.6	13.6	13.6
Hypotnus Distance (ft):	13.7	13.7	13.7	13.7	14.2	14.9	15.8
Max. Rem. Response Distance (ft):	4.0	6.0	8.0	10.0	10.0	10.0	10.0
Well Spacing (ft) :	-	-	-	60.3	62.1	65.2	69.2
Number of Samples over 1775 feet:	-	-	-	29.5	28.6	27.2	25.7
Days per quarterly sample (1775 ft):	-	-	-	3.1	3.2	3.3	3.6
Days per quarterly sample (887.5 ft):	-	-	-	6.2	6.4	6.7	7.1

Comments:
Clay barrier 12' width requires use of 30 sample points with spacings at 60 feet.
Depth to groundwater based on water table elevations on Conceptual Plan - Proposed Clive 11e(2)/Class A Combined Embankment (April 2007).







ENLARGEMENT

Schematic Installation Diagram

Groundwater Monitoring & Remedial Response System
Proposed 11e(2)/Class A Combined Embankment
Energy*Solutions* – Clive Facility

FIGURE 1 – EXISTING CONDITION
Not to Scale

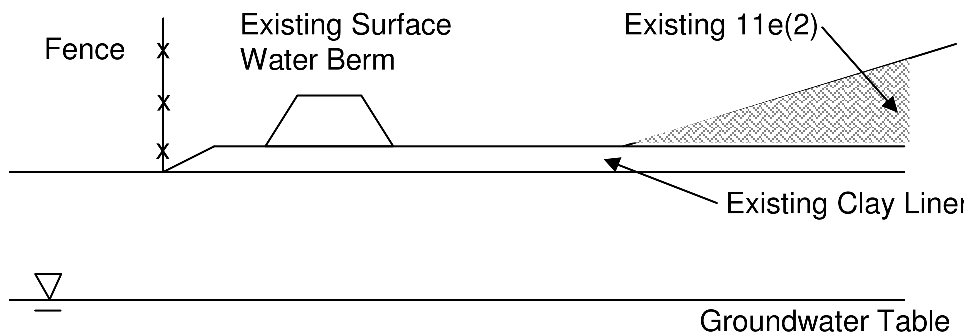


FIGURE 2 – HORIZONTAL BORE & WELL INSTALLATION
Not to Scale

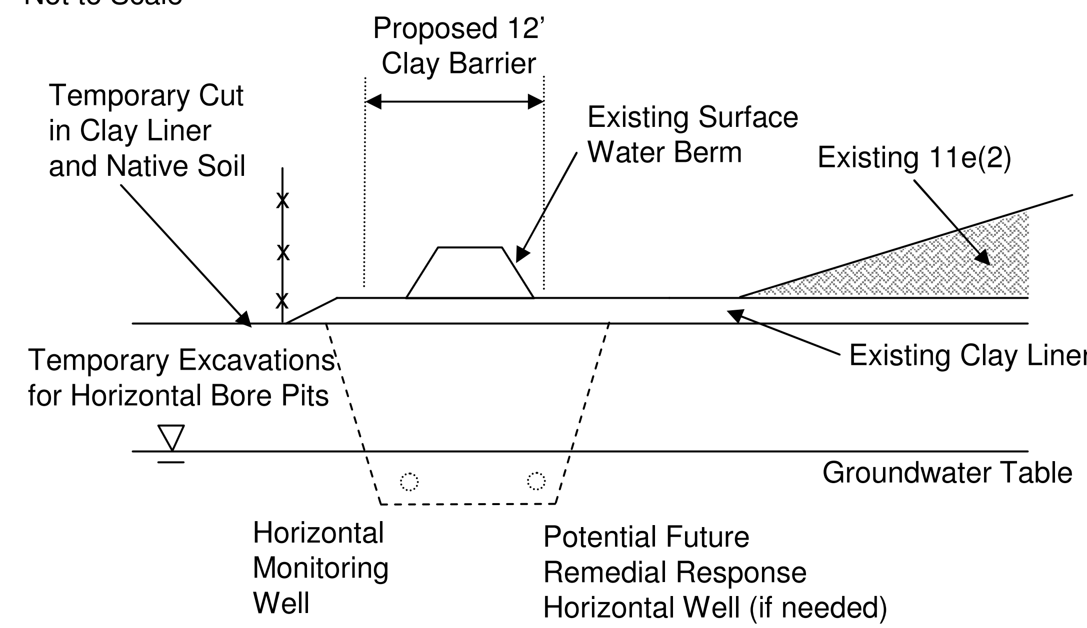


FIGURE 3 – HORIZONTAL WELL COMPLETION
Not to Scale

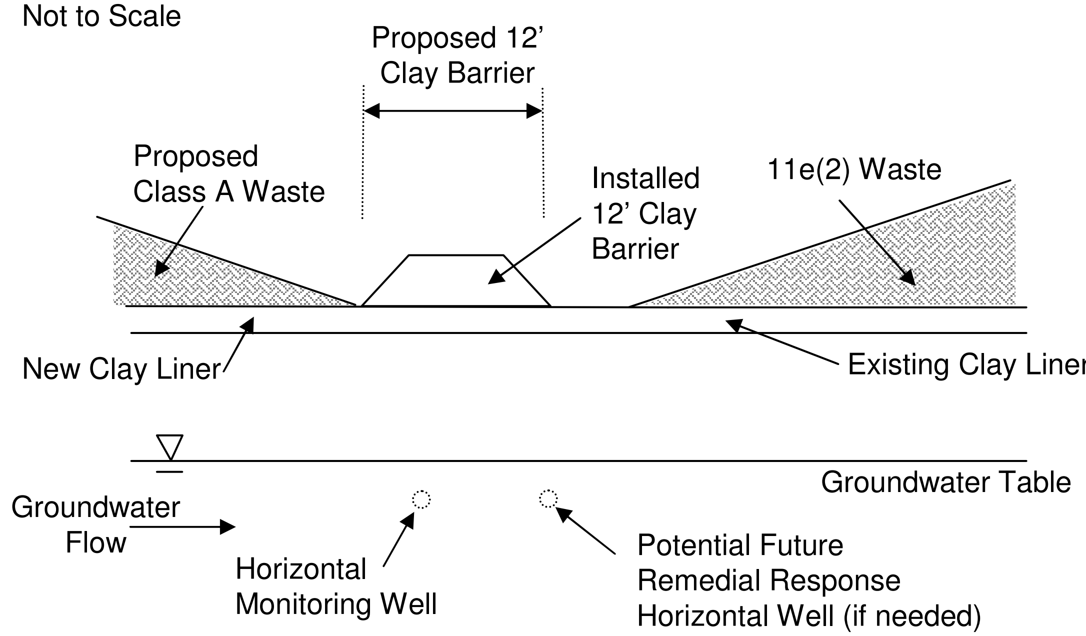
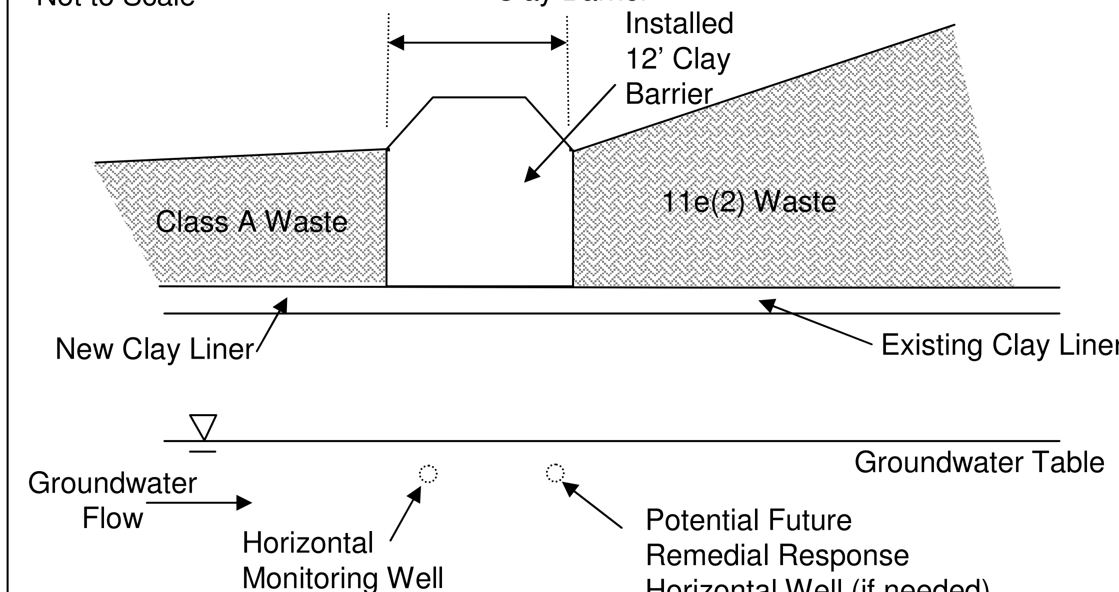
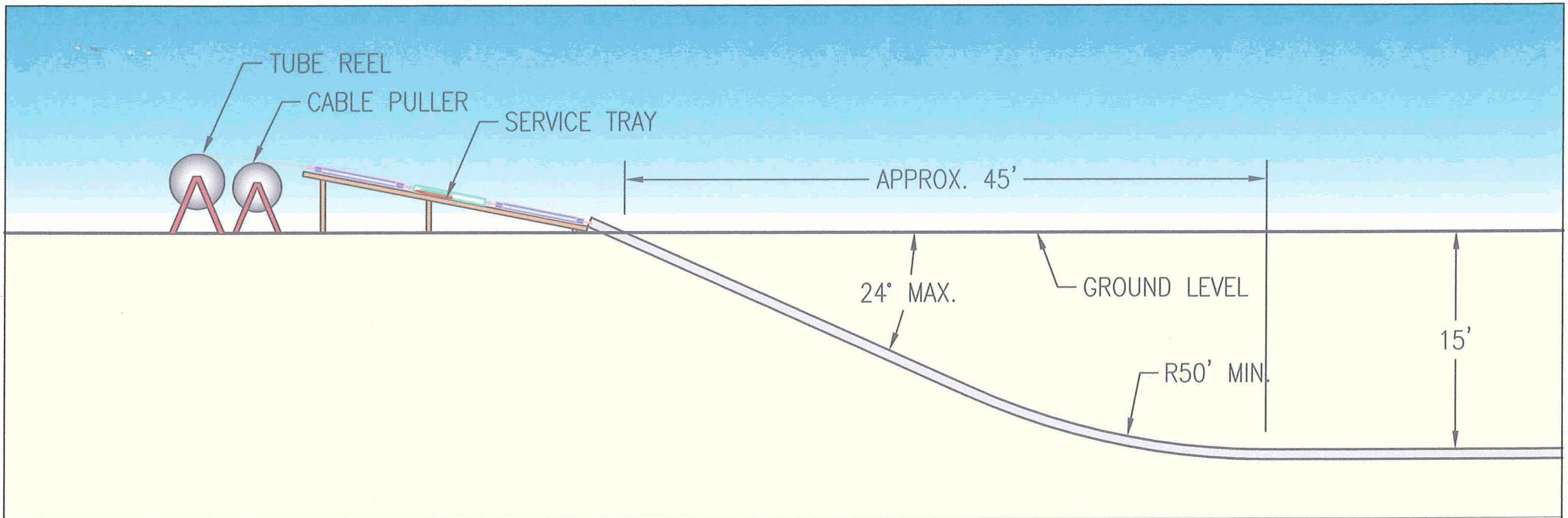
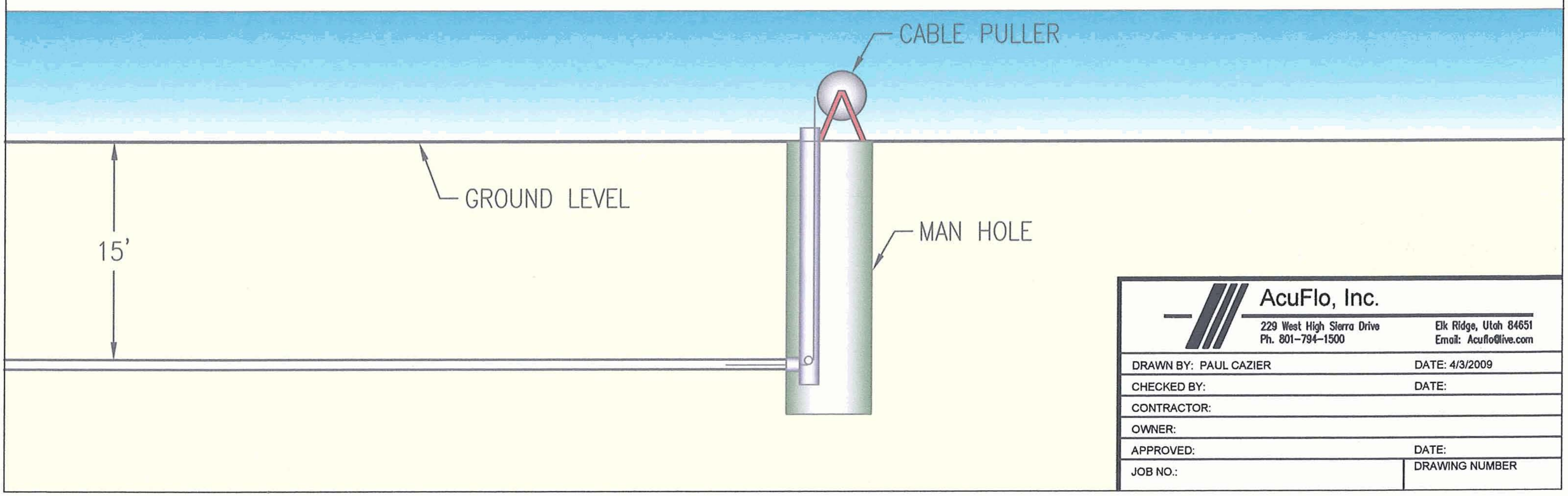


FIGURE 4 – CLAY BARRIER
Not to Scale

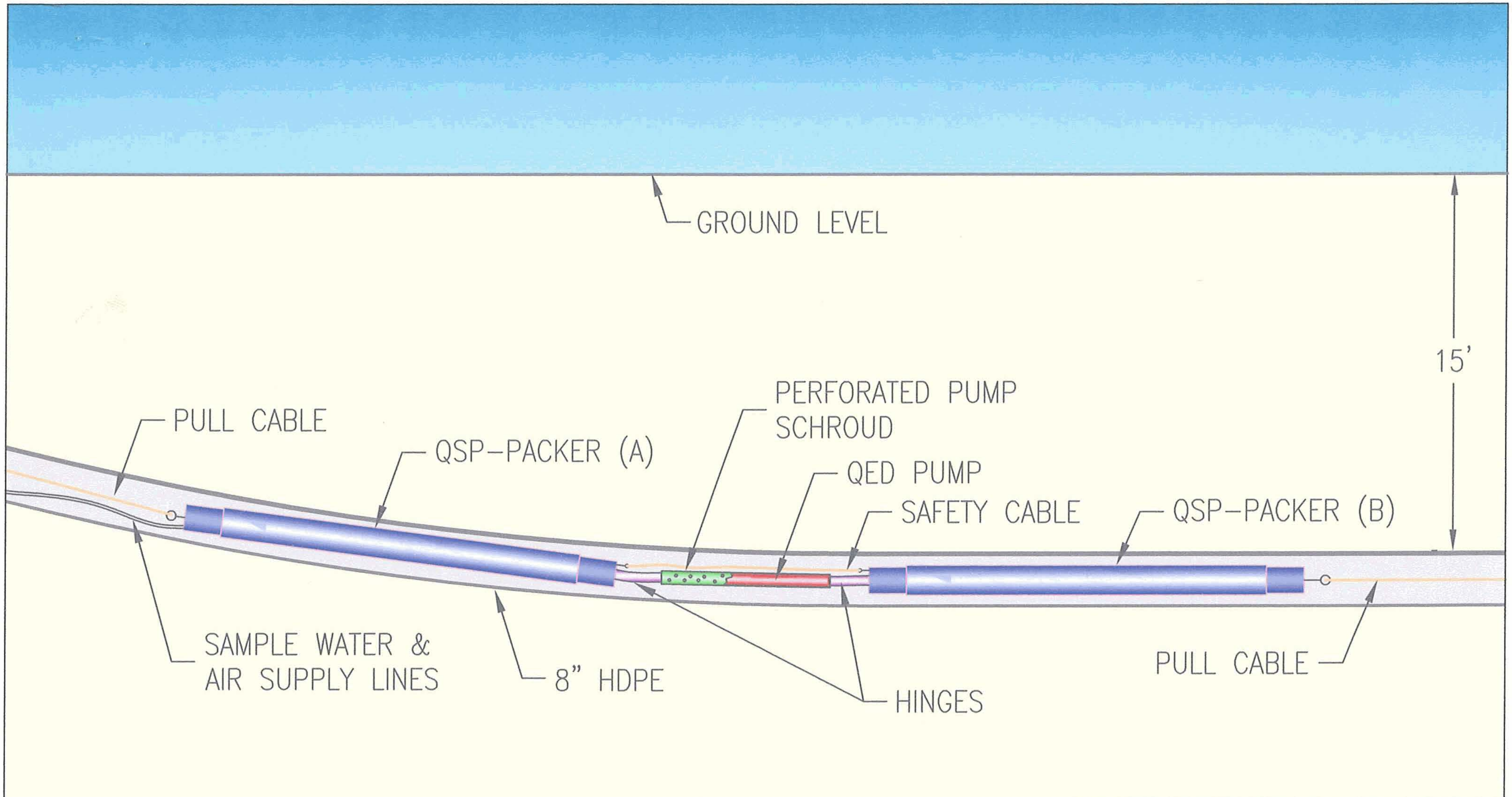






AcuFlo, Inc.
229 West High Sierra Drive
Ph. 801-794-1500
Elk Ridge, Utah 84651
Email: Acuflo@live.com

DRAWN BY: PAUL CAZIER	DATE: 4/3/2009
CHECKED BY:	DATE:
CONTRACTOR:	
OWNER:	
APPROVED:	DATE:
JOB NO.:	DRAWING NUMBER



GROUND WATER SAMPLING
CUSTOM PUMP / PACKER ASSEMBLY

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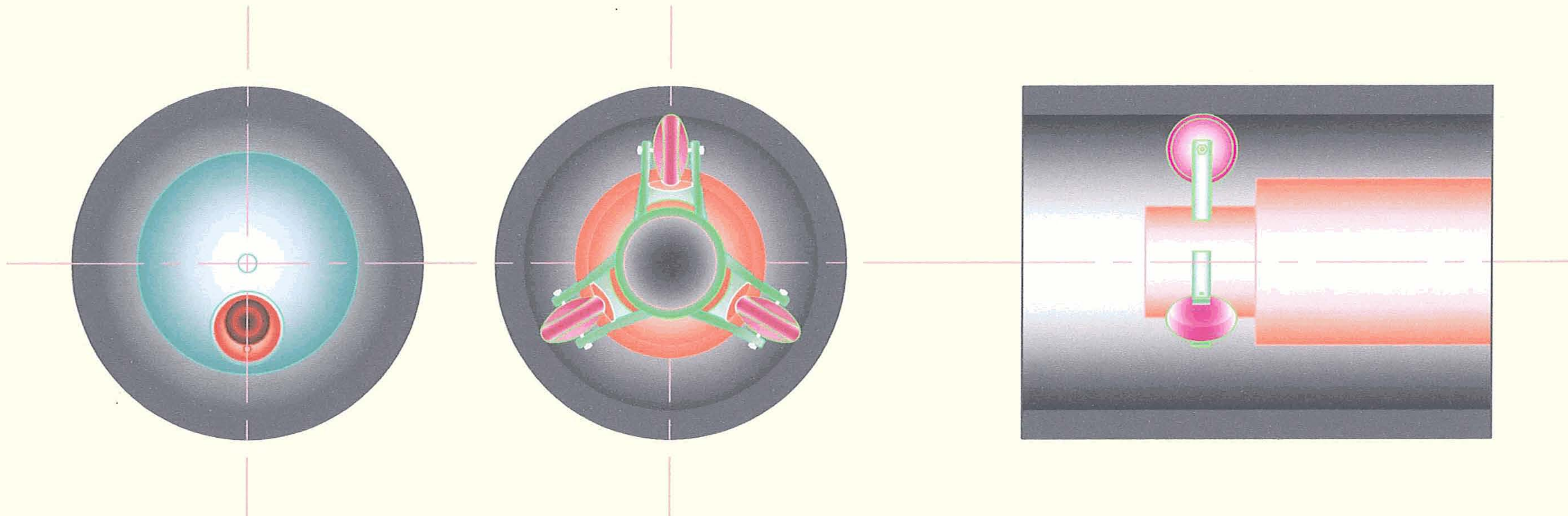

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CHECKED BY:	DATE:
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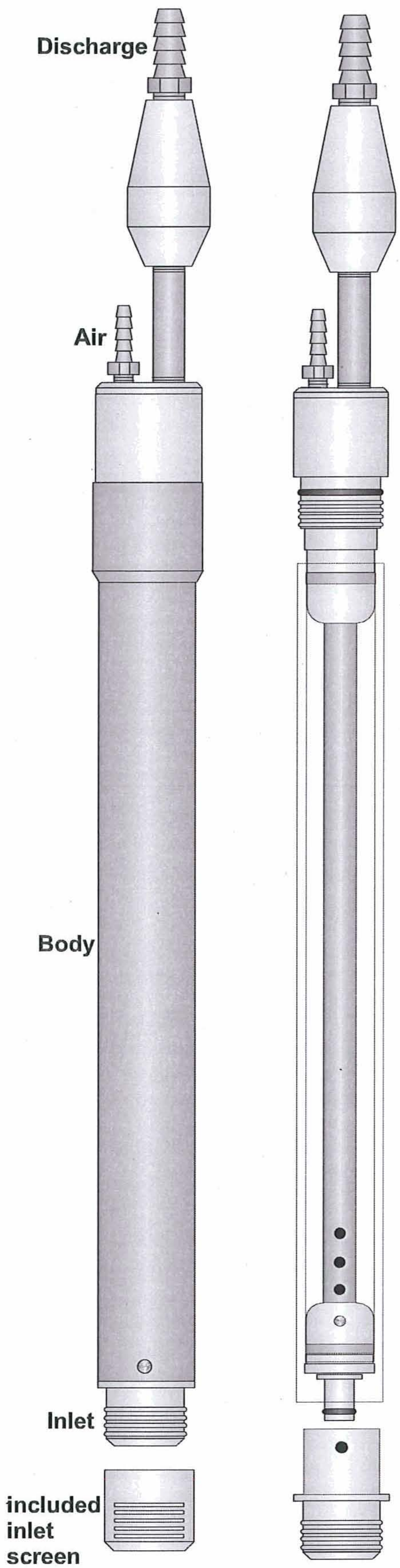
OWNER:	
APPROVED:	DATE:
JOB NO.:	DRAWING NUMBER

PULSEPUMP® Model LP1650 — Technical Data / Specifications



Pump Type: Positive Air Displacement
Dual Sleeve Bladder Pump

Materials: Body - 316 Stainless Steel
Bladder, Bladder Sleeve - Teflon
Checks - EPDM
Housings - Teflon
O-Rings - Viton

Dimensions:

Pump O.D.: 1.75" (4.4 cm)
Length: 27.5" (70 cm)
Length w/Screen: 28.2" (72 cm)
Weight: 13.9 lbs. (6.3 kg)

Fittings: Stainless Steel Barb Type
Air - 3/8" O.D. (9.5 mm)
Discharge - 1/2" O.D. (12.7 mm)

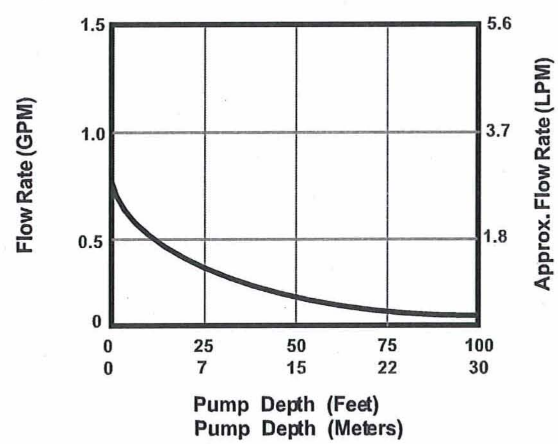
Pump Volume:

LITERS	MILLILITERS	GALLONS	OUNCES
.19	190	.05	6.42

Maximum Lift: 200 Feet (60 m)

PUMP FLOW RATES AT:

PUMP FLOW RATES AT 100 P.S.I. (6.89 Bar):



ACCESSORIES:

P/N C1602 Floating Layer Adapter
P/N 35639 Stainless Steel Probe Extender

Dimensions, Inflation and Differential Pressure

The general specifications for a packer include:

1. **Uninflated Outside Diameter (OD)**
2. **Maximum inflated OD**
3. **Borehole differential pressure**
4. **Uninflated exposed rubber element length**
5. **Materials of construction**

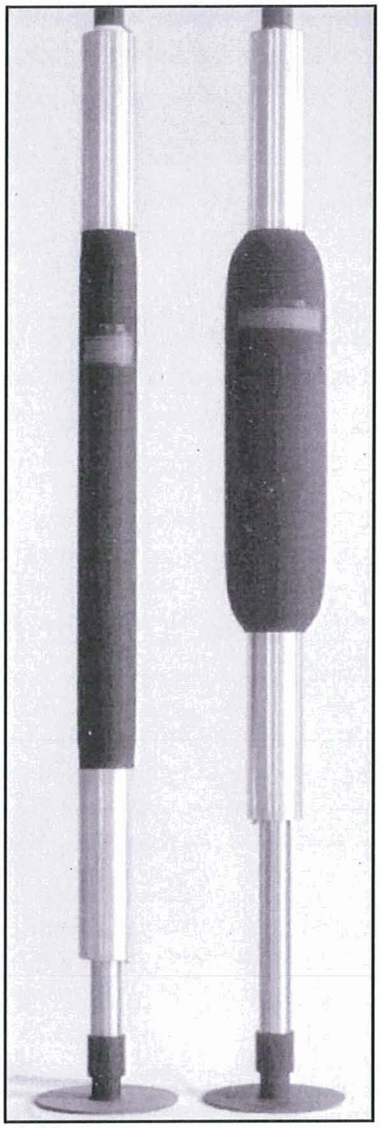
The uninflated OD must always be smaller than the minimum hole diameter through which the packer must pass. The maximum inflated outside diameter is the largest suggested hole size for which the packer should be used. The borehole differential pressure is the difference in pressures above and below the packer, e.g. drawdown or injection pressure over hydrostatic. With gas inflation, the packer inflation pressure is the sum of the pressures necessary to:

1. Match the water pressure above the packer (submergence pressure), or to match the injection pressure at the packer;
2. Stretch the rubber element out to the borehole; and
3. Seat the packer firmly enough against the well hole to prevent any movement caused by the borehole differential pressure.

The exposed element length affects the "holding power" and sealing ability of the packer. A longer element has more rubber contact against the hole and provides a larger frictional force to support a larger borehole differential pressure. The packer is strongest (highest differential pressure rating) if its uninflated OD is close to the hole size and is weakest when inflated to its maximum diameter.

As a manufacturer of inflatable packers, Baski carefully controls all aspects of design, machining, element-building, processing, and testing. Since all operations are "in-house", there is a wide selection of materials and sizes available beyond standard design. Our standard off-the-shelf packers are available for 2 to 21 inch boreholes, and custom sizes for 1 to 60 inch holes can be provided.

Oftentimes, packer installations can require additional equipment. In order to pressurize a packer, a pressure source (nitrogen cylinder, gas booster, or water pump), pressure regulator, and inflation tubing are usually necessary. The inflation tubing can be inexpensive, 1/4 inch OD nylon tubing for working pressures up to 625 psi, or 3/16 inch ID hydraulic hose and stainless steel tubing for higher pressures. A fluid intensifier pump uses 100 psi compressed air to pump water to 4,500 psi or higher. When pumping water out from between two packers, a pump shroud can be used to provide cooling water for the submersible pump motor and to mechanically connect the pump to the packers. Perforated pipe or screen is also available for injection or withdrawal of fluids from between the packers. In-Line Adapters (ILA) are commonly used to seal electrical and pneumatic feed-throughs, lines that pass through the inside of the packer. Finally, rubber packer sleeves can be manufactured to economically increase the packer OD for larger diameter applications.



Uninflated and Inflated Sliding-End Packers

Borehole Differential Pressure Rating

In order to choose the appropriate Baski Inflatable Packer (BIP™), the anticipated borehole differential pressure must be known. The borehole differential pressure is the difference between the test zone pressure below and the borehole pressure above the packer. **The pumping drawdown in a well *or* the downhole injection pressure at the packer over the hydrostatic are two common examples of the borehole differential pressure.**

BASKI

Manufacturer of Inflatable Packers, Flow Control Valves, Pitless Units and other products for investigating, controlling and producing the EARTH'S FLUIDS.™

Email: info@baski.com
Website: www.baski.com

Phone: 1-303-789-1200 • 1-800-55-BASKI
FAX: 1-303-789-0900

SPECIFICATION SHEET: Packer Model MD-4.5

Medium Duty, Sliding-Head Type (USA Pat. No. 4,455,027)

Dimensions and Confined/Unconfined Test Pressures:

Uninflated O.D., max.	4.5"	114 mm
Largest recommended hole size	8.5"	216 mm
Mandrel pipe size, nominal	2"	51 mm
Approximate mandrel pipe I.D.	1.94"	49 mm
Uninflated element length, min.	40"	1,016 mm
Tested unconfined to	500 psi	35 bar
Tested confined in a 6" (152 mm) chamber to	1,000 psi	70 bar

Differential Pressure Rating (DPR): in single packer applications, for specific hole sizes

Cased or Competent Hole Size		Maximum Differential Pressure Rating	
inches	mm	psi	bar
5.5	140	1,000	70
6.0	152	1,000	70
6.5	165	800	55
7.0	178	600	40
8.0	203	400	30
8.5	216	350	25

Please call factory for DPR in straddle packer applications.

Construction and Materials:

Element	Construction	Fully-reinforced (reinforcing the entire length of element)
	Materials	Reinforced natural rubber, with outer covering of natural rubber
	Connection to ends	11" (279 mm) Type 316 stainless steel Continuous Crimp Collar
Heads	Connection	1/4" NPT inflation ports, top and bottom
Mandrel	Pipe	2" Schedule 80 pipe
	Material	Type 316 stainless steel
	Connection	2" NPT, top and bottom
Other	Metal Parts	Type 316 stainless steel

Accessories:

In-Line Adapter	Model ILA2.0	2" nominal pipe size, Aluminum, 8 top ports Includes an assortment of brass fittings for sealing electrical leads in varying diam., 3/16", 1/4", 3/8"

Shipping Data:

Approx. net weight	91 lbs.	41 kg
Approx. net length	84"	2,134 mm

Pricing and Terms:

Please call for pricing, FOB Denver factory and valid for 60 days.
Our terms are prepay (wire transfer, Visa, MasterCard, or certified check).
Company checks require approximately two (2) weeks to clear.

Attachment 6.2

Analytical Parameters for Detection Monitoring: Class A LLRW and 11e.(2) Waste Cells

3. Revision of Ground Water Protection Levels

After submittal of additional ground water quality data, the ground water protection levels may be revised by the Executive Secretary.

Table 1A: Ground Water Protection Levels (GWPL) – Universal to All LARW, Class A, and Class A North Wells

Parameter	GWPL [1]	Parameter	GWPL [1]
Field and Inorganic Parameters (mg/l)		*Radiologic Parameters – Alpha Emitters [9] (pCi/l)*	
Cyanide	0.2	Adjusted Gross Alpha [10]	15
Fluoride	4.0	Neptunium-237 [11]	7
Total Nitrate/Nitrite (as N)	10.0	Strontium-90	42
pH (units)	6.5 – 8.5	Thorium-230	83
Dissolved Metals (mg/l)		Thorium-232	92
Arsenic	NA [2]	Uranium-233	26
Barium	2.0	Uranium-234	26
Beryllium [3]	0.004	Uranium-235	27
Cadmium	0.005	Uranium-236	27
Chromium	0.1	Uranium-238	26
Copper	1.3	*Radiologic Parameters – Beta/Gamma Emitters [12] (pCi/l)*	
Lead	0.015	Carbon-14	3,200
Mercury	0.002	Iodine-129 [13]	21
Molybdenum	NA [2]	Technetium-99	3,790
Nickel [3]	0.10	Tritium	60,900
Selenium	0.05		
Silver	0.1	*Combined Radiologic Parameters (pCi/l)*	
Uranium – total [4]	0.03	Radium-226 + Radium-228 [14]	5
Zinc	5.0		
Organic Parameters (mg/l)			
Acetone [5]	0.7	1,2-Dichloroethane	0.005
2-Butanone [15]	4.0	Methylene Chloride [7]	0.005
Carbon Disulfide [5]	0.7	1,1,2-Trichloroethane [8]	0.005
Chloroform [6]	0.08	Vinyl Chloride	0.002

1. All ground water protection levels (GWPLs) derived from Ground Water Quality Standards (GWQS, see UAC R317-6-2), except as noted.
2. Due to naturally elevated concentrations of arsenic and molybdenum in the Class IV saline aquifer at Clive, Utah, these constituents are poor indicators of cell leakage and therefore will not be used as compliance parameters with ground water protection levels. However, the Permittee will continue to sample, analyze, and report arsenic and molybdenum data in all compliance monitoring wells at Permit and License renewal as a best management practice.
3. Beryllium and Nickel GWQS derived from EPA drinking water Maximum Contaminant Levels (MCL), as published in the July 17, 1992 Federal Register, Vol. 57, No. 138, pp. 31776 – 31849, Table 1.
4. Total uranium GWQS of 0.03 mg/l from EPA final MCL in National Primary Drinking Water Regulations Final Rule for Radionuclides (December 7, 2000 Federal Register, Vol. 65, No. 236, p. 76708).

5. GWQS for acetone, and carbon disulfide determined by DWQ staff from reference doses available in the technical literature, see August 8, 1994 DWQ Staff Report: Ground Water Quality Conditions and Proposed Revision to Ground Water Protection Levels, Envirocare of Utah Inc., Low-Level Radioactive Waste and 11e.(2) Waste Disposal Facility, near Clive, Tooele County, Utah, p. 3.
6. GWQS for chloroform derived from a 1998 EPA final drinking water MCL for total trihalomethane compounds in "Drinking Water Standards and Health Advisories", EPA 822-B-00-001, Summer 2000.
7. GWQS for methylene chloride derived from EPA drinking water MCL (ibid.).
8. GWQS for 1,1, 2-Trichloroethane from final EPA MCL in "Drinking Water Regulations and Health Advisories", EPA 822-B-96-002, October 1996.
9. All GWPL values for alpha-emitting radionuclides based on 1E-4 lifetime cancer mortality risk concentration levels provided in 1991 EPA draft MCL values for drinking water (July 18, 1991 Federal Register, Vol. 56, No. 138, pp. 33078-9, 33100-3, and Appendix C).
10. Adjusted Gross alpha activity excludes radon, radium-226, and uranium alpha particle activity. Gross alpha activity to be determined by co-precipitation, EPA Method 00-02.
11. Neptunium-237, as determined by Total Radioactive Neptunium, EPA Method 907.0.
12. All GWPL values for beta/gamma emitting radionuclide parameters based on a 4 millirem/year equivalent dosage, as per 1991 EPA draft MCL values for drinking water (July 18, 1991 Federal Register, Vol. 56, No. 138, pp. 33078, 33103, and Appendix B).
13. Iodine-129, as determined by Total Radioactive Iodine, EPA Method 902.0.
14. GWQS of 5 pCi/l for combined radium-226 + radium-228 from final EPA MCL in National Primary Drinking Water Regulations Final Rule for Radionuclides (December 7, 2000 Federal Register, Vol. 65, No. 236, p. 76708).
15. GWQS for 2-Butanone (methyl ethyl ketone) derived from Life-time health advisory value in "2006 Edition of the Drinking Water Standards and Health Advisories", EPA 822-R-06-013, August 2006

Table 1C: Ground Water Protection Levels – Universal for all 11e.(2) Wells

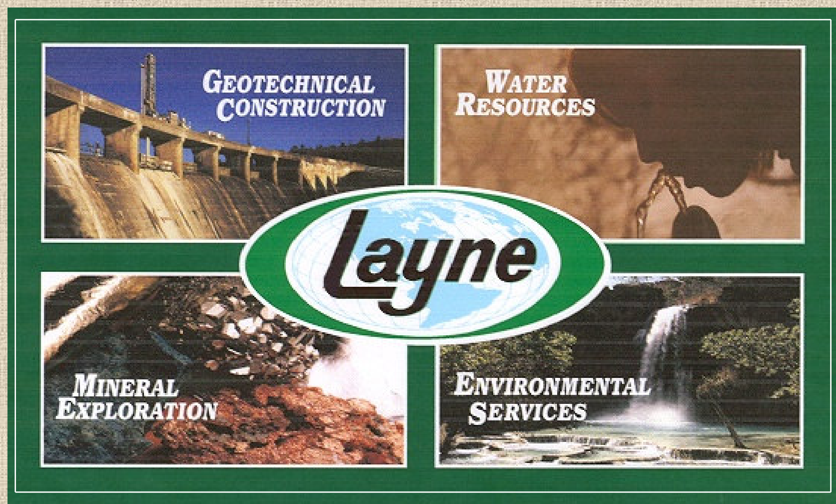
Parameter	GWPL [1]	Parameter	GWPL [1]
Field and Inorganic Parameters [2] *(mg/l)*		*Organic Parameters – Specific to 11e.(2) (mg/l)*	
Cyanide	0.2	Acetone [5]	0.7
Fluoride	4.0	2-Butanone [11]	4.0
Total Nitrate/Nitrite (as N)	10.0	Carbon Disulfide [5]	0.7
pH (units)	6.5 – 8.5	Chloroform [6]	0.08
Dissolved Metals [2] *(mg/l)*		1,2-Dichloroethane	0.005
Arsenic	NA [3]	Methylene Chloride [7]	0.005
Barium	2.0	Naphthalene [8]	0.02
Beryllium [4]	0.004	Diethyl Phthalate [9]	5.0
Cadmium	0.005	2-Methylnaphthalene [10]	0.004
Chromium	0.1		
Copper	1.3		
Lead	0.015		
Mercury	0.002		
Molybdenum	NA [3]		
Nickel [4]	0.10		
Selenium	0.05		
Silver	0.1		
Uranium – total	0.03		
Zinc	5.0		

1. All field, inorganic, dissolved metals, and organic indicator organic parameters and corresponding GWPLs for the 11e.(2) wells are equivalent to those for the LARW wells in Table 1A, above.
2. All ground water protection levels (GWPL) derived from Ground Water Quality Standards (GWQS, see UAC R317-6-2), except as noted.
3. Due to naturally elevated concentrations of arsenic and molybdenum in the Class IV saline aquifer at Clive, Utah, these constituents are poor indicators of cell leakage and therefore will not be used as compliance parameters with ground water protection levels. However, the Permittee will continue to sample, analyze, and report arsenic and molybdenum data in all compliance monitoring wells at Permit and License renewal as a best management practice.
4. Beryllium and Nickel GWQS derived from EPA drinking water Maximum Contaminant Levels (MCL), as published in the July 17, 1992 Federal Register, Vol. 57, No. 138, pp. 31776 – 31849, Table 1.
5. GWQS for acetone, and carbon disulfide determined by DWQ staff from reference doses available in the technical literature, see August 8, 1994 DWQ Staff Report: Ground Water Quality Conditions and Proposed Revision to Ground Water Protection Levels, Envirocare of Utah Inc., Low-Level Radioactive Waste and 11e.(2) Waste Disposal Facility, near Clive, Tooele County, Utah, p. 3.
6. GWQS for chloroform derived from a 1998 EPA final drinking water MCL for total trihalomethane compounds in "Drinking Water Standards and Health Advisories", EPA 822-B-00-001, Summer 2000.
7. GWQS for methylene chloride derived from EPA drinking water MCL (ibid.).
8. Naphthalene GWQS derived from final EPA drinking water LHA (ibid.).
9. GWQS for diethyl phthalate based on draft EPA drinking water LHA (ibid.).
10. GWQS for 2-methylnaphthalene could not be located or determined, thanks to a lack of reference dosage information in the technical literature. Consequently, a detection monitoring approach has been taken and the GWPL set equal to the minimum achievable detection limit for the compound as a result of matrix interferences from high TDS content of Clive ground water. As health-based risk or other reference dosage information becomes available, the Executive Secretary may modify the Permit and set a GWQS for 2-methlynaphthalene.
11. GWQS for 2-Butanone (methyl ethyl ketone) derived from Life-time health advisory value in "2006 Edition of the Drinking Water Standards and Health Advisories", EPA 822-R-06-013, August 2006

Attachment 7.1

Layne Christensen Drilling Capabilities

Integrated Solutions for Complex Problems



LAYNE CHRISTENSEN COMPANY

A World Leader in Water Supply Development and Subsurface Construction

- **Provider of Quality Water Supplies Since 1882**
- **The Largest Company of its Kind in the world**
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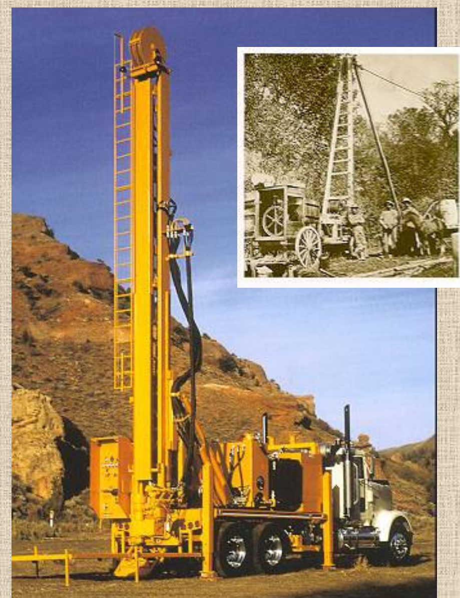

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Drilling Technologies

- Cable Tool
- Direct Rotary, Mud or Air
- Reverse Rotary
- Augers and DPT
- Caisson Installation
- Dual Wall Reverse Circulation "Dual Tube"
- Dual Rotary "Barber" Rig
- Coring Technologies
- Directional Drilling, Angle Drilling
- Dual Wall Percussion Hammer
- Sonic Drilling

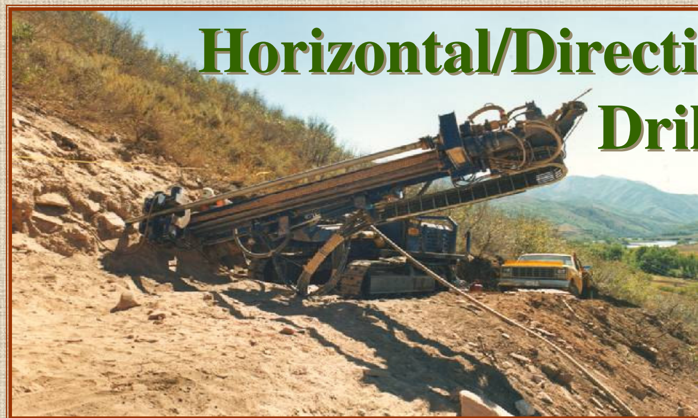
LAYNE CHRISTENSEN COMPANY

Creating a Drilling Plan

1. Define the Project's Purpose and Goals.
2. Research Regulatory Requirements, Geology and Water Chemistry (if applicable).
3. Establish Borehole/Well Diameters, Length and Materials.
4. Review Site Logistics for access, Drilling Derived Waste (DDW) Discharge Plans and Permits, Ingress and Egress Plans
5. Selection of a Drilling and Circulation Method.
6. All facets of project must emphasize SAFETY FIRST.
7. Procedure for project execution to achieve project goals with expected contingency plans.
8. Estimates for Construction. This may include an additional Value Engineering Step.
9. Contractor Qualifications – Equipment Specifications, Support Equipment, Insurance, Supervisory and Operating Personnel Resumes'
10. Quality Assurance/Quality Control Program and Safety Program to be maintained for all site activities.

LAYNE CHRISTENSEN COMPANY

Horizontal/Directional Drilling



- Straight Angle/Horizontal Drilling
- Directional Drilling
  - Surveying Technologies
  - Steering Technologies
  - Hole Geometry and Tooling String Design
  - Project Description

LAYNE CHRISTENSEN COMPANY

Horizontal/Angle Drilling

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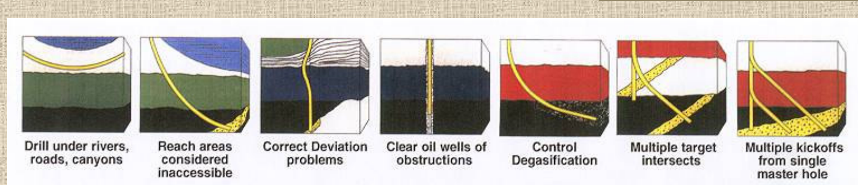
Horizontal/Angle Drilling

- Most “Drilling Technology” can be utilized for straight horizontal/angle drilling.
- Standard drilling equipment packages must be modified to perform angle or horizontal drilling safely and efficiently.
  - Angle Mast
  - Sub frame for Mast
  - Handling Equipment for Drill Rods, Well Materials and DDW
- If a straight angle/horizontal well can satisfy the project’s goals, it can be more cost effective than directional drilling
- Angle/Horizontal Wells offer design advantages for vertical fractures in bedrock or thin, saturated zones in sand and gravel.

Directional Drilling Services



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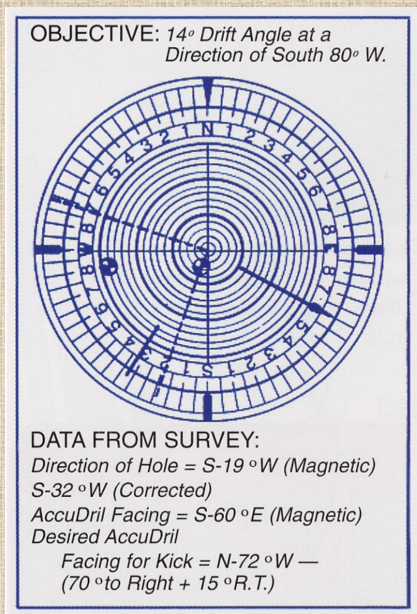
Surveying Equipment for Directional Drilling

1. Walk-over Survey System
   – Advantage is the system is easy to use
   – Disadvantages are limited depth, interference from utilities, locater runs off of a battery pack and must be able to walk to borehole path to track the tool.
2. Single Shot Survey System
   – Advantages is the system is easy to use
   – Disadvantages are the Single Shot system works off of the Earth's magnetic field which may have application limitations and can be time consuming, especially in horizontal applications
3. Gyroscopic Surveys
   – Advantages is the system is not effected by magnetic fields
   – Disadvantages are the system is time consuming due to the orienting time per survey which escalates the cost per foot of the drilling system and has limited use in horizontal applications
4. Wire Survey System
   – Advantages are reduced survey time over Gyroscopic Surveys, can be easily used in either horizontal or vertical positions and has higher accuracies with background interference.
   – Disadvantage is each drill rod connection requires a wire connection or "splice" to maintain the survey system.

Survey Equipment for Directional Drilling Con't

5. EM Surveys
   - Advantages are EM can be utilized with air and/or fluid applications, survey are fast which reduces down time and system can be calibrated for some background interference. Finally, hole inclination is not a factor to survey time and accuracy.
   - Disadvantages are the survey are only run at rod connections and the system's direct cost is higher than the other system due to manpower and equipment requirements.
6. MWD Surveys (Monitor While Drilling)
   - Advantages are the MWD surveys allow for "real-time" survey data during drilling eliminating surveying time at rod connections. Finally, hole inclination is not a factor to survey time and accuracy.
   - Disadvantages are MWD can only be used on a fluid system and the system's direct costs are much higher than the other systems due to manpower and equipment requirements.



Single Shot Survey

- This is a sample of information generated from a single shot survey.

Single Shot/Gyro Survey

- Equipment is housed inside of non-mag rod. This rod is then lowered into bottom hole orienting sub (Step 1 of survey)

Single Shot/Gyro Survey

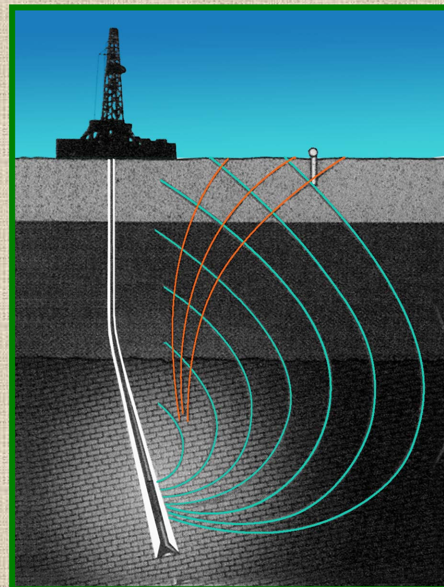
- Close-up view of the connection of camera rod into bottom hole orienting sub

Single Shot/Gyro Surveys

- Close-up of Bottom Hole Orienting Sub (also called "Mule Shoe Sub")

MWD Conceptual Diagram

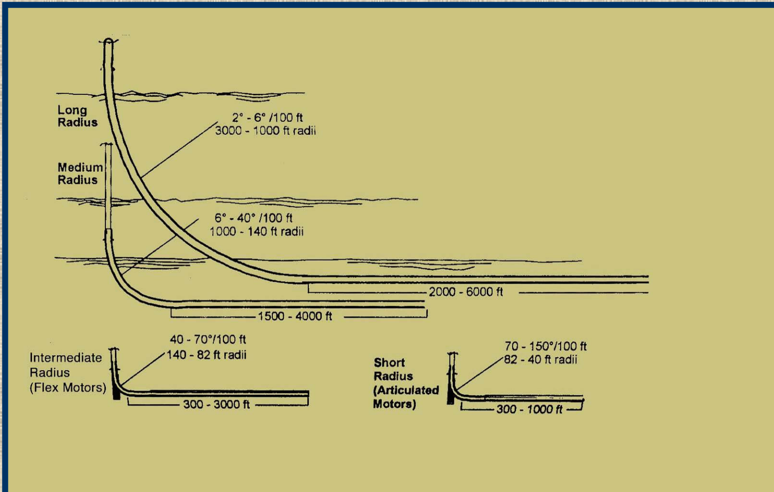
- Schematic of an electromagnetic MWD transmission of data to a surface antenna.



Steering Equipment for Directional Drilling

1. Fluid Jetting with Duckbill
   - Uses Walk Over Survey System
   - Built for shallow, unconsolidated sands
   - To build well, must have exit hole and back ream
2. Bent Sub and Positive Displacement Motors
   - Utilizes a bent sub above a straight housing motor
3. Bent Housing Drill Motor
   - Utilizes a fixed bend in the housing for the drill motor
4. Adjustable Bent Housing Drill Motor
   - Housings are adjustable from 0 to 3 degrees
   - Can be utilized with a bent sub to supplement the deviation

Geometry of Entry Angles



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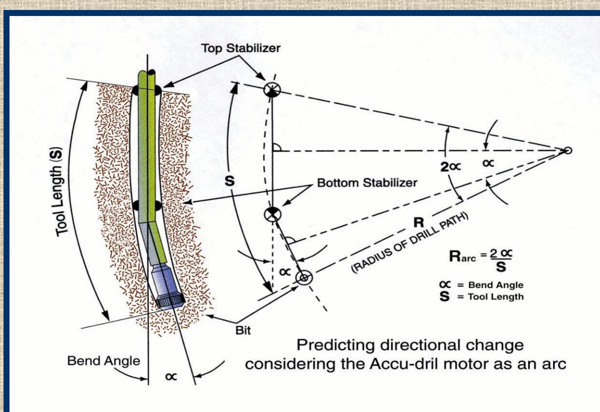
Drill Motor Deviation Calculation Example



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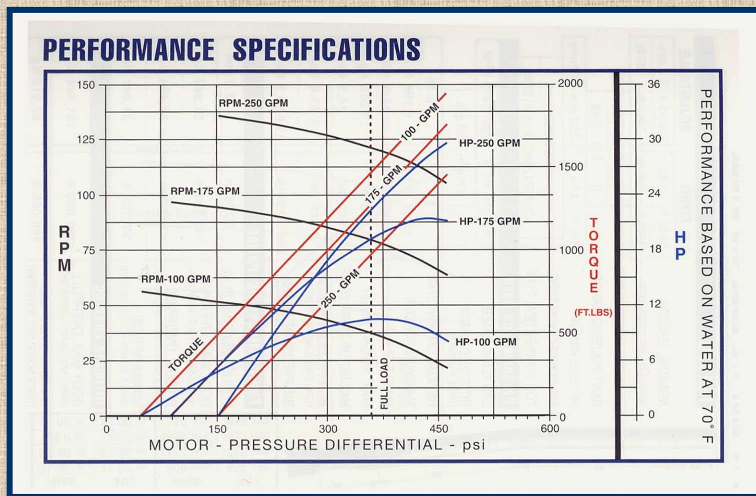
Positive Displacement Motor



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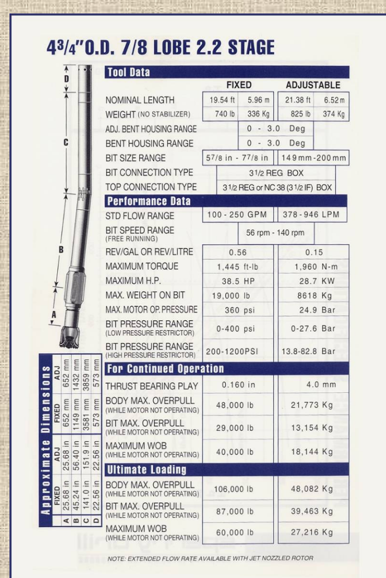
Typical Specification Sheet for Drill Motors

- Illustrates information for Drill Motor Selection



4 3/4" O.D. 7/8 LOBE 2.2 STAGE

Tool Data	FIXED		ADJUSTABLE	
NOMINAL LENGTH	19.54 ft	5.96 m	21.38 ft	6.52 m
WEIGHT (NO STABILIZER)	740 lb	336 Kg	825 lb	374 Kg
ADJ. BENT HOUSING RANGE	0 - 3.0 Deg			
BENT HOUSING RANGE	0 - 3.0 Deg			
BIT SIZE RANGE	5 7/8 in - 7 7/8 in		149 mm - 200 mm	
BIT CONNECTION TYPE	3 1/2 REG BOX			
TOP CONNECTION TYPE	3 1/2 REG or NC 38 (3 1/2 IF) BOX			

Performance Data		
STD FLOW RANGE	100 - 250 GPM	378 - 946 LPM
BIT SPEED RANGE (FREE RUNNING)	56 rpm - 140 rpm	
REV/GAL OR REV/LITRE	0.56	0.15
MAXIMUM TORQUE	1,445 ft-lb	1,960 N-m
MAXIMUM H.P.	38.5 HP	28.7 KW
MAX. WEIGHT ON BIT	19,000 lb	8618 Kg
MAX. MOTOR OP. PRESSURE	360 psi	24.9 Bar
BIT PRESSURE RANGE (LOW PRESSURE RESTRICTOR)	0-400 psi	0-27.6 Bar
BIT PRESSURE RANGE (HIGH PRESSURE RESTRICTOR)	200-1200PSI	13.8-82.8 Bar

For Continued Operation		
THRUST BEARING PLAY	0.160 in	4.0 mm
BODY MAX. OVERPULL (WHILE MOTOR NOT OPERATING)	48,000 lb	21,773 Kg
BIT MAX. OVERPULL (WHILE MOTOR NOT OPERATING)	29,000 lb	13,154 Kg
MAXIMUM WOB (WHILE MOTOR NOT OPERATING)	40,000 lb	18,144 Kg

Ultimate Loading		
BODY MAX. OVERPULL (WHILE MOTOR NOT OPERATING)	106,000 lb	48,082 Kg
BIT MAX. OVERPULL (WHILE MOTOR NOT OPERATING)	87,000 lb	39,463 Kg
MAXIMUM WOB (WHILE MOTOR NOT OPERATING)	60,000 lb	27,216 Kg

Approximate Dimensions	FIXED	ADJ	FIXED	ADJ
A	25.68 in	25.68 in	652 mm	652 mm
B	45.24 in	56.40 in	1149 mm	1432 mm
C	141.0 in	151.9 in	3581 mm	3859 mm
D	22.56 in	22.56 in	573 mm	573 mm

NOTE: EXTENDED FLOW RATE AVAILABLE WITH JET NOZZLED ROTOR

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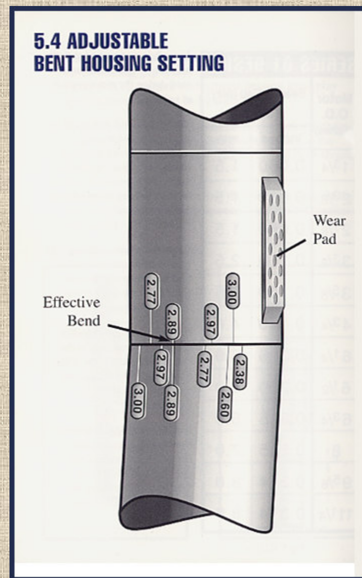
Diagram of Bent Housing Drill Motor

The numbers reference bent housing angle which are adjustable in the field.



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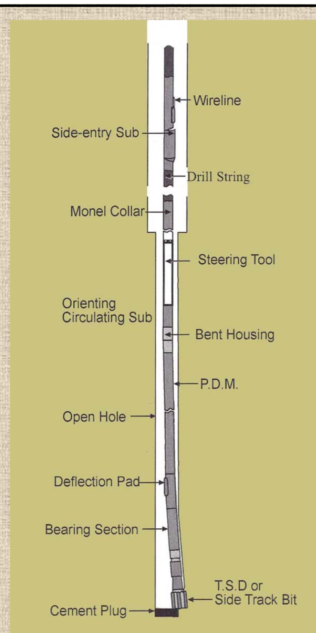
Typical Tooling Arrangement

- This is a depiction of a typical bent sub with drill motor equipment for hole corrections.



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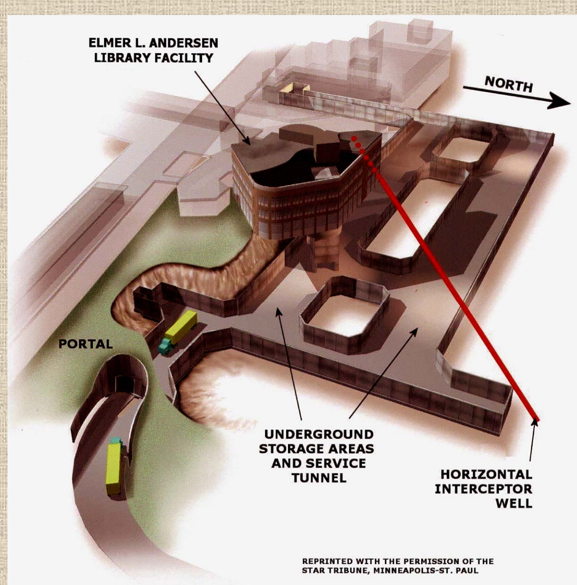

U of M

- Project Overview of the Horizontal Interceptor Well

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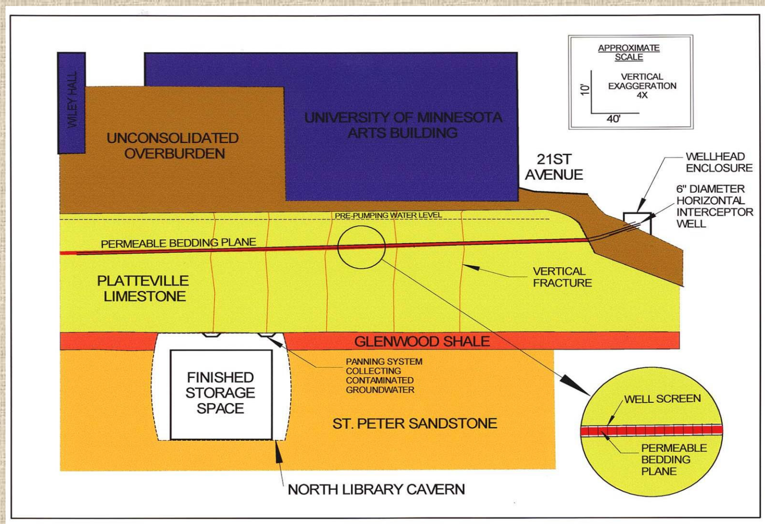
Cross-sectional View of U of M



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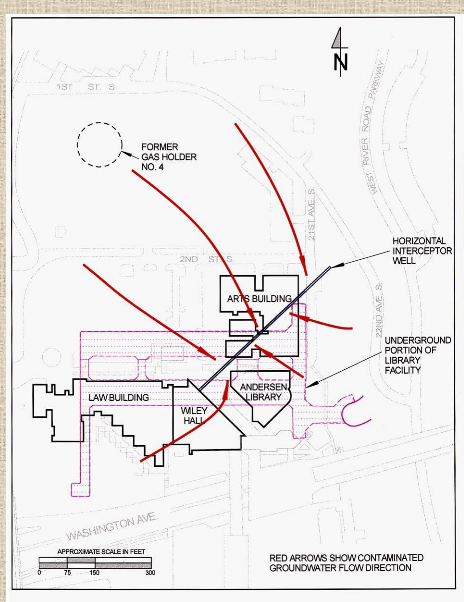

U of M Plan View

- Illustrates the effectiveness of the horizontal interceptor in fractured dolomite.

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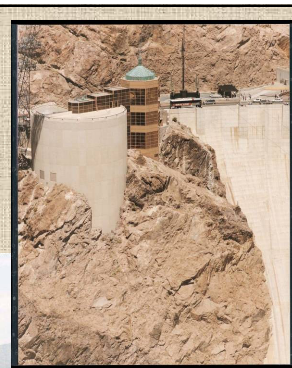
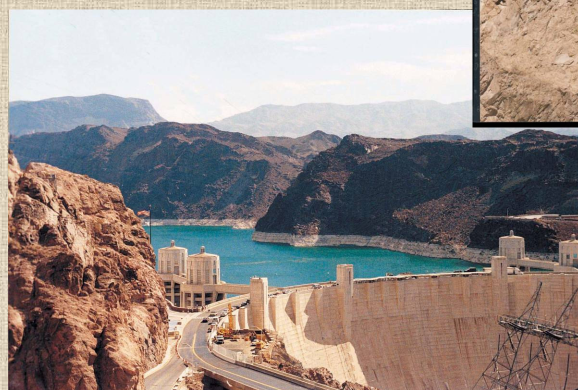
Hoover Dam Directional Drilling





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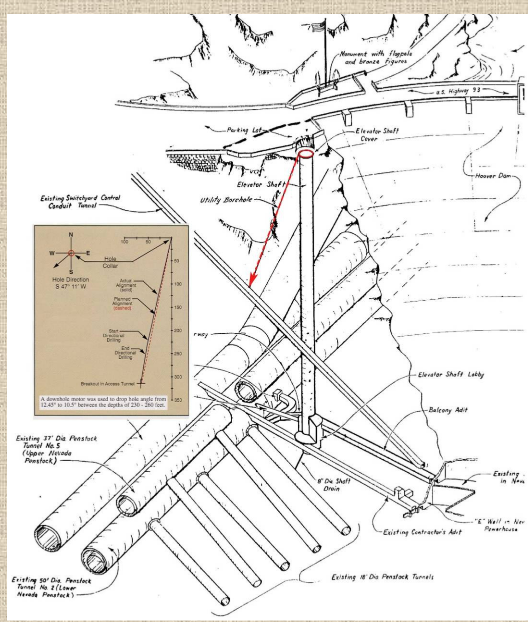

- Building the new center required routing electrical cables to an exisitng conduit tunnel deep within the canyon wall. The challenge was to drill a borehole at a precise angle to hit a 24" diameter breakout target 320 feet away.

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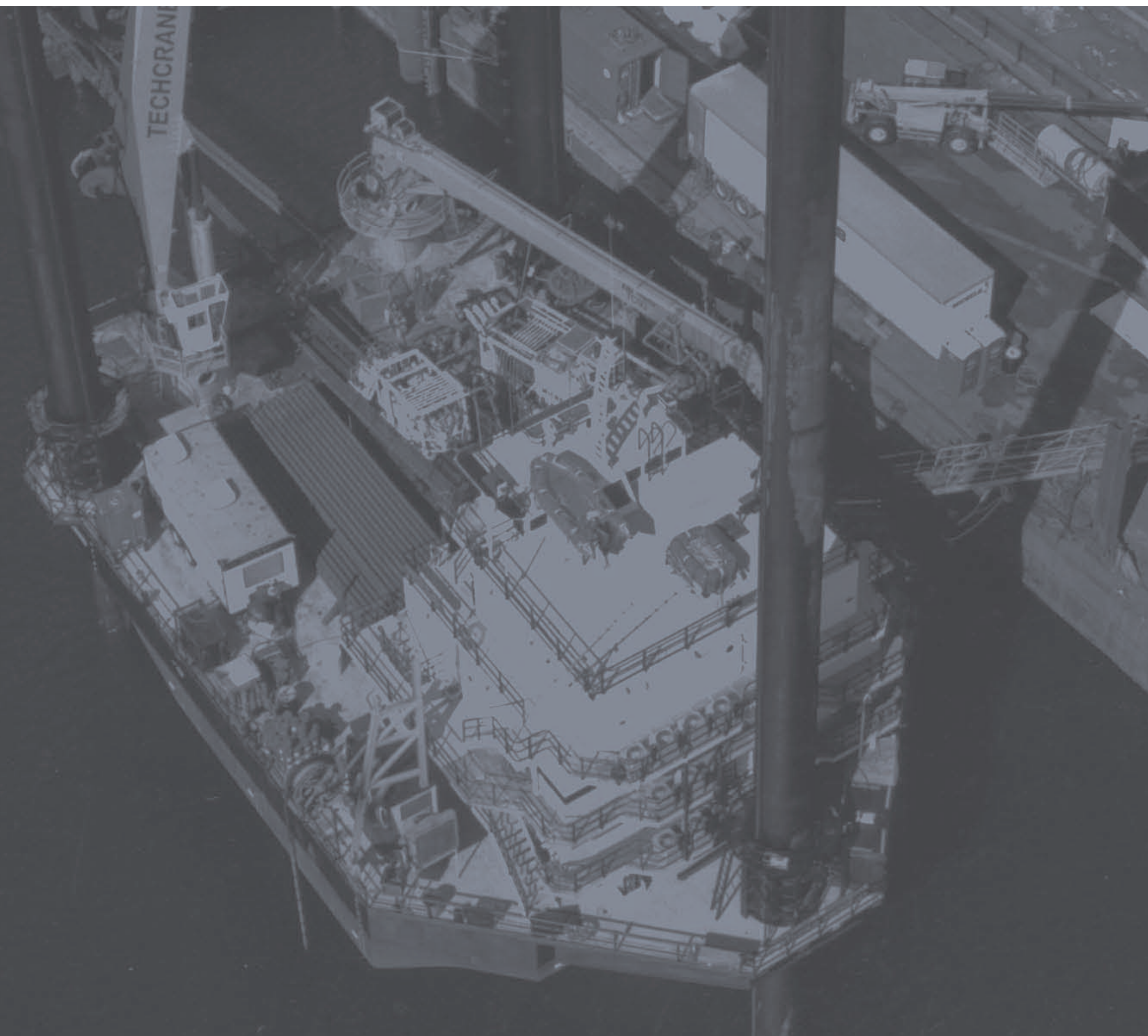
Attachment 7.2

Michel Directional Crossings Drilling Capabilities

MICHELS DIRECTIONAL CROSSINGS

Going the Distance



LAND CROSSINGS…

Truly Groundbreaking!

The utility construction industry has come to depend on Michels for precision HDD to provide maximum depth and security with minimal surface disruption to deliver a remarkable environmentally sensitive solution. Even in the most delicate wilderness environments and pristine habitats, once our work is complete, the only things we leave behind are footprints and satisfied clients!

Michels boasts more than 60 drilling rigs with several of our largest rigs capable of 1.2 million pounds of drilling thrust and pulling power, and equipment capable of boring virtually any ground condition…from sand or clay to solid rock! HDD crossings are incredibly efficient and are routinely completed in a minimal time frame, clearing most underground obstructions at depths where conventional installation is cost prohibitive if not virtually impossible.

Michels also custom fabricates large specialized drilling equipment, available for projects anywhere in the world.

We welcome the challenges of specialized drilling projects and promise to do our utmost to create inventive new HDD applications to keep our clients on the cutting edge of an increasingly competitive global marketplace.

We keep
our clients on the
cutting edge…

WATER CROSSINGS...

Our Greatness is Found Just Below the Surface

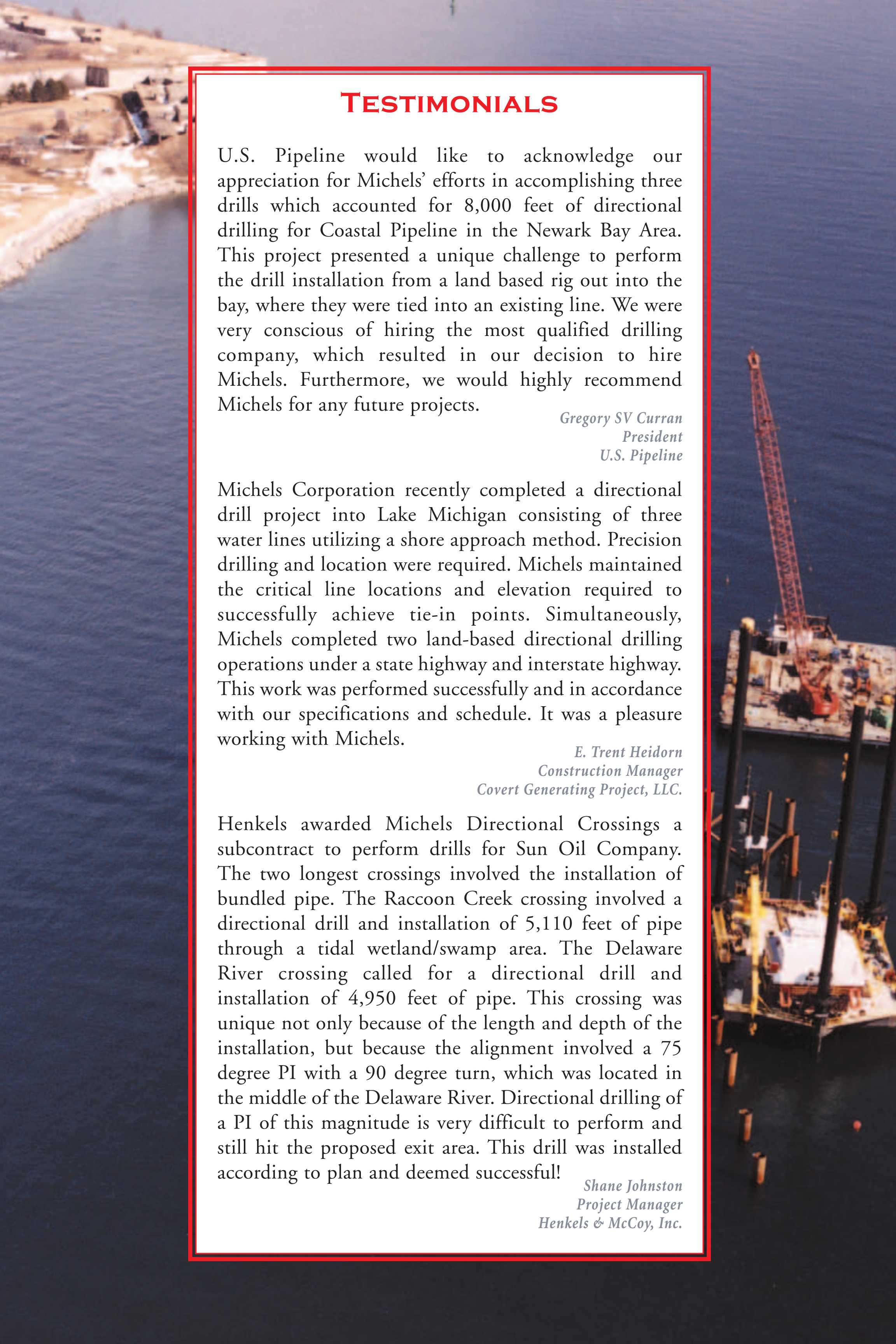
Nearly 75% of the earth's surface is covered by water. Michels land-to water and water-to-water crossings technology allows us to provide shore landings and near-shore navigational channel crossings for marine-laid utilities connecting to land-based infrastructure.

HDD is especially efficient for river crossings. With HDD, piping is drilled well below the river bed, making all buried pipe impervious to shoreline erosion, ice movement, dredging, anchor and watercraft activity. With HDD, the construction operations are largely out of sight, offering the perfect solution for environmentally sensitive marine environments.

Michels boasts a prominent track record with successful water crossings in excess of one mile, even while drilling through extreme subterranean rock formations. Our experienced team of water-based drilling technicians offers unmatched experience to complete even the most rigorous jobs on time...every time. And when multiple rigs are required to complete a project on schedule, Michels calls upon our vast fleet of privately owned rigs to lend a hand!

No job is too small and no project too large for our team of consummate land and water-based drilling professionals. Michels...the best HDD under H_20!

Call 920-583-3132 today to learn how Michels can help you go the distance.



Testimonials

U.S. Pipeline would like to acknowledge our appreciation for Michels' efforts in accomplishing three drills which accounted for 8,000 feet of directional drilling for Coastal Pipeline in the Newark Bay Area. This project presented a unique challenge to perform the drill installation from a land based rig out into the bay, where they were tied into an existing line. We were very conscious of hiring the most qualified drilling company, which resulted in our decision to hire Michels. Furthermore, we would highly recommend Michels for any future projects.

Gregory SV Curran
President
U.S. Pipeline

Michels Corporation recently completed a directional drill project into Lake Michigan consisting of three water lines utilizing a shore approach method. Precision drilling and location were required. Michels maintained the critical line locations and elevation required to successfully achieve tie-in points. Simultaneously, Michels completed two land-based directional drilling operations under a state highway and interstate highway. This work was performed successfully and in accordance with our specifications and schedule. It was a pleasure working with Michels.

E. Trent Heidorn
Construction Manager
Covert Generating Project, LLC.

Henkels awarded Michels Directional Crossings a subcontract to perform drills for Sun Oil Company. The two longest crossings involved the installation of bundled pipe. The Raccoon Creek crossing involved a directional drill and installation of 5,110 feet of pipe through a tidal wetland/swamp area. The Delaware River crossing called for a directional drill and installation of 4,950 feet of pipe. This crossing was unique not only because of the length and depth of the installation, but because the alignment involved a 75 degree PI with a 90 degree turn, which was located in the middle of the Delaware River. Directional drilling of a PI of this magnitude is very difficult to perform and still hit the proposed exit area. This drill was installed according to plan and deemed successful!

Shane Johnston
Project Manager
Henkels & McCoy, Inc.

MICHELS
DIRECTIONAL CROSSINGS

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Brownsville, Wisconsin 53006

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8

ENERGYSOLUTIONS

ALARA REVIEW FOR CLASS A SOUTH/11E.(2) AMENDMENT

I. Worker Radiation Safety

a. External Dose

1. R313-15-201. Occupational Dose Limits for Adults

The chemical, physical and radiological composition of radioactive waste proposed for disposal at Class A south are consistent with current waste composition at Class A and Class A north embankments. Clive radiation workers are consistently below all legal dose limits (total effective dose equivalent) and effectively controlled within the Clive Radiation Safety Committees' goals. Therefore, the Clive Radiation Protection Program will need no revisions for this Class A south/11e.(2) disposal embankment.

b. Internal Dose

1. R313-15-204. Determination of Internal Exposure

Clive radiation workers are consistently below all legal dose limits (total effective dose equivalent) and effectively controlled within the Clive Radiation Safety Committees' goals. Therefore, the Clive Radiation Protection Program will need no revisions for this Class A south/11e.(2) disposal embankment.

II. Environmental

a. R313-15-301. Dose Limits for Individual Members of the Public

As described in II.d. below, compliance with the 100 mrem/year and 2 mrem in one hour to a member of the public are within the capabilities of the current Environmental Monitoring Plan and the Clive Radiation Protection Program.

b. Effluent Constraint Limits

As described in II.d. below, compliance with the 10 mrem/year constraint limit to the general population is within the capabilities of the current Environmental Monitoring Plan and the Clive Radiation Protection Program.

c. R313-25-19. Protection of the General Population from Releases of Radioactivity

As described in II.d. below, compliance with 25/75/25 mrem/year dose to a member of the public is within the capabilities of the current Environmental Monitoring Plan and the Clive Radiation Protection Program.

d. Air and Soil Environmental Stations

The Class A south/11e.(2) area is currently licensed for 11e.(2) radioactive waste. The justification for its' current environmental monitoring program has already been approved by the U.S. Nuclear Regulatory Commission (NRC) and/or the Utah Division of Radiation Control (DRC). From an environmental perspective, the effluent concentration limits (ECLs) for 11e.(2) material (uranium, thorium and daughters) are more restrictive and more conservative than the ECLs for low-level radioactive waste (mixed activation/fission products).

The chemical, physical and radiological composition of radioactive waste proposed for disposal at Class A south/11e.(2) are consistent with current waste composition at Class A and Class A north embankments. Quarterly environmental reports document that radiological data, both radiation and effluents, are consistently below regulatory requirements and ALARA constraints.

After discussions with the Clive Environmental Manager, the addition of an environmental monitoring station, on the west restricted area (RA) boundary between A-21 and A-13, is recommended. With this addition, there are no other environmental actions necessary to support the Class A south/11e.(2) amendment.

e. Haul Route

The haul route used to transport waste from Rotary Dump, Truck Unloading dock and Intermodal Unloading facility will be similar to current haul routes with no expected adverse changes to radiation dose and effluents from the RA.

III. ALARA Program

a. The current Occupancy Factor (OF) for the Clive RA, as approved by the RSC, is 25%. There are no changes necessary to this OF for the Class A south/11e.(2) amendment.

IV. **Action Item(s)**

a. Add Environmental Air Station on the west restricted area boundary between A-21 and A-13. This would include requisite radiation monitoring device and radon/thoron monitoring.

Clive Radiation Safety Committee Concurrence: [signature] 6-9-09