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OAG-003-22

# MEMORANDUM

**TO:** Douglas J. Hansen, Director
Division of Waste Management and Radiation Control
Utah Department of Environmental Quality

Jalynn Knudsen, Assistant Director
Division of Waste Management and Radiation Control
Utah Department of Environmental Quality

Otis Willoughby, Low-Level Radioactive Waste Section Manager
Division of Waste Management and Radiation Control
Utah Department of Environmental Quality

**FROM:** Bret F. Randall, Assistant Attorney General
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**DATE:** January 10, 2022

**SUBJECT:** Energy*Solutions* Amendment #26 – Volumetric Limitations

## INTRODUCTION AND BACKGROUND

*The Utah Attorney General's Office does not usually provide formal legal opinions. The contents of this Memorandum do not reflect any determination made by Utah's Attorney General. However, Assistant Attorneys General in the Office are authorized to provide their client agencies with legal advice and analysis. The statements made herein are offered in that context, in our capacity as Assistant Attorneys General.*

On June 28, 2021, Energy*Solutions*, L.L.C. ("Energy*Solutions*" or "Licensee") submitted to the Division of Waste Management and Radiation Control ("Division") a request to amend Radioactive Material License No. UT 2300249 (the "Amendment Request") and a request to modify Groundwater Quality Discharge Permit #UGW450005 (the "Modification Request"), on the basis of a Memorandum from Energy*Solutions*' outside legal counsel, Parr, Brown, Gee & Loveless, dated June 28, 2021. The Amendment Request and the Modification Request are referred to collectively herein as the Amendment/Modification Request.

This matter relates to a written political understanding, dated March 15, 2007, between then Governor Jon Huntsman and Energy*Solutions* (Attachment 1). This document is commonly referred to as the "Huntsman Agreement" (and is so referenced in the Amendment/Modification Request), but the use of the word "Agreement" is potentially misleading because the arrangement is not a conventional legal contract. Rather, it reflects a political understanding or arrangement. In order to avoid potential ambiguity, the March 15, 2007, document is referred to herein as the "Huntsman Arrangement."

The waste volume references set forth in the License and in the Permit originated in connection with Amendment #14, finalized by the former Division of Radiation Control ("DRC") in November of 2012. Before that time, neither the License nor the Permit referred to specific waste volumes. The former DRC's rationale and factual and legal basis for Amendment #14 is found in two documents: (1) Utah Division of Radiation Control, Energy*Solutions* LLRW Disposal Facility, Class A West Amendment Request Safety Evaluation Report (URS Corporation, June 2012) (Attachment 2) (the "Amd. 14 SER"); and, (2) the Public Participation Summary for EnergySolutions' Class A West Embankment License Amendment Request (November 14, 2012) ("Amd. 14 PPS") (Attachment 3).

The Huntsman Arrangement refers to the Northwest Interstate Compact (the "Compact"), more formally known as the Northwest Interstate Compact on Low-Level Radioactive Waste Management. The Northwest Interstate Compact is an interstate compact that arises from the federal Low–Level Radioactive Waste Policy Act (the "LLRWPA"), codified at 42 U.S.C. §§ 2021b–2021j. This legislation gave states the authority under the Constitution's Compact Clause, U.S. Const. art. I, § 10, to enter into interstate agreements, or compacts, to deal with low-level radioactive waste on a regional basis. In 1986, Congress passed the Omnibus Low–Level Radioactive Waste Interstate Compact Consent Act, Pub.L. No. 99–240, 99 Stat. 1842, Title II (codified at 42 U.S.C. § 2021d note) (the "Consent Act"). The Consent Act provided congressional consent for "the States of Alaska, Hawaii, Idaho, Montana, Oregon, Utah, Washington, and Wyoming to enter into the Northwest Interstate Compact on Low–Level Radioactive Waste Management." Consent Act § 221. For more background on the Northwest Compact, see *EnergySolutions LLC v. Utah*, 625 F.3d 1261 (10th Cir. 2010). In turn, the Utah Legislature has adopted the Northwest Interstate Compact as a matter of Utah statutory law. *See* Utah Code §§ 19-3-201-206. Under Section 204, the Governor of the State of Utah has the authority to designate the state official as the person responsible for the administration of the compact on behalf of the State of Utah. *See* Utah Code § 19-3-204(1).

In relevant part, the Huntsman Arrangement provided that Governor Huntsman would refrain from asking the Northwest Interstate Compact on Low-Level Radioactive Waste Management (the "Compact"),[1] via the Governor's

[1] The Northwest Interstate Compact on Low-Level Radioactive Waste Management, PL99–240(HR1083), § 221, states that "[n]o facility located in any party state may accept low-level waste generated outside of the region comprised of the party states, except as provided in article V." *Id.* § 221(IV)(2). Article V provides that "the committee may enter into arrangements with states[,] provinces, individual generators, or regional compact entities outside the region . . . for access to facilities on such terms and conditions as the committee may deem appropriate." *Id.* § V. But such arrangement must be approved by a 2/3 vote of all members of the committee and must include the affirmative vote of any member of any party state in which such arrangement is located. *Id.* Thus, it appears the Governor's representative on the committee could, in effect, veto any arrangement to import waste from outside the compact states. *See*

appointed Compact representative, to restrict Energy*Solutions'* waste capacities "[f]or so long as Energy*Solutions* refrain[ed] from applying for a license, license amendment, or license renewal for disposal of low-level radioactive waste beyond the currently-licensed low-level radioactive waste cell volume, which were licensed as of May 1, 2006, and the Converted Class A Cell . . . ." The reference to the May 1, 2006, date relates to the approved engineering plans for Class A waste embankment and the Mixed Waste embankment in existence as of that date.

In Amendment #14, the former DRC appears to have undertaken to enforce the Huntsman Arrangement, not through the Governor's remedies through the Northwest Compact, but by apparently imposing new aggregate waste volume limits into an ostensibly, legally-enforceable License Condition, 9.E (and through a conforming modification to the Groundwater Discharge Permit or "Permit"). The current Amendment/Modification Request challenges the legal basis for a portion of Condition 9.E as modified in Amendment #14 (and the conforming modification to the Permit).

## QUESTION PRESENTED

Is there a valid legal basis for the Division to enforce total maximum waste volume limitations implied in the Huntsman Arrangement through administrative actions, specifically the License and the Permit approved by the former DRC in connection with Amendment #14 and its conforming modification of Part I.E.1.a of the Permit?

## SHORT ASWER

To the extent that the former DRC relied on the Huntsman Arrangement as the basis for imposing total maximum volume limitations at Clive, the answer is no. The maximum volume limitations set forth in the Huntsman Arrangement are not based on the Utah Radiation Control Act, or a rule adopted by the Utah Waste Management and Radiation Control Board, or a policy or provision of the Northwest Compact. This answer is based on several considerations:

- The Amd. 14 SER and the Amd. 14 PPS incorrectly characterized the Huntsman Arrangement as reflecting Energy*Solutions*' *agreement to limit* the volumes of waste it would accept at its facility. This is not correct. The Huntsman Arrangement represents a mutual forbearance arrangement that expressly referenced and reserved Energy*Solutions*' right to file future licensing applications or modifications that may exceed certain defined waste volumes.

- The Huntsman Arrangement does not direct or expect that the Utah Department of Environmental Quality ("DEQ") should itself assume the responsibility to enforce the Huntsman Arrangement through administrative actions. To the contrary, as a mutual forbearance understanding, the Huntsman Arrangement did not purport to limit Energy*Solutions*' right to file, and for the agency to process, a future license amendment exceeding the stated volume limitations. Rather, the Huntsman Arrangement provided that in the event of such a future amendment, then Governor Huntsman expressed his intent to utilize legal remedies potentially available to the governor through the governor's appointed Compact representative.

- The Huntsman Arrangement is not binding on future governors.

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*EnergySolutions v. Utah*, 625 F.3d 1261, 1264 (10th Cir. 2010) (concluding that the Clive Facility "may not accept any low-level waste generated outside of the Northwest Compact, unless the Northwest Compact permits it").

- The administrative record relating to Amendment #14 included no legal analysis about whether or not the former DRC's incorporation of the Huntsman Arrangement maximum, aggregate volume limitations as License and Permit conditions had a valid legal basis.

## ANALYSIS

### I. Amendment #14 Volume References Relate, in Part, to the New Approved Designs.

The Amendment/Modification Request begins with the argument that the *sole* basis the former DRC relied upon for incorporating specific waste volume limitations administratively was the Huntsman Arrangement. This statement is true in part, but the volume limitation issues in Amendment #14 also have some nuances that deserve analysis.

On the one hand, it is reasonably clear from the administrative record for Amendment #14 that the former DRC believed its role was to incorporate maximum waste volumes that could be disposed of at Clive, as reflected in the Huntsman Arrangement, as administratively enforceable license and permit conditions. *See, e.g.*, Amd. 14 PPS at 7 ("Additional amendments to Energy*Solutions*' License to conform to the Huntsman Agreement are not necessary because the License covers all areas where Class A waste can be disposed.").[2] The administrative record points to no other legal basis for total, aggregate waste volume limitations[3] because no such basis exists in the Northwest Compact policies or regulations, or in the Utah Radiation Control Act or rules (other than the geographic boundary limitation found in Utah Code Section 19-3-105(3) and (8)).

On the other hand, the Amendment #14 administrative record demonstrates that the former DRC did approve new embankment designs for the new Class A West embankment and for the Mixed Waste Landfill Cell. Approved engineering designs as reflected in Energy*Solutions*' licenses and permits always involve specific waste volumes as a function of the approved design and this is true in the case of Amendment #14. The waste volume calculations in the Amd 14 SER were based on the new designs that were ultimately approved in Amendment #14. But this fact does not limit the Division's duty to approve other hypothetical designs with different volumes if the new designs meet the Utah Radiation Control Act, the Radiation Control Rules, and other applicable health and safety requirements. To account for this nuance, it would be appropriate to amend the License and the Permit to cross-reference the approved design drawings, which include approved waste volumes as well as a variety of other approved design features. The administrative record should reflect that Energy*Solutions*' License and Permit are directly tied to, and limited by, the approved embankment designs.

### II. Energy*Solutions* Did Not Agree or Commit to Maximum, Aggregate Waste Volumes.

One important background fact upon which the former DRC relies on its apparent incorporation of maximum waste volume limitations at Clive is provided in the Amd. 14 SER, at page 7, as follows:

> In a formal agreement with Governor Huntsman in 2007, indicating that it would withdraw its application to develop and operate its proposed "Class A Combined (CAC)" Embankment, ***the***

[2] This statement by the former DRC was in response to public comments requesting more clear waste volume disposal limitations based on the Huntsman Arrangement. The former DRC's characterization of its administrative actions as being intended to "*conform to the Huntsman Agreement*" corroborates the conclusion that a basis for the waste volume limitations was the Huntsman Arrangement. The administrative record includes similar references.

[3] In other words, maximum waste volumes that Energy*Solutions* could never exceed even if a hypothetical new waste embankment design otherwise met all applicable legal and regulatory requirements.

> ***Licensee agreed to limit the volume of waste to be disposed of at its facility located at Clive, Utah***. The major points of the 2007 agreement are summarized as follows:
>
> 1. Energy*Solutions* agreed to promptly withdraw the CAC Cell LLRW license amendment pending before the Utah Board of Radiation Control and its Executive Secretary.
>
> 2. Energy*Solutions* reaffirmed that it will not accept Class B or C low-level radioactive waste or waste having a higher radionuclide concentration than the highest radionuclide concentration allowed under licenses existing on February 25, 2005.
>
> 3. The Governor agreed to refrain from making, and would not permit his designee to make, any request to the Northwest Interstate Compact regarding low-level waste volumes for receipt at Energy*Solutions*, or to initiate or support action to limit the volume of low-level radioactive waste on Section 32, of Energy*Solutions* Clive Facility.
>
> 4. The authority and rights of the State of Utah, the Utah Board of Radiation Control, the Board's Executive Secretary, the Compact, and Energy*Solutions* are not altered by this Agreement.

(emphasis added). Similarly, in the Amd. 14 PPS, at page 6, the former DRC stated: "On March 15, 2007, Governor Jon Huntsman for the State of Utah and CEO Steve Creamer for Energy*Solutions* entered into an agreement (Appendix E) that ***committed EnergySolutions to limit its disposal*** to 'the currently-licensed low-level radioactive waste cell volumes,' . . . ."

The emphasized characterizations of the Huntsman Arrangement are not factually or legally correct. Based on the plain language of the Huntsman Arrangement, Energy*Solutions* did not directly or indirectly agree or commit to limit the volume of waste to be disposed of at Clive. Rather, then Governor Huntsman agreed to refrain from requesting that the Compact address volumes "*for so long as* EnergySolutions *refrains from* applying for" a license or amendment in excess of the volumes (emphasis added). A forbearance agreement is not the same as an agreement to perform in a certain way. Nor is a forbearance agreement the same as a waiver. On this point, we concur with the legal analysis set forth on page #2 of the Memorandum from Parr, Brown, Gee & Loveless, dated June 28, 2021, attached to Energy*Solutions*' June 28, 2021, Amendment/Modification Request. For this reason, we recommend that the new administrative record for Amendment #26 serve to update and correct the highlighted portions of the Amd. 14 SER, at page 7, and the Amd. 14 PPS, at page 6.

## III. The Huntsman Arrangement is *Not* Binding on Future Governors.

There is another error in the previous administrative record regarding the Huntsman Arrangement that should be updated and corrected in connection with the administrative record for Amendment #26. It is the conclusion that the Huntsman Arrangement is binding on future governors. This incorrect understanding of the legal status of the Huntsman Arrangement is reflected in a Memorandum dated September 10, 2014, from the former DRC to Energy*Solutions* (DRC-2014-007787) (the "2014 DRC Memorandum") (Attachment 4). The 2014 DRC Memorandum reaffirms the former DRC's understanding and interpretation of the Huntsman Arrangement that it was a binding, continuing, and legally-enforceable agreement by both Energy*Solutions* and the State of Utah. Based on our internal review, we understand that the 2014 DRC Memorandum was not based on legal analysis or legal advice provided by the Utah Attorney General's Office. We disagree with the conclusions reached in the 2014 DRC Memorandum. The current Governor of the State of Utah has independent legal authority to take actions (or to refrain from taking actions) with respect to the Northwest Compact. Generally speaking, the previous actions or forbearances

by former Governors of the State of Utah relating to the Northwest Compact are not binding on future governors. More specifically, then Governor Huntsman's commitment to refrain from pursuing certain remedies associated with the Northwest Compact based on conditions defined by then Governor Huntsman are not binding on the current Governor.

On this topic, the 2014 DRC Memorandum is inconsistent with a legal memorandum prepared by Assistant Attorney General Laura Lockhart for the Division of Waste Management and Radiation Control, dated April 6, 2015, entitled "Interpreting the Huntsman Arrangement" (the "2015 Lockhart Memo"), published as Appendix G to Energy*Solutions* LLRW Disposal License – Condition 35 Safety Evaluation Report, Volume 2 (Attachment 5). *See* 2015 Lockhart Memo at 3 (finding that the Huntsman Arrangement is not binding on future governors—"Future administrations are therefore free to agree to different volume limitations or to end any limitations."). We concur with the 2015 Lockhart Memo.

Even though the 2014 DRC Memorandum was created after the waste volume limitations were approved in Amendment #14 (and the conforming Permit modification), this Memorandum still may be considered to be part of the administrative record because it purports to ratify and clarify the previous agency actions. As a result, we recommend that the administrative record for Amendment #26 serve to update and correct the 2014 DRC Memorandum.

## IV. The Huntsman Arrangement Did Not Direct that the DEQ Itself Enforce Waste Volume Limits Administratively.

The former DRC's administrative actions imposing total, aggregate waste volume limitations are inconsistent with the plain and unambiguous wording of the Huntsman Arrangement itself. Nothing in the Huntsman Arrangement suggests an intent or direction by Governor Huntsman for the former DRC to impose total, aggregate waste volume limitations through administrative actions. In relevant part, it provides: "[f]or so long as Energy*Solutions* refrains from *applying for a license, license amendment, or license renewal* for disposal of low-level radioactive waste beyond the currently-licensed low-level radioactive waste cell volume, which were licensed as of May 1, 2006, and the Converted Class A Cell . . . ." (emphasis added). This wording is careful and deliberate because it defines the important relationships in terms of the intended enforcement mechanism. *See* 2015 Lockhart Memo at 3 (discussing the remedy in the Huntsman Arrangement as being the Governor's legal remedies through the Northwest Compact).

Based on plain meaning of the wording used, the Huntsman Arrangement does not seek to impair Energy*Solutions*' future right to file an application for "a license, license amendment, or license renewal" seeking waste disposal capacity in excess of the waste volumes referenced in the Huntsman Arrangement. Rather, it expressly provides that *in the event* Energy*Solutions* were to file a new application in the future, then the *Governor* may seek an independent legal remedy through the Compact. This wording itself answers the question as to whether the former DRC should have assumed a direct enforcement role administratively. By approving maximum waste volume limitations administratively, the former DRC circumvented the Governor's role in relating to the Northwest Compact by preventing Energy*Solutions* from ever filing an application for "a license, license amendment, or license renewal" that exceeds the Huntsman Arrangement waste volume limitations. *See* Amd. 14 PPS at 7 ["Because there is no other area that may accept Class A waste, *there is no possibility that the (Huntsman) Agreement will be violated under currently applicable licenses*."] (emphasis added). The former DRC's assumption of administrative enforcement of the Huntsman Arrangement's waste volume limitations is incompatible with the Huntsman Arrangement itself.

## V. The DEQ Lacked Legal Authority to Impose Waste Volume Limitations through Administrative Actions.

Assuming, for the sake of argument, that the Huntsman Arrangement directed or expected the former DRC to impose waste volume limitations administratively (which is not the case), it is clear that the former DRC would have lacked, and did lack, the legal authority to do so. On pages 2-3 of the Parr, Brown, Gee & Loveless June 28, 2021, Memorandum, Energy*Solutions* contends that the former DRC lacked the legal authority to impose maximum waste volume limitations through administrative actions. We concur with this conclusion and the legal analysis provided by Energy*Solutions* on this point to the extent that Amendment #14 was based on the Huntsman Arrangement.[4] We are especially persuaded by the application of the facts and holding in the Utah Supreme Court's opinion in *State v. Foukas*, 560 P.2d 312, 313-15 (Utah 1977). In that decision, the Supreme Court compared and contrasted a governor's independent authority to establish speed limits with an administrative agency's legal authority to establish speed limits. Applying that analysis here leads to the conclusion that the former DRC impermissibly relied upon the Huntsman Arrangement as the basis for certain administrative actions, unrelated to statutory, regulatory, or technical reasons. *See* Lockhart Memo at 3 ("There are also no requirements from other sources that would prevent a different administration from effecting a different policy. There is no disposal volume limitation in the Compact policies or regulations, and, other than the geographic boundary limitation found in Utah Code Ann. § 19-3-105(3) and (8), there is no disposal volume limitation in state law."). Again, we concur with the 2015 Lockhart Memo.

BFR/CSN/srb

Attachments: (1) Huntsman Agreement
(2) Class A West Amendment Request Safety Evaluation Report
(3) Public Participation Summary for Class A West Embankment License Amendment Request
(4) September 10, 2014, Memorandum from the former DRC to Energy*Solutions*
(5) Appendix G – Interpreting the Huntsman Agreement Memorandum

[4] We disagree with this argument to the extent that the Division may rely on an appropriate legal basis that implicates waste volumes. The Division is charged by law to ensure the applicable performance objectives are met, including health and safety. If there were a valid performance or safety-related reason to limit waste volumes, the Division would have the legal authority and responsibility to do so.

# Attachment #1

## AGREEMENT

This agreement is entered into by and between the Governor of the State of Utah and EnergySolutions, LLC, and any successor or assignee ("EnergySolutions") as follows:

1. EnergySolutions will promptly withdraw the Combined Class A Cell license amendment currently pending before the Utah Board of Radiation Control and its Executive Secretary. EnergySolutions may complete the required licensing process for conversion of the remaining already licensed unused capacity (the "converted already licensed capacity") of the currently-licensed 11e.(2) Cell to a Class A Cell (the "Converted Class A Cell"), and upon successfully meeting all technical and legal requirements, utilize the converted already licensed capacity for the disposal of low-level radioactive waste in the Converted Class A Cell.

2. EnergySolutions and the State of Utah reiterate their commitment that they do not support Class B or C low-level radioactive waste or radioactive waste having a higher radionuclide concentration than the highest radionuclide concentration allowed under licenses existing on February 25, 2005, being disposed in the State of Utah as outlined in Utah Code Annotated Section 19-3-103.7.

3. For so long as EnergySolutions refrains from applying for a license, license amendment, or license renewal for disposal of low-level radioactive waste beyond the currently-licensed low-level radioactive waste cell volumes, which were licensed as of May 1, 2006, and the Converted Class A Cell, the Governor agrees to refrain from making, and shall not permit his designee to make, any request to the Northwest Interstate Compact on Low-Level Radioactive Waste Management (the "Compact") regarding low-level radioactive waste volumes for receipt by EnergySolutions, except as necessary to facilitate the Converted Class A Cell volume, or to initiate or support action to limit the volume of low-level radioactive waste on Section 32, Township 1S, Range 11W, of EnergySolutions' Clive Facility.

4. Nothing in this agreement shall be construed as an admission by EnergySolutions that the Compact has jurisdiction over its operations or facilities or a waiver of EnergySolutions' rights of recovery, if any, for unlawful taking without due process of law, impairment of third-party contracts, violation of vested property rights, or similar claims, based on future actions of the State of Utah or the Compact. Notwithstanding the foregoing, this agreement shall not be used as the basis for any claims against the State of Utah or the Compact.

5. Except for the commitments made by the Governor pursuant to this agreement, nothing in this agreement shall alter or limit the authority or legal rights of the State of Utah, the Compact, the Utah Board of Radiation Control, or the Board's Executive Secretary.

This Agreement will take effect upon the signatures of the parties.

Jon M. Huntsman, Jr.
Governor
State of Utah

March 15, 2007
Date

R. Steve Creamer
Chief Executive Officer
EnergySolutions, LLC

3/15/07
Date

# Attachment #2

# UTAH DIVISION OF RADIATION CONTROL
# ENERGY*SOLUTIONS* LLRW DISPOSAL FACILITY
# CLASS A WEST AMENDMENT REQUEST

# SAFETY EVALUATION REPORT

**June 2012**

**for**
**Utah Division of Radiation Control**
**195 North 1950 West**
**Salt Lake City, UT 84116**

**URS Corporation**
**756 East Winchester Street, Suite 400**
**Salt Lake City, UT 84107**

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| | |
|---|---|
| 11e.(2) | Section 11e.(2) of the Atomic Energy Act of 1954, as amended |
| 1998 LAR | License Renewal Application dated March 16, 1998 |
| 2003 LRA | License Renewal Application dated July 2, 2003 |
| 2005 LRA | License Renewal Application dated June 20, 2005 |
| ABC ALA | Application for License Amendment (Classes A, B & C waste) dated December 13, 2000. |
| Act | Utah Radiation Control Act |
| AMEC | AMEC Earth and Environmental, formerly AGRA Earth and Environmental |
| AR | amendment request |
| ASCE | American Society of Civil Engineers |
| ASTM | ASTM International, formerly American Society for Testing and Materials |
| CA | Class A |
| CAC | Class A Combined |
| CAN | Class A North |
| CAW | Class A West |
| CEDE | committed effective dose equivalent |
| CFR | Code of Federal Regulations |
| cm/sec | centimeters per second |
| CQA/QC | Construction Quality Assurance/Quality Control |
| CSLM | Controlled Low Strength Material |
| CWF | Containerized Waste Facility |
| DOE | US Department of Energy |
| DOT | US Department of Transportation |
| Division | Utah Division of Radiation Control |
| EJR | Engineering Justification Report |
| Energy*Solutions* | Formerly Envirocare of Utah, LLC and Envirocare of Utah, Inc. |
| EPA | US Environmental Protection Agency |
| EWIS | Electronic Waste Information System |
| FR | Federal Register |
| ft | feet; foot |

| | |
|---|---|
| ft/ft | feet per foot |
| g | gravity |
| H | horizontal |
| HIC | High Integrity Container |
| HMR | Hydrometeorological Report |
| hr | hour; hours |
| in | inch; inches |
| in/yr | inches per year |
| LAR | License Amendment Request |
| LARW | Low-Activity Radioactive Waste |
| LLRW | Low-level Radioactive Waste |
| LRA | License Renewal Application |
| mR/hr | milliroentgen/hour |
| mrem | millirem |
| mrem/yr | millirem/yr |
| NGA | Next Generation Attenuation |
| NORM | naturally occurring and accelerator produced material |
| NRC | US Nuclear Regulatory Commission |
| PATHRAE | Low-Level Radioactive Waste Environmental Transport and Risk Assessment Code |
| PE | professional engineer |
| PEER | Pacific Earthquake Engineering Research Center |
| PGA | Peak Ground Acceleration |
| PMF | Probable Maximum Flood |
| PMP | Probable Maximum Precipitation |
| QAM | Quality Assurance Manual |
| QAP | Quality Assurance Program |
| R | Roentgen |
| RCRA | Resource Conservation and Recovery Act |
| SER | safety evaluation report |
| SLB&M | Salt Lake Baseline and Meridian |
| SNM | Special Nuclear Material |

| | |
|---|---|
| TEDE | total effective dose equivalent |
| TSD | Treatment, Storage and Disposal |
| UDOGM | Utah Division of Oil, Gas and Mining |
| UDSHW | Utah Division of Solid and Hazardous Waste |
| UDWQ | Utah Division of Water Quality |
| UMTRA | Uranium Mill Tailings Remedial Action |
| UNSAT-H | Unsaturated Soil Water and Heat Flow code |
| URCA | Utah Radiation Control Act |
| URCB | Utah Radiation Control Board |
| URCR | Utah Radiation Control Rules |
| URS | URS Corporation |
| USACE | US Army Corps of Engineers |
| V | vertical |
| yr | year |

# 1.0 INTRODUCTION

The purpose of this Safety Evaluation Report (SER) is to identify and summarize the information the Utah Division of Radiation Control (Division) has evaluated in its' review of the Energy*Solutions*, LLC (Licensee) license amendment request (LAR) to construct and operate a Class A West (CAW) disposal embankment. This SER summarizes the grounds upon which the Division concludes that regulatory requirements are satisfied to protect public health, safety and the environment.

The CAW embankment will be used for the disposal of radioactive materials and waste. The existing Class A North (CAN) and Class A (CA) embankments will combine, the existing footprint will be extended and the height increased. The height at the peak of the completed CAW embankment will be 75.3 ft, an increase of 22 ft from the height of the CA embankment. The total disposal volume of the CAW embankment is 8,742,097 cy, an increase of 3,222,692 cy from the combined capacity of the CAN and CA embankments.

The Division is responsible for regulating activities in the State of Utah (State of Utah or State) that involve radioactive materials, some types of radioactive waste, and radiation. As part of this responsibility, the Division enforces requirements promulgated by the State of Utah. Requirements applying to land disposal of radioactive waste are contained in Utah Radiation Control Rules (URCR), Rule R313-25, "License Requirements for Land Disposal of Radioactive Waste – General Provisions." Additional applicable rules are contained in URCR Rule R313-15 "Standards for Protection Against Radiation," which defines requirements for protecting individuals from the effects of radiation and URCR Rule R313-22, "Specific Licenses," which specifies licensing requirements, many of which are met by compliance with or superseded by the provisions of URCR Rule R313-25. Additional chapters of the URCR are also applicable.

In accordance with requirements, the Director has issued licenses to various entities within the State of Utah to possess and manage radioactive materials and wastes. One such entity, Energy*Solutions*, LLC, is licensed to receive, store, and dispose, by land burial, the following categories of radioactive materials and waste:

- Naturally-occurring and accelerator produced radioactive material (NARM) waste,
- Low-activity radioactive waste (LARW),
- Class A low-level radioactive waste (LLRW),
- Special nuclear material (SNM),
- 11.e(2) waste,
- Radioactive waste that is also determined to be hazardous (mixed waste), and
- Naturally occurring radioactive material (NORM).

Energy*Solutions* holds the following licenses and permits:

- State of Utah Radioactive Material License UT2300249, Amendment 13, expires January 25, 2013,
- State of Utah Radioactive Material License, 11(e).2 Byproduct Material License UT2300478, Amendment 6, Under timely renewal,

- State of Utah Part B Permit, EPA Identification Number UDT982598898, expires April 4, 2013, and
- State of Utah Ground Water Quality Discharge Permit Number UGW450005, expires June 8, 2013.

In order for the Division to ensure that all proposed changes to licensed facilities and operations will meet applicable regulatory requirements, a licensee must submit a LAR request, detailing and justifying the proposed action, in accordance with provisions of URCR Section R313-22-38. As required by URCR, the Licensee has submitted an LAR to construct and operate a CAW disposal embankment.

Under authority of the Utah Radiation Control Act (Act), the Radiation Control Board has established requirements and criteria for licensing commercial LLRW disposal facilities contained in URCR Rule R313-25, "License Requirements for Land Disposal of Radioactive Waste – General Provisions." Under provisions of URCR Section R313-25-4, no person may receive, possess, or dispose of waste, at a land disposal facility, unless authorized by a license issued by the Director, an Agreement State, or the U.S. Nuclear Regulatory Commission pursuant to URCR Rules R313-22 and R313-25 or equivalent requirements.

The requirements of URCR Rule R313-25 address such topics as:

- Performance Objectives,
- Site Suitability Requirements,
- Facility Design, Construction, Operating, Closure, and Post-closure Requirements,
- Waste Characteristic Requirements,
- Environmental Monitoring Requirements,
- Financial Assurance and Financial Qualifications Requirements and
- Administrative Requirements.

The Division reviews a licensee's LAR to determine the extent to which each applicable regulatory requirement is satisfied and ensure that particular licensing actions are justifiable under provisions of the regulations. The license amendment process for major modifications follows the following steps:

- Review the LAR.
- Prepare interrogatories as necessary to resolve issues not adequately addressed in the amendment request.
- Review interrogatory responses, assuring that all required information is contained in either the initial submittal or responses to interrogatories.
- Prepare draft SER and draft revised license conditions.
- Publicize the Director's decision to amend the license.
- Conduct public hearings and receive public comment.
- Prepare public participation document.
- Prepare final SER and final license revisions.

Since the LAR evaluation addresses an existing facility license, the LAR review and SER preparation paid primary attention to changes to the Licensee's currently authorized facilities and operations, as well as, previously submitted and approved scientific and engineering analyses.

The Licensee was required to update the scientific and engineering analyses to reflect current practices and state-of-the-art science and engineering procedures.

Under Section 19-1-301.5 a person who wishes to challenge a License/Permit Order may only raise an issue or argument during an adjudicatory proceeding that was raised during the public comment period and was supported with sufficient information or documentation to enable the director to fully consider the substance and significance of the issue.

# 2.0 HISTORICAL OVERVIEW

The first activities involving radioactive waste management at South Clive, Utah were those conducted by the U.S. Department of Energy (DOE). DOE removed uranium mill tailings from the inactive Vitro mill site located near Salt Lake City, Utah beginning in February 1985 and concluding in June 1989. Uranium mill tailings and radioactively contaminated materials that remained at the inactive Vitro site were excavated and relocated by rail and truck to the South Clive site, located 85 miles west of Salt Lake City. The tailings and contaminated materials were transferred to a specially constructed embankment in Section 32, Township 1 South and Range 11 West, Salt Lake Baseline and Meridian, Tooele County, Utah.

Concurrent with the Vitro relocation project, Envirocare of Utah, Inc. (Envirocare, Inc.) began disposal operations at its Clive Facility in 1988 under a State radioactive materials license to dispose of NORM waste. In 1990, Envirocare, Inc. submitted a license application to modify its license to allow disposal of low activity radioactive material (LARW). In 1991, the Division granted the amendment request by adding LARW disposal to the facility's license. From time to time, the LARW disposal license was amended to address changes needed based on review of Licensee-furnished submittals and/or updated or new regulatory guidelines. In 1998, the Director renewed the Licensee's license to dispose of LARW.

The ownership history of the radioactive waste disposal facilities located at South Clive, Utah is as shown in Table 2-1.

**Table 2-1 – Ownership History.**

| Owner | Dates of Ownership |
|---|---|
| Envirocare of Utah, Inc. | February 2, 1988 through May 15, 2005. |
| Envirocare of Utah, LLC | May 16, 2005 through March 1, 2006. |
| Energy*Solutions*, LLC | Commencing March 2, 2006. |

Currently, the Licensee is authorized to dispose of NORM, NARM, 11e.(2) waste, LARW, LLRW, and mixed radioactive and hazardous waste (mixed waste) at its South Clive, Utah disposal facility under radioactive material licenses issued by the Division. The licensing and permitting history of the South Clive, Utah site is summarized below:

- 1984–1989– DOE disposal of Vitro Tailings: Remedial activities began at the Salt Lake City Vitro mill site in February 1985 and were completed in June 1989. Contaminated materials that remained at the Vitro Mill site were excavated and relocated by rail and truck to a South Clive disposal cell, a new site acquired by the State of Utah and located 85 miles west of Salt Lake City.
- 1988 – Envirocare, Inc. begins disposing of NORM: On February 28, 1988, Envirocare, Inc. received its first license from the State Bureau of Radiation Control to dispose of NORM.
- 1991 – License amendment for LARW disposal: On March 21, 1991, Envirocare, Inc. received a LARW license, from the State Bureau of Radiation Control to accept 44 radionuclides with specified concentration limits less than Class A LLRW limits. This type of waste is termed LARW.

- 1991 – Mixed Waste permit: On November 30, 1991, Envirocare, Inc. received a Resource Conservation and Recovery Act (RCRA) hazardous waste permit from the State Bureau of Solid and Hazardous Waste to accept mixed waste.
- 1992 – Resolution and Order agreement with Northwest Interstate Compact (Compact): On May 28, 1992, Envirocare, Inc. entered into an arrangement, the "Resolution and Order" with the Compact, that allowed them to accept certain types of LLRW from outside of the Compact. Envirocare, Inc. did not receive Compact approval to receive LLRW from Northwest Compact states. However, Envirocare, Inc. was granted permission to accept mixed waste from all states. The Resolution and Order was the result of a discussion at a December 18, 1991, meeting of the Compact. The Resolution and Order has subsequently been modified and reviewed.
- 1993 – Uranium Mill Tailings disposal license from the U.S. Nuclear Regulatory Commission (NRC): On November 30, 1993, Envirocare, Inc. received a license from the NRC to accept uranium mill tailings.
- 1993 – LARW License Amended: On August 27, 1993, Envirocare, Inc.'s LARW license was modified by the Division to accept 14 additional radionuclides with specified concentration limits less than the Class A limits.
- 1995 – LARW License Amended: On June 20, 1995, Envirocare, Inc.'s LARW license was modified by the Division to accept 17 additional radionuclides with specified concentration limits less than the Class A LLRW limits. It was subsequently amended on November 13, 1995, to accept 8 additional radionuclides with specified concentration limits less than the Class A LLRW limits.
- 1996 – LARW Renewal request submitted: In August 1996, Envirocare, Inc. submitted a renewal request for the LARW license to the Division.
- 1996 – Macro-encapsulation approval: On October 3, 1996, Envirocare, Inc. received a Hazardous and Solid Waste Amendment permit for macroencapsulation from the U.S. Environmental Protection Agency (EPA) Region 8.
- 1998 – Amended Resolution and Order agreement with Northwest Compact. The Second Amended Resolution and Order of November 9, 1998, is currently in effect. With very few exceptions, Envirocare, Inc. could not accept waste from Northwest Compact states. Envirocare, Inc. could accept NORM, LLRW and mixed waste from all other approved compact states and non-approved states. The restrictions of the Amended Resolution and Order are presently (2012) followed by Energy*Solutions*, LLC.
- 1998 – LARW License Renewal containing LLRW amendment request approved: On October 22, 1998, Envirocare, Inc.'s LARW license was renewed and issued as a 5-year LLRW license by the Director which included concentration limits by radionuclides less than and up to the Class A LLRW limits.
- 1999 – Class B & C LLRW license application submitted.
- 2000 – Full Class A waste disposal cell approved: On October 5, 2000, Envirocare, Inc. was issued a license amendment by the Director for a new Class A disposal cell that allowed them to begin disposing of Class A wastes within an approved Class A disposal embankment area.

- 2001 – Land Ownership exemption granted: On January 19, 2001, the Utah Radiation Control Board (URCB) granted Envirocare, Inc. an exemption to the state and federal land ownership rule based on several conditions being met.
- 2001 – Class B & C License granted pending approval: On July 9, 2001, Envirocare, Inc. was issued a separate license from the Division to accept Class B and C LLRW pending legislature and gubernatorial approval. The license was subsequently appealed to the URCB.
- 2001 – Class A LLRW Cask Amendment Granted: On October 19, 2001, Envirocare, Inc. was issued an approval for a license amendment to receive and dispose of Class A LLRW in casks.
- 2002 – Resolution and Order agreement with Northwest Compact reviewed: The Second Amended Resolution and Order of November 9, 1998, was most recently reviewed at the June 5, 2002, meeting of the Compact and no changes were made. Therefore, Energy*Solutions*, LLC is presently required to follow the 1998 Resolution and Order Agreement that was made with the Compact.
- 2003 – Final agency action of Class B & C waste: On February 10, 2003, Envirocare, Inc. was granted final agency action by the URCB on the Class B and C LLRW license, pending legislative and gubernatorial approval.
- 2003 – NRC Uranium Mill Tailings license amendment request: On March 27, 2003, Envirocare, Inc. submitted a request to the NRC to amend their NRC uranium mill tailings license to accept tailings with Radium-226 concentrations up to 100,000 pCi/g. This was to allow them to accept the DOE Fernald Site Closure Project (Fernald) waste if it were classified as 11e(2) byproduct material.
- 2003 – NRC Uranium Mill Tailings disposal license renewal request: On May 27, 2003, Envirocare, Inc. submitted a license renewal application to the NRC for the uranium mill tailings disposal cell. Envirocare, Inc. was granted timely renewal (current license remaining in effect until a decision is reached on the license renewal application).
- 2003 – Class A LLRW license renewal request: On July 2, 2003, Envirocare, Inc. submitted a license renewal application to the Division for its LLRW license. Envirocare, Inc. was granted timely renewal.
- 2003 – Withdrawal of 2003 NRC Uranium Mill Tailings license amendment request: On November 19, 2003, Envirocare, Inc. withdrew their request for a license amendment from the NRC to accept waste from the DOE Fernald site.
- 2004 – Mixed Waste license public comment period: On May 4, 2004, a 30-day public comment period commenced on an amendment to the LLRW license for Envirocare, Inc. to accept mixed waste up to Class A limits.
- 2005 – Name Change: On May 16, 2005, the name on the Licenses and permits was changed from Envirocare of Utah, Inc. to Envirocare of Utah, LLC.
- 2005 – Class A LLRW North Embankment amendment request: On January 17, 2005, Envirocare, Inc. submitted a request for a license amendment to the LLRW license to allow disposal of Class A materials in the northern area previously approved for Class A, B, and C waste disposal.
- 2005 – Withdrawal of Class B and C waste license request: In February 2005, Envirocare, Inc. withdrew a request for a Class B and C waste disposal license.

- 2005 – Submittal of License Renewal Application: On June 20, 2005, Envirocare, LLC submitted an application to renew its LLRW disposal license.
- 2005 – Submission of the Class A Combined (CAC) amendment request: On May 27, 2005, the Envirocare, LLC submitted a license amendment request to the LLRW license to create a Class A Combined Cell.
- 2006 – Transfer of Licenses and Permits: On March 2, 2006, the licenses and permits were transferred from Envirocare of Utah, LLC to Energy*Solutions*, LLC.
- 2007 – Agreement with Governor Huntsman: On March 15, 2007, the Licensee entered into an agreement with Governor Huntsman to withdraw the amendment request for a Class A Combined Cell.
- 2011 – Submission of the CAW Embankment License Amendment Request: On May 2, 2011, the Licensee submitted a request to amend the LLRW license and permit to create the proposed CAW disposal embankment and to formally retract a previous request for a CAC disposal cell.

In a formal agreement with Governor Huntsman in 2007, indicating that it would withdraw its application to develop and operate its proposed "Class A Combined (CAC)" Embankment, the Licensee agreed to limit the volume of waste to be disposed of at its facility located at Clive, Utah. The major points of the 2007 agreement are summarized as follows:

1. Energy*Solutions* agreed to promptly withdraw the CAC Cell LLRW license amendment pending before the Utah Board of Radiation Control and its Executive Secretary.
2. Energy*Solutions* reaffirmed that it will not accept Class B or C low-level radioactive waste or waste having a higher radionuclide concentration than the highest radionuclide concentration allowed under licenses existing on February 25, 2005.
3. The Governor agreed to refrain from making, and would not permit his designee to make, any request to the Northwest Interstate Compact regarding low-level waste volumes for receipt at Energy*Solutions*, or to initiate or support action to limit the volume of low-level radioactive waste on Section 32, of Energy*Solutions* Clive Facility.
4. The authority and rights of the State of Utah, the Utah Board of Radiation Control, the Board's Executive Secretary, the Compact, and Energy*Solutions* are not altered by this Agreement.

On November 16, 2011, the Division approved the Licensee's 2010 financial surety report. The Licensee demonstrates annually, to the Division’s satisfaction, that it is financially capable to carry out all licensed activities. The Licensee has provided financial assurances sufficient to fund the safe closure of the facility, as well as the long-term monitoring and maintenance of the proposed facility.

# 3.0 DESCRIPTION OF CAW LICENSE AMENDMENT REQUEST

## 3.1 DESCRIPTION OF THE PROPOSED CAW EMBANKMENT

The design for the CAW Embankment is conceptually the same as the previously approved designs of the CA and CAN embankments. It is designed as primarily above-grade and will be constructed using materials native to the site or found in close proximity to the site. Engineered features of the embankment are designed based upon State of Utah requirements, NRC guidance, EPA guidance, and the Licensee's past experience at this location.

The majority of existing procedures and plans applicable to the Energy*Solutions* facility as a whole, including Radiation Safety, Quality Assurance, Health and Safety, Training, Electronic Recordkeeping, and Administration, are unaffected by the licensing and permitting of the CAW Embankment. Updated discussion and procedures are located in the Licensee's License Renewal Application LRA dated June 20, 2005, (Envirocare of Utah, LLC 2005c, LRA).

No change will result to waste placement procedures, equipment used, or forms used in documenting waste placement as a result of permitting the CAW Embankment. Certain revisions were required to be made to the Construction Quality Assurance Quality Control (CQA/QC) Manual in conjunction with permitting the CAW Embankment to accomplish the following:

- Change the name and revise the scope of the CQA/QC Manual to include the CAW Embankment;
- Provide information on updated settlement monument locations for the CAW Embankment; and
- Provide CQA/QC observation and testing procedures related to required new clay liner construction and connections of existing clay liners to newly constructed clay liner sections.

Waste placement in the CAW Embankment will be conducted in accordance with the currently approved CQA/QC Manual (which is Revision 25d approved on April 4, 2011) or any subsequent revision (e.g., proposed Revision 26b) to the CQA/QC Manual, after approval by the Division. Updated procedures are provided to the Division regularly.

The Licensee's anticipated schedule and sequence of construction activities for the CAW Embankment will begin following technical review of the embankment design and revision to licensing and permitting documents, including the Radioactive Material License, Ground Water Quality Discharge Permit, and Environmental Monitoring Plan. Once these approvals are complete, the Licensee is authorized to begin waste placement to the elevations proposed for the CAW embankment. Waste placement will proceed generally from south to north, starting on top of existing wastes placed in the Class A embankment footprint. Disposal operations in the CAW Embankment may continue for up to 17 years.

## 3.2 BASIS FOR CAW EMBANKMENT REVIEW AND CONCLUSIONS

As described in the foregoing section, the design and operation of the currently proposed CAW Embankment is substantially similar to those already approved for use in the CAN and CA disposal embankments. Although some aspects of the proposed embankment differ from those of previously proposed embankments, many remain unchanged.

Where the Division has judged the proposed change to have no effect on the rationale for previously approved amendments, the rationale for previous approved amendments is taken to apply directly to the proposed CAW Embankment LAR. While all aspects have been reviewed, only those aspects, that affect the rationale for granting approval of the CAW Embankment LAR, are addressed in this SER.

## 3.3 DESCRIPTION OF REVIEW/COMMENT/RESPONSE PROCESS

In reviewing the CAW Embankment LAR, the following major items and/or issues were identified and evaluated:

- Characteristics and design of the proposed CAW embankment, including extension and connection of the clay liners in the CA and CAN embankments, to form a continuous clay liner encompassing the proposed footprint area, waste placement and backfill, cover system, and buffer zone.
- The projected physical performance of the proposed embankment, including effects of projected differential settlement and consolidation on cover system integrity, annual infiltration rates, and effective transit times for water and potential contaminants migrating within, under, and laterally away from the waste embankment, proposed monitoring well and vadose zone monitoring device locations, the potential for a design seismic event to induce liquefaction and/or cyclic softening of soils or otherwise potentially affect embankment stability, and ability of the proposed CAW Embankment to provide adequate long-term erosion protection.
- The projected radiological performance of the proposed embankment, including determining the extent to which the Utah groundwater protection standards are satisfied and estimating potential radiological impacts to members of the public that might be exposed to releases from the facility during operations.

Where the Division judged information submitted by the Licensee to be inadequate to make an affirmative decision, formal interrogatories were issued to solicit missing information. Once required information was provided to allow resolution of issues to the Division's satisfaction, this SER was prepared. The Division and the Licensee have resolved all regulatory issues as required by Division requirements, with two exceptions. Two new license conditions will be added to the license to require the Licensee to perform an additional investigation and an embankment design modification to resolve these two issues, as discussed in detail in this SER. The Division has received or developed information that provides reasonable assurance that all applicable performance objectives and regulatory requirements involved with the regulatory issues described in this SER will be satisfied.

# 4.0 FACILITY SAFETY AND REGULATORY COMPLIANCE

URCR Rule R313-25 contains regulatory requirements that potentially apply to EnergySolution's request to amend its license to construct and dispose of Class A LLRW in the CAW embankment. The Division has previously reviewed and approved many aspects (elements) of the LAR through previous amendment requests and renewals. For these aspects, no Division review of these elements is required. Requirements of URCR Rule R313-25 are listed in Table 4-1. Requirements that do not apply to the Division's review of the CAW Embankment LAR are identified, together with reasons why they do not apply.

The applicable requirements are identified in Table 4-1. As required, review items are documented in the CAW Embankment LAR and associated submittals and are addressed in the following sections.

## 4.1 URCR SECTION R313-25-6. GENERAL INFORMATION

### 4.1.1 Identity of Licensee

**Requirement 2506-1:** The general information shall include the identity of the applicant including:

(a) the full name, address, telephone number, and description of the business or occupation of the applicant;

(b) if the applicant is a partnership, the names and addresses of the partners and the principal location where the partnership does business;

(c) if the applicant is a corporation or an unincorporated association;

(i) the state where it is incorporated or organized and the principal location where it does business;

(ii) the names and addresses of its directors and principal officers; and

(iii) if the applicant is acting as an agent or representative of another person in filing the application, the applicant shall provide, with respect to the other person, information required under URCR Subsection R313-25-6(1) [URCR Subsection R313-25-6(1)].

**Table 4-1 – Applicability of URCR Section R313-25 Regulatory Requirements for CAW Embankment LAR.**

| URCR R313-25 Section | | CAW Embankment LAR Requires Review? | Reason If Review Not Required |
|---|---|---|---|
| **Number** | **Title** | | |
| URCR R313-25-1 | Purpose and Authority | No | Contains only general information, none of which is changed or affected by the CAW Embankment LAR |
| URCR R313-25-2 | Definitions | No | Presents definitions of terms with special meanings, none of which are changed or affected by the CAW Embankment LAR |
| URCR R313-25-3 | Pre-licensing Plan Approval Criteria for Siting of Commercial Radioactive Waste Disposal Facilities | No | Lists requirements for siting new LLRW disposal facilities which is not the case for the CAW Embankment |
| URCR R313-25-4 | License Required | No | Declares the State's requirement that a license is required to dispose of radioactive waste, a fact conceded by submission of the CAW Embankment LAR |
| URCR R313-25-5 | Content of Application | No | Identifies the content requirements of a license application in broad terms, with reference to URCR Sections R313-25-6 through R313-25-10 whose needs for review in connection with the CAW Embankment LAR are individually addressed below |
| URCR R313-25-6 | General Information | Yes | Addressed in Section 4.1 |
| URCR R313-25-7 | Specific Technical Information | Yes with Exceptions | Exceptions identified and justified in Section 4.2 |
| URCR R313-25-8 | Technical Analyses | Yes with Exceptions | Exceptions identified and justified in Section 4.3 |
| URCR R313-25-9 | Institutional Information | No | Deals with land ownership that is not changed or affected by the CAW Embankment LAR |
| URCR R313-25-10 | Financial Information | No | The Licensee's financial qualifications are not materially changed or affected by the CAW Embankment |
| URCR R313-25-11 | Requirements for Issuance of a License | Yes with Exceptions | Exceptions identified and justified in Section 4.4 |
| URCR R313-25-12 | Conditions of Licenses | No | Addresses the concept of license conditions that will have been determined as a result of the CAW Embankment LAR process |

**Table 4-1 – Applicability of URCR Section R313-25 Regulatory Requirements for CAW Embankment LAR.**

| URCR R313-25 Section | | CAW Embankment LAR Requires Review? | Reason If Review Not Required |
|---|---|---|---|
| **Number** | **Title** | | |
| URCR R313-25-13 | Application for Renewal or Closure | No | Addresses licensing actions for which the Applicant is not now applying in its submission of the CAW Embankment LAR |
| URCR R313-25-14 | Contents of Application for Site Closure and Stabilization | No | Addresses licensing actions for which the Licensee is not now applying. |
| URCR R313-25-15 | Post-Closure Observation and Maintenance | No | Addresses licensing actions for which the Applicant is not now applying. |
| URCR R313-25-16 | Transfer of License | No | Addresses licensing actions for which the Applicant is not now applying. |
| URCR R313-25-17 | Termination of License | No | Addresses licensing actions for which the Applicant is not now applying. |
| URCR R313-25-18 | General Requirement | No | Generally states only requirements that are covered in URCR Sections R313-25-19 and R313-25-22, without imposing additional requirements. |
| URCR R313-25-19 | Protection of the General Population from Releases of Radioactivity | Yes | Addressed in Section 4.5 |
| URCR R313-25-20 | Protection of Individuals from Inadvertent Intrusion | Yes | Addressed in Section 4.6 |
| URCR R313-25-21 | Protection of Individuals During Operations | Yes | Addressed in Section 4.7 |
| URCR R313-25-22 | Stability of the Disposal Site After Closure | Yes | Addressed in Section 4.8 |
| URCR R313-25-23 | Disposal Site Suitability Requirements for Land Disposal – Near-Surface Disposal | No | The Division has reviewed and approved the characteristics of the site at which the proposed CAW will be constructed and operated. |
| URCR R313-25-24 | Disposal Site Design for Near-Surface Land Disposal | Yes | Addressed in Section 4.9 |
| URCR R313-25-25 | Near Surface Land Disposal Facility Operation and Disposal Site Closure | Yes with Exceptions | Exceptions identified and justified in Section 4.10 |
| URCR R313-25-26 | Environmental Monitoring | Yes with | Exceptions identified and justified in Section 4.10 |

**Table 4-1 – Applicability of URCR Section R313-25 Regulatory Requirements for CAW Embankment LAR.**

| URCR R313-25 Section | | CAW Embankment LAR Requires Review? | Reason If Review Not Required |
|---|---|---|---|
| Number | Title | | |
| | | Exceptions | |
| URCR R313-25-27 | Alternative Requirements for Design and Operations | No | Addresses alternative requirements for design and operation that the CAW Embankment LAR does not involve |
| URCR R313-25-28 | Institutional Requirements | No | Deals with land ownership that is not changed or affected by the CAW Embankment LAR |
| URCR R313-25-29 | Section 29 does not exist in URCR R313-25 | No | Section 29 does not exist in URCR Rule R313-25 |
| URCR R313-25-30 | Applicant Qualifications and Assurances | No | The Licensee's financial qualifications and assurances are not materially changed or affected by the CAW Embankment LAR |
| URCR R313-25-31 | Funding for Disposal Site Closure and Stabilization | Yes with Exceptions | Exceptions identified and justified in Section 4.12 |
| URCR R313-25-32 | Financial Assurances for Institutional Controls | No | The Division has previously reviewed and accepted arrangements for assuring funding to cover costs during institutional control; the arrangements are not materially changed or affected by the CAW Embankment LAR; the Division reviews and approves adequate financial assurance annually. |
| URCR R313-25-33 | Maintenance of Records, Reports, and Transfers | No | Neither the need for nor the Licensee's procedures for maintaining records, reports, and transfers are changed or affected by the CAW Embankment LAR |
| URCR R313-25-34 | Tests on Land Disposal Facilities | No | Deals with the Director's activities and authorities that are not changed or affected by the CAW Embankment LAR |
| URCR R313-25-35 | Director Inspections of Land Disposal Facilities | No | Deals with the Director's activities and authorities that are not changed or affected by the CAW Embankment LAR |

**Basis:** At the time of this submittal, the information contained in Section 1.1 of the CAW Embankment LAR (Energy*Solutions* 2011a; 2011b) and other relevant documents (engineering reports, supplemental data submissions and interrogatory responses) that the Licensee has submitted indicates that the requirements of URCR Subsection R313-25-6(1) have been met. The 2011 CAW Embankment LAR identifies as the full name, address, and telephone number of the Licensee as follows:

**Table 4-2 – Identification of Licensee.**

| Identification of Licensee |
|---|
| Energy*Solutions*, LLC<br>423 W 300 S Ste 200<br>Salt Lake City UT 84101-1102<br>(801) 532-1330 |

Also included in the referenced documentation are the names and addresses of the Licensee's directors and principal officers. The LAR also specifies that the Licensee's state principal business is the operation of the radioactive waste disposal operations located at Clive, Utah. Energy*Solutions* did not act as an agent or representative of another person in submitting the LAR. Additionally, Energy*Solutions* is not a partnership. On March 2, 2006, Envirocare of Utah, LLC, a limited liability company organized under the laws of the State of Utah, changed its name to Energy*Solutions*, LLC. Directors and principal officers of Energy*Solutions*, LLC are as follows:

**Table 4-3 – Directors and Principal Officers of Energy*Solutions*, LLC.**

| | | |
|---|---|---|
| **President and Chief Executive Officer Energy*Solutions*, LLC** | Val J. Christensen<br>423 West 300 South, Suite 200<br>Salt Lake City, UT 84101 | |
| **Board Members/Managers:** | Steven R. Rogel, Chairman<br>423 W 300 South, Suite 200<br>Salt Lake City, UT 84101 | Robert Whitman, Director<br>Franklin Covey Co.<br>2200 West Parkway Blvd.<br>Salt Lake City, UT 84119 |
| | J.I. Everest II, Director<br>423 West 300 South, Suite 200<br>Salt Lake City, UT 84101 | Dr. Pascal Colombani, Director<br>Senior Advisor<br>AT Kearney Paris<br>44 rue de Lisbonne<br>75008 Paris, France |
| | David B. Winder, Director<br>490 16th Avenue<br>Salt Lake City, UT 84103 | David J. Lockwood, Director,<br>PartnerValueAct Capital<br>435 Pacific Ave., 4th Floor<br>San Francisco, CA 94133 |

| **Table 4-3 – Directors and Principal Officers of Energy*Solutions*, LLC.** | | |
|---|---|---|
| | J. Barnie Beasley, Jr., Director<br>729 Falling Springs Dr.<br>P.O. Box 558<br>Tiger, GA 30576 | Claire Spottiswoode, CBE,<br>Director, Chairman<br>Energy*Solutions* EU Ltd.<br>1st Floor, Stella Building<br>Windmill Hill Bus. Park<br>Whitehill Way<br>Swindon, SN5 6NX, UK |

***References:***

Energy*Solutions*, 2011a; 2011b

### 4.1.2 Qualifications of Licensee

**Requirement 2506-2:** The general information shall include the qualifications of the applicant including:

(a) the organizational structure of the applicant, both offsite and onsite, including a description of lines of authority and assignments of responsibilities, whether in the form of administrative directives, contract provisions, or otherwise;

(b) the technical qualifications, including training and experience of the applicant and members of the applicant's staff, to engage in the current activities. Minimum training and experience requirements for personnel filling key positions described in URCR Subsection R313-25-6(2)(a) shall be provided;

(c) a description of the applicant's personnel training program; and

(d) the plan to maintain an adequate complement of trained personnel to carry out waste receipt, handling, and disposal operations in a safe manner [URCR Subsection R313-25-6(2)].

**Basis:** The information contained in the CAW Embankment LAR (Energy*Solutions* 2011a; 2011b), along with supporting and relevant documents, (engineering reports, supplemental data submissions and interrogatory responses) the Licensee has submitted, indicate that the requirements of URCR Subsection R313-25-6(2) have been met. The qualifications of the Licensee for the CAW Embankment are similar to those previously approved in the 2005 CAN SER and reviewed in the 2005 LRA SER and in other previous LRA SERs (e.g., (URS Corporation 2005a; 2005b).

Based on the information summarized above, the Division concludes that the Licensee's qualifications are acceptable.

***References:***

Energy*Solutions*, 2011a; 2011b

URS Corporation, 2005a

URS Corporation, 2005b

### 4.1.3 Proposed Disposal Site and Activities

**Requirement 2506-3**: The general information shall include a description of:

(a) the location of the disposal site;

(b) the general character of the current activities;

(c) the types and quantities of waste to be received, possessed, and disposed of;

(d) plans for use of the land disposal facility for purposes other than disposal of wastes; and

(e) the existing facilities and equipment [URCR Subsection R313-25-6(3)].

**Basis:** The information contained in the CAW Embankment LAR (Energy*Solutions* 2011a; 2011b) and other relevant documents, (engineering reports, supplemental data submissions and interrogatory responses) the Licensee has submitted, indicate that the requirements have been met. The CAW Embankment LAR provides an adequate description of the proposed CAW Embankment. The CAW Embankment LAR and other documents describe the legal location of the operating Clive radioactive waste disposal facility as Section 32, Township 1 South, Range 11 West, Salt Lake Basin and Meridian (SLB&M), Tooele County, Utah. The Licensee also identifies other operations that are conducted by the Licensee and nearby facilities.

The proposed disposal site and activities for the CAW Embankment are conceptually the same as the previously approved CAN and CA embankments, with one exception being the larger footprint size and height of the CAW Embankment, and conceptually the same as that reviewed for the previously proposed CAC disposal embankment, with the CAW Embankment being only slightly larger in area but shorter in height than the previously proposed, but unimplemented, CAC disposal embankment. The CAW Embankment is designed as a primarily above-grade disposal embankment.

Based on the information summarized above, the Division concludes that the descriptions of the proposed CAW Embankment and proposed disposal activities are acceptable.

***References:***

Energy*Solutions*, 2011a; 2011b

### 4.1.4 Proposed Schedules

**Requirement 2506-4:** The general information shall include the expected schedules for construction, receipt of waste, and first emplacement of waste at the existing land disposal facility [URCR Subsection R313-25-6(3)].

**Basis:** The information contained in the CAW Embankment LAR, and other relevant documents (engineering reports, supplemental data submissions and interrogatory responses) the Licensee has submitted, indicate that the requirements of URCR Subsection R313-25-6(4) have been met. The information includes schedules for construction, receipt, and first emplacement of waste. The Licensee indicates that construction of new liner between the CA and CAN embankments

could begin as early as the first construction season following approval of the license amendment (Energy*Solutions* 2011a; 2011b; Section 1.3) Disposal operations in the CAW Embankment may continue for up to 17 years from the time the amendment is approved. Final cover construction shall be completed on or before the end of 18 years after the date of initial placement of the first lift (UGWDP Condition 6).

***References:***

Energy*Solutions*, 2011a; 2011b

## 4.2 URCR SECTION R313-25-7. SPECIFIC TECHNICAL INFORMATION

The CAW Embankment LAR technical review involves some aspects of URCR Section R313-25-7, whereas other aspects of URCR Section R313-25-7 are not specifically pertinent to the review. The applicability of URCR Section R313-25-7 provisions to the review of the CAW Embankment LAR are summarized in Table 4-4. Those sections that do apply to the CAW Embankment LAR are addressed in the paragraphs following the table.

**Table 4-4 – Applicability of URCR Section R313-25-7 Provisions to CAW Embankment LAR.**

| URCR R313-25-7 Section | | CAW Embankment LAR Requires Review? | Justification |
|---|---|---|---|
| Number | Topic | | |
| 7(1) | Site Characteristics | No | Division has previously reviewed and approved site characteristics |
| 7(2) | Design Features | Yes | Dimensions and cover system have changed |
| 7(3) | Principal Design Criteria | Yes | Clay layer distortion criteria have been reconsidered |
| 7(4) | Natural Events or Phenomena | Yes | Probable Maximum Precipitation Event was verified with additional procedure |
| 7(5) | Codes and Standards | No | Division has previously reviewed and approved codes and standards which the CAW Embankment LAR does not change or affect |
| 7(6) | Construction and Operation | No | Except for dimensions and cover design (addressed elsewhere in this SER), construction and operations are not changed or affected by the CAW Embankment LAR |
| 7(7) | Site Closure Plan | Yes | Timing and sequencing of final closure activities for the CAW Embankment have changed compared to those for the Class A and CAN embankments |
| 7(8) | Natural Resources | No | Division has previously reviewed and approved natural resources which the CAW Embankment LAR does not change or affect |

**Table 4-4 – Applicability of URCR Section R313-25-7 Provisions to CAW Embankment LAR.**

| URCR R313-25-7 Section | | CAW Embankment LAR Requires Review? | Justification |
|---|---|---|---|
| Number | Topic | | |
| 7(9) | Radioactive Material Description | No | Division has previously reviewed and approved the description of radioactive wastes which the CAW Embankment LAR does not change or affect |
| 7(10) | Quality Assurance Programs | Yes | Provisions for constructing the final cover system stated in the Construction Quality Assurance/Quality Control Manual have been slightly revised |
| 7(11) | Radiation Safety Program | No | Division has previously reviewed and approved the Radiation Safety Program which the CAW Embankment LAR does not change or affect |
| 7(12) | Environmental Monitoring Program | Yes | The CAW Embankment LAR requires the abandonment and relocation of some vadose zone lysimeters and groundwater monitoring wells and the addition of one air monitoring station |
| 7(13) | Administrative Procedures | No | Division has previously reviewed and approved Administrative Procedures which the CAW Embankment LAR does not change or affect |
| 7(14) | Electronic Recordkeeping System | No | Division has previously reviewed and approved the Electronic Recordkeeping System which the CAW Embankment LAR does not change or affect |

### 4.2.1 Principal Design Features: Descriptions, Design Criteria, Justification, and Applicable Codes/Standards

**Requirement 2507-2**: Design features of the near-surface disposal cell includes those features related to infiltration of water; integrity of covers; structural stability of backfill, wastes, and covers; contact of wastes with standing water; disposal site drainage; disposal site closure and stabilization; elimination, to the extent practicable, of long-term disposal site maintenance; inadvertent intrusion; occupational exposures; disposal site monitoring and adequacy of the size of the buffer zone for monitoring and potential mitigative measures [URCR Subsection R313-25-7(2)].

**Basis**: The requirements contained in URCR Subsections R313-25-7(2) and -7(3) addressing the design features of the facility and the principal design criteria, as they relate to the performance objectives established for those design features, apply in different ways and to different extents to the various principal design features incorporated into the proposed CAW embankment. For

example, one principal design feature is the perimeter drainage system that performs a required function of conducting the flow of surface water run-off away from the CAW Embankment in order to minimize contact between water and disposed LLRW. However, the drainage systems would play no direct role in protecting against inadvertent intrusion. In contrast, another design feature, the rock riprap layer in the cover system, is intended to help perform the required function of protecting against inadvertent intrusion but does not have as a primary function the minimization of contact between water and disposed LLRW. That required function would be provided primarily by other components or aspects of the cover such as cover slope inclination and the radon barrier layer. Thus, the applicability of the various regulatory requirements and design criteria pertaining to the design of principal design features depends upon each individual design feature.

The principal design features of the proposed CAW Embankment, addressed in this section of the SER, are the following:

- liner,
- waste placement and backfill,
- cover,
- drainage systems and
- buffer zone.

Each of the above principal design features is addressed in separate sections below. Each principal design feature is first described, key design criteria for that design feature are discussed and their relationship to the performance objectives for that design feature are summarized. Information regarding the design-basis conditions, assumed to apply during operation and following final closure of the CAW Embankment are discussed, and the codes and standards applied to design and construction of the CAW Embankment are summarized. For completeness, and to facilitate traceability to the applicable URCR Rule R313-25 requirements, each applicable regulatory requirement is repeated as each principal design feature is discussed in this SER. Note that regulatory requirements, that the Division judged not to be affected by the changes in the proposed CAW Embankment LAR are not addressed, as enumerated in Table 4-4 of this SER.

In this SER, information pertaining to the several design features is presented in separate SER sections. For example, the clay liner is addressed in Section 4.2.1.1 and a description of the clay liner design feature is presented in Section 4.2.1.1.1. The design criteria are described in Section 4.2.1.1.2 and the design basis and justification of the design criteria are described in Section 4.2.1.1.3.

The provisions of URCR Subsection R313-25-7(2) identify the following 11 required functions that the principal design features must perform:

- Minimize infiltration of water,
- Ensure integrity of covers for disposal units,
- Ensure structural stability of backfill, wastes, and covers,
- Minimize contact of wastes with standing water,
- Provide disposal site drainage,
- Ensure disposal site closure and stabilization,

- Eliminate to the extent practicable long-term disposal site maintenance,
- Protect against inadvertent intrusion (not applicable to disposal of Class A waste),
- Limit occupational exposures,
- Allow for and provide disposal site monitoring and
- Provide a buffer zone for monitoring and allow for implementation of potential mitigative measures, if required.

The Licensee has identified the five principal design features described in the second paragraph of this subsection. The Licensee has determined that these five principal design features perform a range of required functions as indicated in Table 4-5 below. Entries in the table indicate that at least one principal design feature performs one or more of the required functions identified during the CAW Embankment design process.

***References*:**

Energy*Solutions*, 2011a; 2011b

#### 4.2.1.1 Clay Liner

##### 4.2.1.1.1 Description of Design Feature – Clay Liner

**Requirement 2507-2:** Descriptions of the design features of the land disposal facility and of the disposal units for near-surface disposal shall include those design features related to infiltration of water; integrity of covers for disposal units; structural stability of backfill, wastes, and covers; contact of wastes with standing water; disposal site drainage; disposal site closure and stabilization; elimination to the extent practicable of long-term disposal site maintenance; inadvertent intrusion; occupational exposures; disposal site monitoring; and adequacy of the size of the buffer zone for monitoring and potential mitigative measures [URCR Subsection R313-25-7(2)].

**Basis:** The clay liner proposed for the CAW Embankment is identical to that approved for the Class A and CAN embankments. The proposed CAW Embankment liner system consists of a prepared foundation overlain by a two-foot thick layer of compacted clay having a saturated hydraulic conductivity of 1 x $10^{-6}$ cm/sec or less. The characteristics of the liner of the proposed CAW Embankment are presented in Table 3.3 of the CAW Embankment LAR (Energy*Solutions* 2011a) and summarized below:

- The permeability of the CAW embankment liner will be less than or equal to 1 X 10-4 cm/sec and greater than that of the cover system.
- Existing terrain is excavated to a depth of approximately seven to ten ft below native grade. Excavation depth is determined based on the top of liner elevation shown on design drawings. The minimum excavation depth is two ft deeper than the top of liner elevation shown on design drawings. Overburden removed in reaching foundation elevation is stockpiled for future use in liner construction, capping the embankment, or as fill material.
- The embankment foundation is prepared from in-situ soils to meet design, grade, and compaction specifications. Specifications and inspection activities for foundation

preparation are detailed in proposed Revision 26b to the CQA/QC Manual [Table 1, Work Element – Foundation Preparation (Energy*Solutions* 2011d)].

- Clay liner construction methods are approved with the satisfactory construction of a clay liner test pad, as detailed in the CQA/QC Manual (Table 1, Work Element – Clay Liner Test Pad). The equipment and procedures used for the test pad are reviewed and approved by a professional engineer qualified to certify such soil considerations. The test pad method is then reviewed and approved for construction by engineering staff of the DRC.

**Table 4-5 – Summary of Principal Design Features and Their Required Functions – CAW Embankment.**

| Required Function | Required Functions Performed By Principal Design Features | | | | |
|---|---|---|---|---|---|
| | **Clay Liner** | **Waste Emplacement and Backfill** | **Cover** | **Drainage Systems** | **Buffer Zone** |
| Minimize infiltration | | | Minimize infiltration<br>Encourage run-off<br>Prevent desiccation<br>Limit frost penetration<br>Limit biointrusion | Minimize infiltration under flood conditions | |
| Ensure cover integrity | Mitigate differential settlement to ensure no cracking occurs in radon barrier layer after embankment closure | Mitigate differential settlement | Mitigate differential settlement<br>Prevent internal erosion<br>Material stability/endure weathering, external erosion | | |
| Reduce exposures | | | Limit dose rates at the cover surface to acceptable level | | |
| Ensure structural stability | | Maintain slope stability | Ensure maximum embankment settlement amount is limited to acceptable level and ensure no slope reversal occurs<br>Maintain slope stability | | |
| Minimize contact of wastes with standing water | Minimize contact of wastes with standing water during operations<br>Minimize contact of wastes with standing water after closure | | | Facilitate flow away from embankment | |

**Table 4-5 – Summary of Principal Design Features and Their Required Functions – CAW Embankment.**

| Required Function | Required Functions Performed By Principal Design Features | | | | |
|---|---|---|---|---|---|
| | **Clay Liner** | **Waste Emplacement and Backfill** | **Cover** | **Drainage Systems** | **Buffer Zone** |
| Provide site drainage | | | | Facilitate flow away from the embankment<br>Minimize infiltration under flood conditions | |
| Ensure ditch integrity | | | | Prevent external and internal erosion | |
| Provide site monitoring &/or allow for corrective measures | | | | | Allow for and provide site monitoring<br>Allow for implementation of corrective measures, if required, in a timely fashion |

- Clay liner borrow materials are sampled and tested to verify their physical characteristics meet the requirements outlined in the CQA/QC Manual (Table 1, Work Element – Clay Liner Borrow Material). These characteristics are summarized in Table 1 of the CQA/QC Manual. Once CQA/QC testing is complete and approved, the clay liner borrow materials become clay liner materials approved for clay liner construction. Borrow materials that fail testing may be reworked or may be discarded and replaced with materials meeting the criteria.
- The clay liner materials are then placed in lifts and compacted to at least 95 percent Standard Proctor, at a moisture content between optimum and 5 percentage points above optimum. Inspection and testing performed on the placed clay liner is described in the currently approved (Revision 25d) version of the CQA/QC Manual (Table 1, Work Element – Clay Liner Placement).
- A number of CQA/QC specifications are applied to protect the placed and approved clay liner against damage. These include drying prevention, seasonal limitations on liner construction to protect against winter weather extremes, and minimization of heavy equipment travel on completed liner (Table 1, Work Element – Clay Liner Placement; Specifications: Liner Drying Prevention, Snow Removal, Cold Weather Placement of Clay Liner, Contamination of Clay Liner, and Heavy Equipment on Clay Liner).
- During operations, water will be actively removed from the open embankment by vacuuming or pumping.

In areas between the existing Class A and CAN embankments, new sections of clay liner for the CAW Embankment will be constructed according to the standards described in Section 4.2.1.1.4 of this SER. The Licensee has provided Figure E in Attachment 9 to the CAW Embankment LAR and to Energy*Solutions* (2011b, dated September 2, 2011) to show the extents of completed CA and CAN embankment liner design limits and areas where new sections of clay liner will need to be constructed and connected to the existing Class A and CAN embankment clay liners.

The proposed CAW Embankment liner system design, being identical to that previously approved for use in the CA and CAN disposal embankments, and the proposed clay liner section connection procedures, being consistent with current industry standard methods are also acceptable for use in the CAW Embankment. Based on the information summarized above, the Division concludes that the Licensee's description of the proposed CAW Embankment clay liner characteristics and description of clay liner construction process are acceptable.

***References:***

Energy*Solutions*, 2011a

Energy*Solutions*, 2011b, Drawing 10014 (Figure E) in Attachment 9 (October 4, 2011)

Energy*Solutions*, 2011d

#### 4.2.1.1.2 Principal Design Criteria – Clay Liner

**Requirement 2507-3:** Descriptions of the principal design criteria and their relationship to the performance objectives [URCR Subsection R313-25-7(3)].

**Basis**: Table 4-6 of this SER summarizes the functions required of the CAW Embankment liner. Required and complementary functions of the liner include:

- Minimize contact of wastes with standing water, both during operations and after closure.
- Ensure cover integrity by mitigating differential settlement to which secondary settlement/consolidation of the materials underlying the placed waste and backfill contribute.

Section 3 and Table 3.2 of the CAW Embankment LAR provide the design criteria pertinent to the liner (Energy*Solutions* 2011a). These design criteria are summarized in Table 4-6 below with respect to each of its defined required design functions.

**Table 4-6 – Summary of CAW Embankment Clay Liner Design Criteria.**

| Required Function/ Complimentary Aspect | Design Criteria |
|---|---|
| Minimize contact of wastes with standing water during operations. | The clay liner will be constructed with a permeability less than or equal to 1 x $10^{-4}$ cm/sec. |
| Minimize contact of wastes with standing water following closure without active maintenance being required. That is, the rate of water enters the disposal unit must be less than the rate at which water leaves. | The clay liner will be constructed with a permeability that is greater than or equal to that of the cover. |
| Ensure integrity of cover by mitigating differential settlement | Foundation and clay liner settlement will be limited (through design and construction) in concert with settlement within waste placement and backfill such that distortion in the cover does not exceed a maximum allowable distortion value specified by design, as justified through design analyses. Settlement monitoring data from a placed interim final cover soil layer overlying the embankment will be verified prior to final cover placement to demonstrate compliance with the specified maximum distortion criterion. |

The design criteria selected for the CAW embankment liner and the description of the required functions of the liner are consistent with the guidance provided in NUREG-1199 (NRC 1191). The requirement that the liner permeability equal or exceed that of the cover will help ensure against "bathtubbing" of liquids on the liner (i.e., within the CAW embankment) after embankment closure without required active maintenance, consistent with NRC requirements (NRC 1982). The technical basis for selecting a maximum allowable distortion criterion for the cover is further discussed in Section 4.2.1.2.2 and in Section 4.2.1.3.3 below under the heading "Mitigate Differential Settlement". Based on the information summarized above and on the discussion of the design basis conditions assumed for use in performance analyses as presented in the sections that follow below, the Division concludes that the Licensee's proposed design criteria for the CAW Embankment liner are acceptable.

***References:***

Energy*Solutions*, 2011a

NRC 1982

NRC 1991

#### 4.2.1.1.3 Design Basis Conditions and Design Criteria Justification – Clay Liner

**Requirement 2507-4:** Descriptions of the natural events or phenomena on which the design is based and their relationship to the principal design criteria [URCR Subsection R313-25-7(4)].

**Basis**: Section 3 and Table 3.2 of the CAW Embankment LAR (Energy*Solutions*, 2011a; 2011b) for the proposed CAW Embankment present information on normal and abnormal conditions, and accident conditions (where applicable) under which the proposed CAW Embankment LAR would be assumed to operate or that are assumed to apply following final closure of the embankment. Table 3.2 of the CAW Embankment LAR: (1) summarizes the conditions considered in the design of the CAW Embankment; (2) provides information justifying the selection of these design criteria; and (3) summarizes the relationship of the design-basis conditions to the principal design features of the CAW Embankment LAR and the design criteria for each of the identified design features.

Normal, abnormal, and accident (where applicable) design basis conditions used to evaluate the performance of the liner with respect to the specified required function(s)of the liner (see Table 3.2 of the CAW Embankment LAR) are summarized in Table 4-7.

Table 4-8 provides a summary of the design criteria for the embankment liner and provides information on procedures to be used and/or other justification for ensuring that the specified liner design criteria will be achieved.

The proposed liner design basis conditions and information provided to justify the liner design criteria are consistent with the guidelines and criteria contained in NUREG-1199 (NRC 1991), NUREG-1200 (NRC 1994), and 10 CFR Part 61 (NRC 1982). Based on the information summarized above, the Division concludes that the information provided by the Licensee regarding design basis conditions (i.e., natural events and phenomena), and their relationship to the principal design criteria and principal design features of the proposed CAW Embankment is acceptable.

***References:***

Energy*Solutions*, 2011a; 2011b; 2011d

NRC, 1982; 1991; 1994

#### 4.2.1.2 Class A Waste Emplacement and Backfill

##### 4.2.1.2.1 Description of Design Feature – Waste Emplacement

**Waste Placement and Backfill**

**Requirement 2507-2:** Descriptions of the design features of the land disposal facility and of the disposal units for near-surface disposal shall include those design features related to infiltration of water; integrity of covers for disposal units; structural stability of backfill, wastes, and covers; contact of wastes with standing water; disposal site drainage; disposal site closure and stabilization; elimination to the extent practicable of long-term disposal site maintenance; inadvertent intrusion; occupational exposures; disposal site monitoring; and adequacy of the size of the buffer zone for monitoring and potential mitigative measures [URCR R313-25-7(2)].

**Basis:** The Licensee has provided information regarding proposed waste placement descriptions, procedures, and specifications for placing and compacting wastes and backfill into the CAW Embankment. Waste placement will be done in accordance with the most current approved CQA/QC Manual or any subsequent revision to the CQA/QC Manual approved by the Division. The only changes to waste and backfill placement activities, associated with the CAW Embankment, compared to those conducted at the existing CA and CAN embankments, would be the greater quantities of wastes and backfill placed, an increase in the overall height, and an increase in size of the footprint of the CAW Embankment compared to the combined Basis: The Licensee has provided information regarding proposed waste placement descriptions, procedures, and specifications for placing and compacting wastes and backfill into the CAW Embankment. Waste placement will be done in accordance with the most current approved CQA/QC Manual or any subsequent revision to the CQA/QC Manual approved by the Division. The only changes to waste and backfill placement activities, associated with the CAW Embankment, compared to those conducted at the existing CA and CAN embankments, would be the greater quantities of wastes and backfill placed, an increase in the overall height, and an increase in size of the footprint of the CAW Embankment compared to the combined footprint of the CA and CAN embankments. Summary reports, submitted by the Licensee, describing waste and backfill emplacement configurations include "Containerized Waste Facility Engineering Justification Report," Revision 1, April 12, 2001; "Engineering Justification Report, Addendum 'Fifteen Percent Void Space Criteria,'" Revision 1, October 10, 2001; "Engineering Justification Report – Waste Placement with CLSM," Revision 0, May 16, 2001; "Geotechnical Study: Increase in Height and Footprint," AMEC Earth and Environmental (AMEC), May 27, 2005, submitted by the Licensee for the previously proposed CAC Embankment, and Attachment 5 to the CAW Embankment LAR (Energy*Solutions* 2011a;b). There would be no changes to waste or backfill placement procedures, equipment used, or forms used in documenting waste placement as a result of permitting the CAW embankment. No revisions to the currently approved "Waste Placement" Work Element of the Construction Quality Assurance Quality Control (CQA/QC) Manual (Revision 25d) are needed in conjunction with permitting the CAW Embankment other than revising the scope definition to address the CAW Embankment rather than the CA and CAN embankments.

**Table 4-7 – Summary of Design Basis Conditions Used in Analyses to Evaluate Liner Performance.**

| Required Function/ Complimentary Aspect | Design Basis Conditions |
|---|---|
| Minimize contact of wastes with standing water during operations. | • *Normal:* 25-year, 24-hour storm event is assumed to occur.<br>• *Abnormal:* 100-year, 24-hour storm event is assumed to occur.<br>• Accident: Heavy equipment damage occurs to the liner. |
| Minimize contact of wastes with standing water following closure without active maintenance being required. That is, the rate of water enters the disposal unit must be less than the rate at which water leaves. | • *Normal:* Liner and cover both retain their respective design permeabilities over time.<br>• *Abnormal:* Degraded cover conditions are assumed.<br>• *Accident:* Not required by guidance provided in NUREG-1199 (NRC 1991). |
| Ensure integrity of cover by mitigating differential settlement | • *Normal:* All settlement is assumed to be completed during the operational period of the CAW Embankment LAR.<br>• *Abnormal:* One area of the embankment is assumed to be constructed to the proposed height of the cover while an adjacent area of the embankment would be constructed to a height of less than 25 ft.<br>• *Accident:* Not required by guidance provided in NUREG-1199 (NRC 1991). |

**Table 4-8 – Comparison of Required and Achieved Conditions for CAW Disposal Embankment Liner.**

| Liner Characteristic | Design Criteria | Design Criteria Justification |
|---|---|---|
| Liner permeability | Must be ≤ 1 X $10^{-4}$ cm/sec | Proposed Revision 26b to the CQA/QC Manual (Energy*Solutions* 2011d) requires no greater than 1 X $10^{-6}$ cm/sec. Operational experience at the facility shows that a permeability of 1 X $10^{-4}$ cm/sec or less is sufficient to encourage water accumulation to occur. Any water ponds or pools on top of the working surface will immediately be removed by active means such as pumping. |
| Liner permeability | Must be greater than cover permeability | Current design requires liner permeability to be 1 X $10^{-6}$ cm/sec or less and be greater than lowest cover component (radon barrier) permeability (1 X $10^{-8}$ cm/sec) to ensure that the rate of water entering the disposal unit is less than the rate at which it leaves via infiltration into underlying materials to prevent water from accumulating on top of the liner. |
| Results in distortion in radon barrier clay layer that does not exceed specified criterion | Distortion of cover must be ≤ specified maximum allowable distortion value | Maximum distortion of Cover due to embankment settlement under abnormal conditions will be projected to be less than or equal to the Specified Maximum Allowable Distortion Criterion. |

The effects of settlement on principal design features such as the cover due to the increased height of the proposed CAW Embankment are discussed in a report by AMEC (AMEC 2011a) constituting Attachment 5 to the CAW Embankment LAR (Energy*Solutions*, 2011a) and analyzed in the "Geotechnical Study: Increase in Height and Footprint," AMEC, May 27, 2005 (AMEC 2005a). Information provided in Attachment 5 to the CAW Embankment LAR (Energy*Solutions*, 2011a;b) demonstrates that the proposed CAW Embankment will perform as well or better than the previously proposed CAC embankment with respect to the projected magnitude of distortion that might occur in the cover due to differential settlement within the completed embankment, i.e., that the CAW Embankment would be expected to achieve and comply with the specified maximum allowable distortion value criterion identified as a key criterion for ensuring long-term stability of the CAW Embankment cover. The technical basis for selecting a maximum allowable distortion criterion for the cover is further discussed in Sections 4.2.1.2.2 and 4.2.1.3.3 below under the subheading "Mitigate Differential Settlement" under "Ensure Cover Integrity".

Based on the information summarized above, the Division concludes that the Licensee's descriptions of the proposed Waste and Backfill Placement Principal Design Feature and procedures for Waste and Backfill placement in the CAW Embankment are acceptable.

***Debris and Large Component Placement:***

**Basis**: The disposal of debris and containerized waste in the large component area would continue unchanged with approval of the CAW Embankment LAR. Disposal of such waste

involves construction of debris and containerized waste/Controlled Low Strength Material (CLSM) pyramids to minimize differential settlement within the embankment. Following acceptance and unloading, debris and/or large components are placed so as to minimize the volume of void spaces between containers/components. Debris and large components are placed to minimize entrapped air in each debris lift. Associated incidental debris is placed in such a manner to minimize entrapped air pockets that cannot be displaced by CLSM. Once debris or large components are placed in the debris lift, the lift is backfilled by pouring CLSM over the waste so that it flows to fill void spaces within the emplacement. CLSM is a low-strength, flowable concrete. Standard concrete mixing and delivery equipment is used to pour CLSM in each debris pour. The flowability of the CLSM is controlled to ensure adequate filling of the voids within the oversized debris pour.

The disposal of debris and containerized waste proposed for the proposed CAW Embankment is identical to that approved for the CAN embankment and the 2005 LRA (URS Corporation 2005a; 2005b). The conditions upon which the disposal is based are similar, except the overall height and surface area of the CAW Embankment are increased, thus increasing the volume of material potentially disposed of in the embankment. Analyses (Attachment 5 of Energy*Solutions* 2011a; 2011b) demonstrate that the disposal of debris and containerized waste in the CAW embankment will perform at least as well as corresponding items approved for the CA and CAN embankments (URS Corporation 2005a; 2005b) and reviewed for the previously proposed CAC embankment (AMEC 2005a; 2005b).

Specifications for CLSM placement are found in Energy*Solutions*' CQA/QC Manual (Energy*Solutions,* 2011d), Table 1, "Work Element – Waste Placement Specification: CLSM Pours."

Based on the information summarized above, the Division concludes that the Licensee's descriptions of the manner of placing debris and large components into the proposed CAW Embankment and CLSM use for backfill are acceptable.

***Bulk Waste Placement:***

**Basis**: The Licensee is proposing that the types and manner of bulk waste placement within the CAW Embankment be the same as those previously approved and used in the CA and CAN disposal embankments (URS Corporation 2005a; 2005b) and the 2005 LRA. Following acceptance and unloading, bulk waste will be emptied and spread into bulk waste lifts that are 12 inches thick or less within the CAW Embankment footprint. After spreading, bulk waste will be compacted to at least 90% of Standard Proctor. The moisture content of each bulk waste lift will be controlled to between 2% (absolute) and 3 % over optimum. After the bulk waste lift is compacted, the density and moisture content of the bulk waste will be tested in accordance with Table 1, "Work Element – Waste Placement" of proposed Revision 26b of the CQA/QC Manual. QC inspectors will document the testing and approval of each bulk waste lift (Energy*Solutions* 2011d). These primary controls used during waste placement create a stable engineered fill that will provide a suitable foundation for the final cover.

The conditions upon which the bulk waste placement are based are similar to those approved for the CA and CAN disposal embankments, except for overall volume of waste to be disposed. Analyses (Attachment 5 of Energy*Solutions,* 2011a and 2011b) demonstrate that the performance

of the CAW Embankment with regard to the placed bulk wastes and cover stability will equal or better the corresponding performance approved for the CA and CAN embankments (URS Corporation 2005a; 2005b) and reviewed for the previously proposed CAC embankment (AMEC 2005a; 2005b.

Based on the information summarized above, the Division concludes that the Licensee's description of the types and manner of placement of bulk waste into the proposed CAW embankment are acceptable.

***References:***

AMEC, 2005a; 2005b

Energy*Solutions*, 2011a; 2011b; 2011d

URS Corporation, 2005a; 2005b

#### 4.2.1.2.2 Principal Design Criteria – Waste Emplacement

**Requirement 2507-3:** Descriptions of the principal design criteria and their relationship to the performance objectives [URCR R313-25-7(3)].

**Basis**: The principal design criteria pertinent to waste placement and backfill in the proposed CAW Embankment are listed in Table 3.2 of the LAR. Justification for these criteria are summarized in Table 3.2 and further detailed in Attachment 5 to the CAW Embankment LAR (Energy*Solutions* 2011a; b). Additional supporting information is provided in Sections 4.3 and 4.4 of the AMEC 2011 "Geotechnical Update Report", included as Attachment 5 to the CAW Embankment LAR (Energy*Solutions* 2011a; b), AMEC 2000, and Energy*Solutions* 2012c. A key design criterion is the limitation of allowable distortion of the upper radon barrier to less than or equal to the specified maximum allowable distortion criterion due to any settlement occurring within the CAW embankment. That is, settlement occurring within the CAW embankment due to settlement of waste and backfill must not result in a magnitude of differential settlement that would contribute to a distortion exceeding the specified maximum allowable distortion criterion. This design criterion is further discussed in Section 4.2.1.3.3 below.

With the possible exception of the Maximum Allowable Distortion Criterion, the principal design criteria proposed for the CAW Embankment with respect to waste emplacement are identical to those approved for the CA and CAN embankments (URS 2005a; b) and reviewed for the previously proposed CAC embankment (AMEC 2005a; b). Analyses performed for the proposed CAC embankment (AMEC 2005a; b), as discussed in Attachment 5 to the CAW Embankment LAR (Energy*Solutions* 2011a; 2011b), demonstrate that the CAW embankment is expected to perform at least as well, with respect to complying with a previously-proposed maximum allowable distortion criterion of 0.02 ft/ft for the cover, which is a criterion that was proposed by the Licensee for the CAN embankment and that was included in the 2005 LRA (URS Corporation 2005a, Section 4.2; URS Corporation 2005b). Other corresponding design elements reviewed for the previously proposed CAC disposal embankment are summarized in Attachment 5 to the CAW Embankment LAR (Energy*Solutions* 2011a; 2011b). As discussed in additional detail in Section 4.2.1.2.3 below under the subheading "Mitigate Differential Settlement" under "Ensure Cover Integrity", prior to placing final cover over the CAW

embankment, the Licensee will: (1) Conduct and submit to the Division the results of laboratory testing of an on-site compacted clayey soil layer comprised of soils proposed for use in construction of the CAW embankment cover to assess the tensile strain and distortion-induced crack resistance properties of the compacted layer. (2) Continue to perform settlement monitoring of the interim soil cover layer placed over filled portions of the CA and CAN embankments. (3) Determine magnitudes of differential settlement currently occurring in the interim soil cover layer and calculate distortion values occurring within these embankment areas. A new license condition will be added to the facility's license to address this additional required testing and distortion analysis. The purpose of the additional testing of site-specific soils is to verify whether the 0.02 maximum allowable distortion value remains an appropriate value of maximum allowable distortion criterion for the cover for use in the design of the CAW embankment. The calculated distortion values will be compared against the highest distortion value estimated, based on the settlement monitoring data acquired to date in the CA and CAN embankments, which is approximately 0.007 ft/ft. This value is well below the previously derived maximum allowable design criterion value of 0.02 ft/ft. As discussed in Section 4.2.1.3.3 below, if required based on the laboratory testing results, a revised maximum allowable distortion criterion for the cover will be identified and invoked as a final design criterion for the cover imposed prior to final cover construction. Based on the information summarized above, the Division concludes that the Licensee's proposed principal design criteria for waste placement and backfill for the CAW Embankment are acceptable.

***References:***

AMEC Earth & Environmental, Inc., 2005a; 2005b

Energy*Solutions*, 2011a; 2011b

URS Corporation, 2005a; 2005b

#### 4.2.1.2.3 Design Basis Conditions and Design Criteria Justification – Waste Emplacement

**Requirement 2507-4:** Descriptions of the natural events or phenomena on which the design is based and their relationship to the principal design criteria [URCR R313-25-7(4)].

**Basis**: Attachment 5 to the CAW Embankment LAR and Table 3.3 of the CAW Embankment LAR describe and summarize the design basis conditions considered in the design of the CAW Embankment waste placement and backfill principal design feature. Also included in LAR are normal and abnormal conditions considered in evaluations of the performance of the CAW Embankment with respect to the identified principal design criteria. Table 3.4 of the CAW Embankment summarizes the results of evaluations conducted to assess the projected performance of the CAW Embankment with respect to waste placement and backfill (LAR Energy*Solutions*, 2011a; b).

As described in Section 4.2.1.3.3 below, updated deterministic and probabilistic seismic hazard analyses were completed. Based on the results of the updated analyses, the design PGA of 0.28g recommended by AMEC in its February 15, 2011, "Geotechnical Update Report" and used for the CAW embankment stability calculations was found to be acceptable.

The design basis conditions and design criteria justification proposed for the CAW embankment, with the possible exception for the case of the cover distortion criterion, pending results of additional soils testing, as described above, are identical to those approved for the CA and CAN embankments (URS Corporation 2005a; b) and those proposed for the previously contemplated CAC disposal embankment (AMEC 2005a; 2005b)). Information furnished in Attachment 5 to the CAW Embankment LAR demonstrates that the CAW embankment would perform at least as well as corresponding items that were previously approved for the CA and CAN embankments (URS Corporation 2005a; b) and reviewed for the previously proposed CAC disposal embankment (AMEC 2005a; 2005b).

Projected performance of the containerized waste placement and backfill is discussed in Attachment 5 to the CAW Embankment LAR (Energy*Solutions*, 2011a,b). The Licensee utilized applicable guidance issued by the NRC, including guidance described in NRC NUREG-1199 (NRC 1991) and NUREG-1200 (NRC 1994), pertaining to normal, abnormal, and accident (where applicable) conditions that should be considered during design of NRC-licensed LLRW disposal facilities.

Based on the information summarized above, the Division concludes that the Licensee's proposed design basis conditions and justification for the design criteria for waste placement and backfill for the CAW Embankment are acceptable.

***References*:**

AMEC, 2005a; 2005b

Energy*Solutions*, 2006; 2011a; 2011b

US Nuclear Regulatory Commission, 1991

US Nuclear Regulatory Commission, 1994

#### 4.2.1.3 Cover Design

##### 4.2.1.3.1 Description of Design Feature – Embankment Cover

**Requirement 2507-2**: Descriptions of the design features of the land disposal facility and of the disposal units for near-surface disposal shall include those design features related to infiltration of water; integrity of covers for disposal units; structural stability of backfill, wastes, and covers; contact of wastes with standing water; disposal site drainage; disposal site closure and stabilization; elimination to the extent practicable of long-term disposal site maintenance; inadvertent intrusion; occupational exposures; disposal site monitoring; and adequacy of the size of the buffer zone for monitoring and potential mitigative measures [URCR R313-25-7(2)].

**Basis**: The currently proposed cover of the proposed CAW embankment is described in Sections 3.1.1 and 3.1.2 of the CAW Embankment LAR (Energy*Solutions*, 2011a; b). Design criteria for the cover are summarized in Table 3.2 and characteristics of the cover system components are described in Table 3.3 of the CAW Embankment LAR. The proposed Cover is depicted on Drawings 10014 C01 and 10014 C02 and on Drawings 10014 C03, Rev. 2 and 10014 C04, Rev. 2, included in Energy*Solutions* (2001e). As shown in Details 1 through 4 on Drawing 10014 C04, the proposed CAW embankment cover is a multi-layer system consisting from bottom to

top of a two-component compacted clay radon barrier, a lower granular filter zone ("Type B" Filter Zone), a sacrificial soil layer, an upper granular filter zone ("Type A" Filter Zone), and an erosion (rock riprap) barrier layer. Table 3.3 of the CAW Embankment LAR and Drawing 10014 C04, Rev. 2, provide material specifications for each layer of the cover (Energy*Solutions*, 2011e). The top of the cover would be sloped at 4%, with the center crest line oriented north-south. The maximum lengths of the top slope, and side slope areas, in horizontal projection, would be approximately 942 ft, and 188 ft, respectively. Sides of the cover would be sloped at 20% (5H:1V).

The radon barrier layer would be comprised of a 1-foot-thick layer of compacted clay having an as-built saturated permeability of 1 x $10^{-6}$ cm/sec and an overlying 1-foot-thick layer of compacted clay having an as-built permeability of 5 x $10^{-8}$ cm/sec or less. The radon barrier would be constructed using soil borrow materials having 85% fines less than 0.075 mm in diameter; plasticity index ranging from 10 to 25; and liquid limit values ranging from 30% to 50%. The radon barrier would be placed and constructed in lifts and compacted to meet the specified design criteria of 95% Standard Proctor at a moisture content between optimum and + 5% (Table 3.3 of CAW Embankment LAR).

A 6-inch-thick lower ("Type B") filter zone, with an overlying 12-inch-thick sacrificial soil layer, would be placed directly over the radon barrier on both the top slope and side slope areas of the cover. The sacrificial soil layer would serve as a freeze/thaw barrier layer above the lower filter zone. Specifications for gradation requirements for the Type B filter zone layer and sacrificial soil layer are as follows (Drawing 10014 C04, Rev. 2, of Energy*Solutions*, 2011e): (1) Ratio of $D_{15}$ of filter to $D_{85}$ of soil must be less than 5; (2) Ratio of $D_{50}$ of filter to $D_{50}$ of soil must be less than or equal to 25; and (3) Ratio of $D_{15}$ of filter to $D_{15}$ of soil must be greater than or equal to 4. In addition, the Type B filter zone layer must exhibit a saturated hydraulic conductivity (permeability) of 3.5 cm/sec or greater, and the sacrificial soil layer must have a minimum initial moisture content at 15 bar (atmospheres) of 3.5% (Drawing 10014 C04, Rev. 2, of Energy*Solutions*, 2011e).

The upper, 6-inch-thick ("Type A") filter zone, overlying the sacrificial soil layer and below the surficial erosion barrier layer, would comprise the final (uppermost) layers of the embankment cover. The "Type A" filter zone layer would consist of a graded mixture of rocks of less than 6 inches in diameter and finer-grained particles and soil. Specifications for thickness, gradation, and rock durability include a minimum 6 inches thick, a $D_{100}$ of 6 inches or less and a rock score of at least 50 are found in Table 3.3 of the CAW Embankment LAR. This layer would serve a similar purpose to the lower ("Type B") filter zone, serving as a protective layer for the sacrificial soil and providing a transitional gradation between the sacrificial soil layer and the overlying rip-rap erosion barrier. The Type A filter layer is also designed to promote the long-term erosional stability of the rock riprap layers on the top slope and side slopes.

The primary erosion barrier component of the cover consists of a minimum 24-inch thick layer of rock riprap consisting of large, durable rock (having a rock score of at least 50) and meeting the specifications provided in Table 3.3 of the CAW Embankment LAR. The top cover portion of the riprap layer would consist of rock riprap designated by Energy*Solutions* as "Type B Riprap" and having the following gradation (Table 3.3 of the CAW Embankment LAR): $D_{100}$ of 4 1/2 inches or less, $D_{50}$ of 1 1/4 inches or more, $D_{10}$ of 3/4 inch or more, and $D_5$ of No. 200

sieve [~0.075 mm] or more. The side cover portion of the riprap layer would consist of rock riprap designated by Energy*Solutions* as "Type A Riprap" and having the following gradation: $D_{100}$ of 16 inches or less, $D_{90}$ of 12 inches or less, $D_{50}$ of 4 ½ inches or more, $D_{10}$ of 2 inches or more, and $D_5$ of No. 200 sieve [~0.075 mm] or more. The rock sizes of the erosion barrier riprap for the top slopes of the embankment ("Type B Riprap") would be smaller than that for the side slopes ("Type A Riprap") due to the flatter inclination of the top slope compared to the side slope areas.

The descriptions of the cover and its components are consistent, in general, with the guidance provided in NUREG-1623 (NRC 2002) and NUREG-4620 (Nelson, et al., 1986). The characteristics of the cover components match those used in the analyses completed to evaluate performance of the CAW Embankment in Section 4.3.2 below. Results of the technical analyses, in Section4.3.2 below, demonstrate that the long-term stability of the CAW Embankment cover is acceptable.

Based on the information summarized above, the Division concludes that the Licensee's design of the proposed CAW embankment Cover system is acceptable.

***References:***

Energy*Solutions*, 2011a; 2011b; 2011e

NRC, 2002

Nelson, et al., 1986

#### 4.2.1.3.2 Principal Design Criteria – Embankment Cover

**Requirement 2507-3:** Descriptions of the principal design criteria and their relationship to the performance objectives [URCR R313-25-7(3)].

**Basis**: Sections 3.1 and 3.2 of the CAW Embankment LAR provide information regarding the design criteria pertinent to the cover of the proposed CAW Embankment.. Sections 3.1 and 3.2 and Table 3.2 of the CAW Embankment LAR summarize the principal design criteria for the cover. The design criteria used by the Licensee for each required function of the cover are summarized in Table 4-9.

Energy*Solutions* furnished additional information in 2011 and 2012 in responses (Energy*Solutions* 2012a; 2012b) to Round 2 and Round 3 interrogatories that were submitted by the Division. In a subsequent letter Energy*Solutions* responded to Division requests that in light of recently published information, additional data be provided to justify the previously proposed maximum allowable distortion value of 0.02 ft/ft. The distortion value is the amount of clay distortion that is allowed, for minimizing potential occurrence of cracks in the radon barrier layer as a result of differential settlement. Additional discussion of the design distortion criterion for the cover is provided in Section 4.2.1.3.3 of this SER.

**Table 4-9 – Summary of Cover Design Criteria.**

| Required Function/Complementary Aspect | Design Criteria |
|---|---|
| Provide means of restricting inadvertent intrusion into the embankment | No specific design criteria are specified; however, the presence of a 7.0-foot thick cover with an uppermost riprap layer, the site's remoteness from population centers and other barriers such as perimeter fencing will serve to restrict inadvertent intrusion into the emplaced, covered wastes. |
| **Minimize Infiltration** | |
| Minimize infiltration | Average infiltration rate through cover < 0.036 inches/year (0.09 cm/year) topslope area; and 0.066 inches/year (0.168 cm/year) sideslope areas (Whetstone Associates 2011b) |
| Encourage run-off | Surface slope must be adequate to maintain positive drainage;<br>Maximum calculated design velocity within the drainage layer must be greater than the predicted maximum drainage velocity for extreme storm events; and<br>No accumulation of water on the surface of the embankment |
| Protect the radon barrier from desiccation | No desiccation cracking allowed in radon barrier clay layer |
| Protect the radon barrier from frost damage | Thickness of rock erosion barrier plus sacrificial soil plus filter zone layers ≥ maximum projected depth of frost penetration (3 ft) |
| Limit biointrusion-related damage to radon barrier | Cover shall discourage biointrusion and shall not cause infiltration through cover to increase above base case infiltration levels (given in second column, second row of this table) |
| **Reduce Exposures** | |
| Limit occupational exposures (by limiting exposures at the cover surface) | Dose rate at cover surface shall be less than 100 mrem total effective dose equivalent (TEDE) per year |
| **Ensure cover integrity** | |
| Mitigate differential settlement | The Division- approved final maximum allowable angular distortion criteria for the Cover will not be exceeded. |
| Prevent internal erosion | Run-off water velocity shall be < 3 ft/sec on surface of radon barrier and to minimize piping, particle size specification for Type B Filter Zone material shall conform to the following:<br>$D_{15}$ (filter)/$D_{85}$ (soil) shall not exceed 5;<br>$D_{50}$ (filter)/$D_{50}$ (soil) must be ≤ 25; and<br>Upward migration of fines will be prevented :<br>$D_{15}$(filter)/$D_{85}$(soil) must be ≥ 4 |
| Exhibit material stability and resist external erosion | Rock erosion barrier shall exhibit internal stability and endure weathering/external erosion for at least 1,000 years |
| **Ensure Structural Stability** | |
| Withstand settlement without damage | Total settlement shall be less than 15 percent of embankment height in order to not compromise drainage capability of the Cover (i.e., cause slope reversal with consequent ponding of water) |
| Maintain slope stability | Embankment shall meet minimum global factor of safety against sliding instability of 1.5 under static conditions and 1.2 under dynamic (earthquake) |

The design criteria selected for the currently proposed CAW Embankment cover and the description of the required functions of the cover are consistent with the requirements and guidance provided in 10 CFR Part 61 (NRC 1982), NUREG-1999 (NRC 1991), NUREG-CR/4620 (Nelson, et al. 1986), and NUREG-1623 (NRC 2002) and with published information pertaining to tensile strains capable of being sustainable in compacted clay layers without cracks occurring.

Based on the information summarized above, and based on the discussion of the design basis conditions, the Division concludes that the Licensee's proposed design criteria for the CAW embankment Cover are acceptable.

***References:***

Energy*Solutions*, 2011a; 2011b; 2012a; 2012b; 2012c

Nelson, et al., 1986

NRC, 1991

NRC, 2002

Whetstone Associates Inc., 2011b

#### 4.2.1.3.3 Design Basis Conditions and Design Criteria Justification – Embankment Cover

**Requirement 2507-4:** Descriptions of the natural events or phenomena on which the design is based and their relationship to the principal design criteria [URCR R313-25-7(4)].

**Basis:** Section 3.2 of the CAW Embankment LAR provides information regarding the design basis conditions, including natural events or phenomena on which the design of the CAW embankment Cover is based. Section 3.2 and Table 3.2 of the CAW Embankment LAR summarize the relationship of the design basis conditions to each of the Principal Design Features and their required functions and the specific design criteria applicable to each cover design feature. Table 3.2 of the CAW Embankment LAR also summarizes the justification for each of the cover design criteria.

The design basis conditions used by the Licensee for design of the CAW embankment cover, corresponding to the specified required function(s) of the cover, by category of function, are summarized in Table 4-10.

**Provide Inadvertent Intruder Barrier**

Utah and NRC regulations require an intruder barrier for the disposal of only Class C LLRW. Since only Class A waste will be disposed of in the proposed Disposal Embankment, no intruder barrier, as specifically defined by Utah regulations, is required. In a more general sense, however, intruder protection is required by the performance objective stated in URCR R313-25-20. These more general requirements are satisfied by the remoteness of the facility from large population centers, the cover system provided to separate the waste from the atmosphere, the presence of an uppermost rock riprap layer on the top slope and side slopes of the CAW Embankment cover, physical access barriers erected and maintained at the closed facility, access

controls maintained at the closed facility, and monuments placed denoting the locations of embankment boundaries.

**Table 4-10 – Summary of Design Basis Conditions Assumed for Design of Cover.**

| Required Function/Complementary Aspect | Design Basis Conditions |
|---|---|
| Provide means of restricting inadvertent intrusion into the embankment | All conditions described below in this table |
| Minimize infiltration | • *Normal:* Average annual precipitation<br>• *Abnormal*: All abnormal conditions related to the Complementary Aspects of "Encourage Run-off", "Desiccation", "Frost Penetration", and "Biointrusion"<br>• *Accident*: Not required under NUREG-1199 |
| Encourage run-off | • *Normal:* 100 year, 24 hour storm event assumed to occur<br>• *Abnormal:* PMP<br>• *Accident:* Downstream blockage assumed to occur in ditch |
| Prevent desiccation | • *Normal*: Historic weather patterns<br>• *Abnormal*: Drought conditions assumed to occur<br>• *Accident*: Not applicable |
| Limit frost penetration | • *Normal:* Historic weather patterns<br>• *Abnormal*: Monthly average minimum temperatures below those predicted by the 500 year return frequency<br>• *Accident*: Not required per NUREG-1199 |
| Limit biointrusion | • *Normal*: Shallow- rooted Desert plant growth<br>• *Abnormal*: Deep- rooted Desert plant growth<br>• *Accident*: Not required per NUREG-1199 |
| Limit occupational exposures (by limiting dose rates at the cover surface) | • *Normal*: Low to moderate gamma emitters<br>• *Abnormal*: High gamma emitters at top of waste<br>• *Accident*: Not applicable |
| **Ensure cover integrity** | |
| Mitigate differential settlement | • *Normal:* All primary and portion of secondary settlement in soil layers complete, no container deterioration will occur up to 100 years<br>• *Abnormal:* Container deterioration after 100 years, allowing creep of compressible waste and additional secondary settlement of soils, earthquake<br>• *Accident:* Not required per NUREG-1199 |

**Table 4-10 – Summary of Design Basis Conditions Assumed for Design of Cover.**

| Required Function/Complementary Aspect | Design Basis Conditions |
|---|---|
| Prevent internal erosion | • *Normal, Abnormal and Accident:* Filter criteria equations used are primarily used for assessing performance of filter layers within dams under fully saturated conditions. Conditions at the Energy*Solutions* Clive Facility are expected to be much less severe in terms of saturation levels The filter gradation ratios used have also been used by the Department of Energy (DOE) to assess filter layer performance under assumed abnormal saturated conditions within UMTRA Project disposal embankments |
| Material stability/Endure weathering, external erosion | • *Normal:* Historic weather patterns will occur<br>• *Abnormal:* PMP condition<br>• *Accident:* Not required per NUREG-1199 |
| **Ensure Structural Stability** | |
| Settlement | • *Normal:* Evenly distributed weight loading<br>• *Abnormal:* Creep of compressible waste and additional secondary settlement of soils after 100-year institutional control period<br>• *Accident:* Not required per NUREG-1199 |
| Maintain slope stability | • *Normal:* Static conditions to occur<br>• *Abnormal:* Earthquake conditions to occur<br>• *Accident:* Not required per NUREG-1199 |

Based on the information summarized above, the Division concludes that the Licensee's proposed means of restricting inadvertent intrusion into the CAW embankment is acceptable.

## Minimize Infiltration

The required function of minimizing infiltration is evaluated via five complementary aspects: minimize infiltration, encourage run-off, provide protection against desiccation damage, provide protection against frost penetration damage, and provide protection against biointrusion-related damage.

The design basis conditions assumed for use in analyses and the justification for the design criteria proposed for the CAW embankment cover for minimizing infiltration through the cover are similar to those approved for the CA and CAN embankments (URS Corporation 2005a; 2005b). The conditions upon which the infiltration evaluation is based are similar to those used for evaluating performance of the CA and CAN embankments but also include updated climatological information. Analyses performed for the CAW Embankment LAR (Energy*Solutions* 2011a and 2011b; including Whetstone Associates 2011a and 2011b) demonstrate that the infiltration minimization capability of the CAW embankment will be at least as effective as that approved for the CA and CAN embankments (URS Corporation 2005a;

2005b) and that reviewed for the previously proposed CAC disposal embankment (Whetstone Associates 2006).

***Previous Cover Infiltration Sensitivity Analyses***

The Licensee previously performed a series of sensitivity analyses to assess the sensitivity of the EPA Hydrologic Evaluation of Landfill Performance (HELP) Model-predicted results for infiltration through final embankment covers at the Energy*Solutions* Clive Facility to changes in various input parameters. Parameters investigated through such sensitivity analyses have included but are not limited to: wind speed, evaporative zone depth (EZD) and precipitation. Results of such sensitivity analyses are summarized below:

- HELP Model sensitivity analyses were completed in 1997 to assess the effects of changes in a number of cover layer/design input values on infiltration rates through the LARW Cell at the Clive Facility, including, but not limited to, wind speed and filter layer hydraulic conductivity (Adrian Brown Consultants 1997). Those sensitivity analyses indicated that:
    - A decrease in the hydraulic conductivity of the lower filter layer in the LARW Cell from 3.5 to 2 cm/sec resulted in a 41% increase in infiltration through the cell, while an increase in the hydraulic conductivity of that layer in the LARW Cell from 3.5 to 6 cm/sec resulted in an 18% decrease in infiltration through the cell.
    - The HELP Model was found to be insensitive to slight variations in wind speed. The sensitivity analyses considered average wind speeds ranging between 5.75 and 8.8 mph (Adrian Brown Consultants 1997). A site-specific average wind speed of 7.2 mph was used in the CAW Embankment LAR HELP Model infiltration modeling (Energy*Solutions*, 2011a; b).
- Additional sensitivity analyses were also conducted to assess the effects of increased precipitation on infiltration rate though a cover system similar to that currently proposed for the CAW embankment for a previously proposed, but not implemented, Class A, B, and C embankment at the Clive Facility (Whetstone Associates 2000a). The modeling results from those analyses predicted that as the average precipitation rate was increased from the assumed base-case value of 7.92 inches/year to 12.78 inches/year (the average of the two highest values recorded at Clive, Utah through the time of the study), the average infiltration rate through the Class A, B, and C Cell was 0.186 cm/yr, compared to 0.169 cm/yr for the base case, for the top slope portion of the cell; and, for the side slope portion of the cell, the average infiltration rate through the cell was predicted to range from about 0.201 to 0.261 cm/yr, compared to 0.201 to 0.280 cm/yr, for the base case. These predicted increases are approximately 10% to less than 7% higher than the predicted base-case results.
- Additionally, previous sensitivity analyses were completed to assess the effects of siltation and vegetation intrusion and different depths of root penetration on infiltration rate though the previously proposed Class A, B, and C embankment cover system (Whetstone Associates 2000b). The modeling results indicated that as the depth of the root-zone was increased in the cover system, the inferred degradation of layers (e.g., loss of hydraulic conductivity in filter layers) that occurred in those filter layers due to root

penetration and siltation and other effects on layer properties (decrease in porosity, increase of wilting point of coarser-grained layers due to siltation) were found to be offset by increased evapotranspiration rates. The base case simulation (no vegetation growth in the cover and no siltation of coarse-grained layers) resulted in an average infiltration rate through the bottom of the clay liner of 0.169 cm/yr of water/year in comparison to average infiltration rates ranging between 0.020 to 0.136 cm of water/year through the top slope portion of the cover system (Whetstone Associates 2000b).

HELP Model simulations for the proposed CAW Embankment were conducted using an assumed EZD of 20 inches, which only allows water to evaporate from the uppermost 20-inch thick interval of the 24-inch thick riprap layer of the proposed final cover (Whetstone Associates Inc, 2011b). In this scenario, incident precipitation that percolates downward more than 20 inches within the cover is constrained in the model so it cannot be removed by evaporation. The Licensee provided information (Whetstone Associates Inc, 2011b) to support a finding that a 20-inch maximum EZD input value is environmentally conservative, because it allows efficient evaporation from nearly all rip rap interstices. The 20-inch EZD value used by the Licensee in infiltration modeling has not been approved by the Division. A new license condition will be added to the facility license that will require the Licensee to provide a modification to the CAW embankment's cover design to allow this issue to be resolved (see the discussion in Section 4.3.1, "Groundwater Pathway" and Section 5.0 below).

The CAW Embankment LAR proposes that the Type B Filter Zone layer have a hydraulic conductivity of at least 3.5 cm/sec. HELP Model infiltration simulations predict that the Type B Filter Zone layer will act as an important lateral run-off component within the cover. For this reason, and because previous sensitivity analyses show that infiltration rates through the CAW Embankment may be sensitive to the hydraulic conductivity of the lower (Type B) Filter Layer, the Licensee has proposed filter permeability criteria for the design of the Sacrificial Soil Layer and the Type B Filter Zone layer in the CAW Embankment cover. See Drawing C10014 C04, Rev. 2 in Energy*Solutions*, 2011e. The design criteria are based on filter/particle gradation criteria for adjacent soil/granular particle layers as recommended by Bertram (1940), NRCS (1994), and others and are intended to help ensure that the filter (drain) layer will, after cover construction, continue to retain sufficient permeability to prevent buildup of large seepage forces and hydrostatic pressures in the filter layer.

Based on the information summarized above, the Division concludes that the Licensee's proposed design criteria and justification supporting those design criteria, and design basis conditions used in infiltration analyses for demonstrating infiltration rates through the CAW embankment, will be maintained at or below the specified (calculated) allowable levels are acceptable.

**Minimize Infiltration – Encourage Run-off**

The three design criteria selected for encouraging surface water run-off drainage from the embankment (Table 4-5) are intended to ensure that (lateral) run-off of precipitation that falls on the surface of the completed embankment will be maintained under expected and possible extreme, future environmental conditions. Encouraging run-off helps ensure that the design

objective of minimizing the volume of precipitation available to infiltrate into the embankment can be achieved.

The side slopes of the CAW embankment would be graded at a 5H:1V inclination to help promote lateral run-off from the embankment side slopes while balancing long-term erosion protection requirements for the embankment in a manner consistent with published NRC recommendations and guidelines (e.g., NRC 2002). Additionally, as discussed under the heading "Minimize Infiltration" above, filter permeability criteria have been established for the Type B Filter Zone layer and Sacrificial Soil Layer in the top slope and side slope portions of the CAW embankment cover to help ensure that the Type B Filter Zone layer will maintain sufficient permeability (hydraulic conductivity) to retain its ability to function as a lateral drainage layer in the cover.

The evaluations performed by the Licensee for assessing long-term stability and maintenance of embankment slopes proposed for the CAW embankment are identical to those previously applied for evaluating the performance of the CA and CAN embankments (URS Corporation 2005a; 2005b). The conditions upon which the run-off evaluations are based are similar, except for the overall size of the embankment, and the use of updated meteorological data in the CAW embankment infiltration simulations. HELP Model infiltration analyses performed for the CAW embankment demonstrate that the run-off control of the CAW embankment will perform at least as well as corresponding items for the CA and CAN embankments (URS Corporation 2005a; 2005b) and proposed for the previously contemplated CAC embankment with respect to encouraging lateral run-off of precipitation from the embankment (e.g., see CAC Embankment Engineering Justification Report [Energy*Solutions* 2006] Section 3.3.1.2; Whetstone Associates 2006).

Based on the information summarized above, the Division concludes that the Licensee's proposed design criteria and justification supporting those design criteria and design basis conditions used in infiltration analyses for demonstrating infiltration rates through the CAW embankment will be minimized and that run-off will be encouraged are acceptable.

**Provide Protection from Effects of Desiccation**

The selected design criterion that there be no desiccation cracking of the radon barrier clay is based on the fact that the top foot of radon barrier clay is the primary infiltration barrier, and, therefore, the hydraulic barrier efficiency of this barrier must not be compromised by desiccation effects.

The normal condition evaluated by the Licensee, with respect to desiccation, considers performance of the radon barrier clay under historic weather patterns of precipitation and evaporation. The abnormal condition evaluation includes an analysis of the effects of a prolonged drought on moisture content of the radon barrier clay. The Licensee did not identify any credible accident scenario that would cause desiccation of the radon barrier clay in excess of the evaluated abnormal condition. Section 3.2 of NUREG-1199 does not require an evaluation of an accident condition for evaluation of desiccation effects.

The Licensee identified the critical time period for desiccation of the radon barrier clay as occurring during its construction, when the radon barrier layer of the cover will be exposed to the

elements. Table 1, "Work Element – Radon Barrier Placement" of the current approved version of, and the proposed Revision 26b,1, of the CQA/QC Manual provide a discussion of protective measures that will be applied during construction to prevent or minimize desiccation of the radon barrier. After it is constructed, the lower Type B Filter Zone, sacrificial soil, upper Type A Filter Zone and erosion barrier layers, once placed, would help isolate both upper and lower parts the radon barrier layers from the atmosphere.

Moisture content modeling was performed for the radon barrier, waste, clay liner, and the Unit 3 sand and Unit 2 clay to the top of the aquifer using the UNSAT-H Model (Whetstone Associates 2011b). This modeling indicates that steady-state moisture content for the clay layers of the cover remain relatively constant at approximately 0.42% by volume. This steady-state moisture content is comparable to the initial value of saturated moisture content of 0.43% assumed for the upper foot of radon barrier.

For normal conditions, the Licensee indicates that the proposed clay borrow sources for radon barrier construction would have an average moisture content of about 18.6% by weight at the plastic limit based on evaluation of 90 data points collected from January through November 2000. The plastic limit is a laboratory-derived measurement of the moisture content at which a soil begins to crack or desiccate (ASTM D4318). This converts to a moisture content at which onset of cracking would occur of approximately 22% by volume; or slightly more than half the value of the steady-state moisture content of the radon barrier clay of 42% by volume.

For abnormal conditions, the Licensee indicates that there is no credible evaporative mechanism to dry out the radon barrier and therefore concludes that the moisture content of the radon barrier would be expected to remain relatively constant for the life of the embankment See Energy*Solutions* 2006, Section 3.3.1.3, submitted in support of the previously proposed CAC embankment. Potential effects of plant life establishment on the radon barrier layer within the cover system, following cover construction, for the previously proposed CAC embankment, similar in depth and characteristics to the proposed CAW embankment cover radon barrier layer, are discussed in Section 3.3.1.5 of the CAC Embankment Engineering Justification Report (Energy*Solutions*, 2006). Also, see the discussion below in "Limit Biointrusion-Related Damage" for a summary of the effects of plant life establishment on the moisture content of the radon barrier layer of the cover.

The Licensee identified the following two aspects of the cover design for the previously proposed and similarly designed CAC embankment cover system, that are intended to contribute to maintenance of moisture content in the radon barrier clays at the modeled steady-state condition:

- The cover is designed to promote run-off of moisture that enters the cover as percolation at the interface between the lower filter zone and the surface of the radon barrier. Run-off at this interface provides a recharge rewetting mechanism for radon barrier clay, should they fall below optimum moisture content; and
- The field capacity of the lower filter zone is over an order of magnitude less than that of the radon barrier. Accordingly, moisture in the system should preferentially migrate to the radon barrier clay. The difference in field capacities should help the lower filter zone serve as a capillary break because the lower filter zone would not be able to pull moisture

from the radon barrier clay for transport to the surface of the cover (Section 3.3.1.3 of Energy*Solutions*, 2006).

Based on the above arguments, the Licensee concluded that the design criteria of "no desiccation cracking in radon barrier clay" will be met. The abnormal conditions evaluation establishes that there is no credible mechanism to dry out the radon barrier.

The infiltration analyses provided in reports submitted by the Licensee, as part of the CAW Embankment LAR, indicate that the effects of desiccation on the integrity of the embankment cover would be no more detrimental than the corresponding (negligible) effects projected to occur for the CA and CAN embankments (URS Corporation 2005a; 2005b) (Whetstone Associates 2011a and 2011b) and for the previously proposed CAC embankment (Energy*Solutions* 2006).

Based on the information summarized above, the Division concludes that the Licensee's proposed design criteria and justification supporting those design criteria and design basis conditions, used for demonstrating that desiccation of the radon barrier clay layer in the CAW Embankment will not likely occur, are acceptable.

**Provide Protection from Effects of Frost Penetration**

Two frost penetration analyses were previously completed to assess the potential for frost penetration into final cover systems in disposal embankments at the Clive Facility for varying sacrificial soil layer components in the covers. The first report (Montgomery Watson, 1998) assessed frost penetration in the top slope portion of the cover containing a sacrificial soil layer, and with the side slope portion having no sacrificial soil layer. The second report (Montgomery Watson, 2000) examined the side slopes with a sacrificial soil layer. Different results are observed for the top and side slopes because the erosion protection rock is larger on the side slope. The report calculated frost depths of 3.4 ft for the top slopes area and 3.2 ft for the side slope area with the sacrificial soil layer as designed. These frost penetration depths are less than the radon barrier clay's design depth of 3.5 ft.

The proposed means of providing protection of the radon barrier clay layer for the proposed CAW embankment is identical to that approved for the CA and CAN embankments. Previous analyses completed for the proposed CAC embankment (Energy*Solutions* 2006, Section 3.3.1.4) demonstrated that frost protection measures would perform at least as well as corresponding items approved for the CAN embankments and the 2005 LRA (2005 CAN SER Section 4.3) in preventing frost penetration into the radon barrier layer. The proposed CAW Embankment cover consists of the same design as the design of the previously proposed CAC disposal embankment cover with the exceptions that the uppermost riprap layer in the CAW Embankment cover on the top slope and sideslopes is 24 inches thick, compared to 18 inches thick for the CAC embankment; and the lower Type B Filter Zone layer on the side slopes of the CAW Embankment cover is 18 inches thick, compared to 12 inches thick for the CAC embankment, and the radon barrier layer depth is greater for the CAW embankment than for the proposed CAC embankment.

Based on the information summarized above, the Division concludes that the Licensee's proposed design criteria and justification supporting those design criteria and design basis

conditions used for demonstrating that frost penetration into, and therefore frost damage to, the radon barrier clay layer in the CAW Embankment will not occur, are acceptable.

**Limit Biointrusion-Related Damage**

The Licensee-specified design criterion that the cover design must discourage plant growth and accommodate indigenous species growth without increasing infiltration rates through the CAW Embankment cover significantly above the base case (unvegetated CAW Embankment cover) is based on the fact that the upper 12-inch-thick portion of the radon barrier clay is the primary infiltration barrier, and, therefore, the hydraulic barrier efficiency of this barrier must not be compromised by plant, animal or root penetration. The Licensee arranged for botanical specialists to conduct a literature review regarding typical plant rooting depths for shrub species identified growing at and around the Clive Facility and to conduct a reconnaissance of the site to confirm vegetation types. Also, the specialists conducted a subsurface testing program to verify, in particular, the depth of root penetration of one deeper-rooted indigenous shrub species growing at the site (Black greasewood) (SWCA 2000). Based on the results of this work, the Licensee acknowledged that it might not be possible to totally prevent establishment of deep-rooted vegetation on the cover following the 100-year period of institutional controls.

The biointrusion barrier proposed for the CAW embankment consisting of the 24-inch-thick rock rip layer, a 6-inch-thick filter zone layer, and a 12-inch-thick sacrificial soil layer on both the top slope and side slopes, and an additional 6-inch thick filter zone layer on the top slope and an additional 18-inch thick filter zone layer on the side slopes, is similar in characteristics but contains a thicker riprap layer than that for the previously proposed CAC disposal embankment (Energy*Solutions* 2006). Analyses performed for the proposed CAC disposal embankment (Section 3.3.1.5 of the CAC Disposal Embankment Engineering Justification Report [Energy*Solutions,* 2006]) and infiltration sensitivity analyses, performed for the previously proposed Class A, B and C embankment cover, (Whetstone Associates 2000b) demonstrate that the radon barrier layer and the infiltration reduction effectiveness of the cover systems would not be negatively affected by post-closure plant-related biointrusion processes, after allowing for assumed future plant root penetration. The biointrusion barrier of the proposed CAW embankment cover would be expected to perform at least as well as or better than corresponding items reviewed and approved for adequacy for the CA and CAN embankments and for the previously proposed CAC disposal embankment (Energy*Solutions,* 2006).

Published information on observed burrowing depths of animals in various soil and rock layers indicates that the thickness and proposed rock sizes of the riprap layers on the top slope and side slope areas of the CAW Embankment cover should be effective at deterring burrowing by animals into the cover throughout the required performance period of the CAW embankment (Cline 1979; Cline et al. 1980; Cline et al. 1982; Gano and States 1982; Reichman, et al. 1990; Reynolds and Wakkinen 1987; Reynolds and Laundre 1988).

Based on the information summarized above, the Division concludes that the Licensee's proposed design criteria, justification supporting those design criteria, and design basis conditions used for demonstrating that the CAW Embankment LAR's ability to withstand damage or disruption due to long-term biointrusion, are acceptable.

## Limit Occupational Exposures

The types of materials received for disposal in the CAW embankment will be no different than materials disposed of in the CA and CAN embankments. Therefore, radiation protection, access control to restricted areas, and personnel protective equipment policies will not change from current policies. Although the CAW embankment will increase the overall licensed disposal capacity at the Clive Facility, annual volumes received for disposal will continue to be bounded by the evaluations performed for license renewal.

The design criterion that the dose rate at the surface of the completed embankment must be less than 100 mrem TEDE per year is a regulatory requirement contained in URCR R313-15-301. Potential external dose rates to persons standing on top of the completed cover system from gamma radiation were evaluated using the MicroShield® computer code. The MicroShield® code was used because it is verified and publically available. A generic 55-gallon drum, consistent with the numerous dimensions of 55-gallon drums currently in use for waste storage and disposal, containing a total activity of 11 curies was assumed to be placed on its side at the top of waste, just below the CAW embankment cover. The cover consists of, from bottom to top:

- Temporary cover – 1 foot thick
- 1E-6 cm/sec radon barrier – 1 foot thick
- 5E-8 cm/sec radon barrier – 1 foot thick
- Filter layer – 0.5 ft thick on topslope; 18 inches thick on sideslopes
- Sacrificial soil layer – 1 foot thick
- Filter layer – 0.5 ft thick
- Riprap cover – 2 ft thick
- Total thickness – 7.0 ft (topslope) and 8.0 ft (sideslopes)

An effective density of 1.6 g/cm$^3$ with a consistency and mineralogy of low-density concrete was assumed. This density is conservative considering that each layer of the cover will be compacted to greater than 95% Standard Proctor density, as per the CQA/QC Manual. MicroShield® projected a contact dose rate on top of the completed cover of 3.75E-4 mR/hr. Multiplied over an entire year, this yields a dose rate of approximately 3 mrem, well below the regulatory limit of 100 mrem TEDE stated above.

Previously submitted, reviewed, and accepted information about occupational doses during operations indicates that most workers at the current facility receive annual doses less that 100 mrem/yr, when the regulatory limit for each is 5,000 mrem/yr. Thus, operational doses are demonstrated to be well within acceptable limits.

Based on the information summarized above, the Division concludes that occupational exposures that could result from the Licensee's proposed CAW embankment are within acceptable limits.

## Ensure Cover Integrity

Ensuring cover integrity involves the following five complementary functions:

- Mitigate Differential Settlement
- Prevent Internal Erosion
- Maintain Material Stability/Withstand External Erosion

- Ensure Structural Stability – Settlement
- Ensure Structural Stability – Maintain Slope Stability

These complementary functions are addressed in the following paragraphs.

***Mitigate Differential Settlement***

Previously, the Licensee provided information indicating that, based on information available at that time, a maximum allowable distortion value of 0.02 ft/ft for the cover and liner represented a reasonably conservative design criterion (AMEC 2000, AMEC 2005a; 2005b). Published data on tensile strains, observed in laboratory tests of compacted clayey soil layers, generally supported a finding that higher tensile strains in soils, similar in plasticity to those proposed for use in the proposed CAW embankment radon barrier layer, would be required to cause failure or cracking.

The Licensee furnished additional information in 2011 and 2012, in responses to Round 2 and Round 3 interrogatories, (Energy*Solutions*, 2012a; 2012b) as part of the CAW Embankment LAR. In a subsequent response to further Division requests the Licensee provided additional data supporting the continued appropriateness of the previously proposed maximum allowable distortion value of 0.02 ft/ft (Energy*Solutions*, 2012c). The Licensee summarized results of a variety of relatively recent laboratory tests, conducted to assess the deformation behavior of compacted clay layers, including small-, full-scale, and trap-door-centrifuge tests and 3-point and 4-point bending beam tests. These recent test results are mixed with respect to the degree that they support earlier test results used by AMEC in 2000 to develop the 0.02 ft/ft distortion criterion (AMEC 2000).

The 0.02 ft/ft distortion criterion was based on the interpretation that higher maximum tensile strains (e.g., ranging from 0.5% to 3%) did not cause the compacted clay layers tested to fail. However, as described in a memorandum from URS Corporation (URS 2012), at least two professional papers published in 2010 suggest that cracking in tested compacted clay layers appeared to occur at a lower strain threshold value than had been suggested by earlier testing results. The URS memorandum acknowledged that actual compacted clay layer cracking behavior will depend on the specific clay layer materials tested.

To resolve the uncertainty associated with the selection of the most appropriate distortion criterion for design of the CAW Embankment cover, the Licensee agreed that it would, as part of the LRA to be submitted on or before December 25, 2012, do the following:

1. Conduct and submit to the Division the results of laboratory testing (including index properties and tensile strength/strain relationships) of soils representative of those expected to be used in constructing the final cover system. The purpose of this laboratory testing will be to assess properties that affect the tensile strain and distortion-induced crack resistance, to determine whether the 0.02 ft/ft maximum allowable distortion value remains an appropriate value for the distortion criterion for the cover of all disposal embankments approved to date.
2. Continue to perform settlement monitoring of the interim soil cover layer placed over filled portions of the CA and CAN embankments.

3. Continue to observe differential settlement in the interim soil cover layer, and use those data to determine the magnitude of the observed distortion within these embankment areas.
4. Demonstrate whether the calculated distortion values exceed the highest observed distortion value based on the settlement monitoring data acquired to-date in the CA and CAN embankments (i.e., 0.007 ft/ft).
5. Delay construction of final covers until observed settlement has stabilized.
6. Either substantiate the adequacy of the 0.02 ft/ft design distortion criterion or revise it, based upon the results of laboratory testing that determine index properties and tensile strength/strain relationships for clays expected to be used in constructing the final cover system.

Also, the Licensee revised the specification for the "Work Element – Temporary Cover Placement and Monitoring" in the LLRW and 11e.(2) CQA/QC Manual (proposed version 26c. dated March 20, 1012 [Energy*Solutions*, 2012c]) to delay placement of final cover until after it has confirmed that future distortion values determined through the interim cover settlement monitoring will not exceed 0.007 ft/ft (Energy*Solutions* 2012c).

Based on the information summarized above, the Division concludes that the Licensee's proposed design criteria and justification supporting those design criteria and design basis conditions used in analyses for demonstrating that differential settlement and resulting potential for settlement-induced damage to the cover (and liner) of the CAW embankment will be mitigated are acceptable.

**Prevent Internal Erosion**

Design criteria for and projections of internal erosion for the currently proposed cover are presented in Section 3 of the CAW Embankment LAR. The Licensee presented rock riprap cover design calculations in Attachment 10 to the CAW Embankment LAR and provided an analysis of the interstitial velocities associated with the clay/rock interface. This analysis uses the slopes of the embankment and the hydraulic conductivity of the Type B Filter to calculate a maximum interstitial velocity at the interface. The maximum estimated calculated interstitial flow velocities, representing maximum possible velocities at the interface, which are not dependent on the amount of water flow, are both orders of magnitude below the selected design criteria velocity of 5.41 ft/sec. Based on this result, the Division has concluded that significant radon barrier clay erosion would not occur.

Internal erosion related to piping, the movement of soil from a soil layer to a rock/filter layer, was evaluated based on procedures developed for saturated embankment dams. Filter criteria were originally developed by evaluating the gradation limits between dissimilar materials so that finer material cannot migrate into the voids of the coarse material, thereby creating the potential for internal erosion. The Licensee indicated that, normally, the embankment cover soils, that are not part of the radon barrier, are dry or partly saturated and internal erosion due to the movement of water between the layers, is not considered to be a design issue. Under temporary saturated flow conditions, internal erosion is considered as an abnormal design event. The Licensee used U.S. Army Corps of Engineers guidance, including published filter design equations, to

demonstrate that movement of particles between a soil and a filter layer would not occur (USACE).

The design criteria for preventing internal erosion involve specifications for the size distribution of soils placed adjacent to each other. These criteria are:

- D15(filter)/D85(soil) ≤ 5,
- D50(filter)/D50(soil) ≤ 25 and
- D15(Lower Layer)/D85(upper layer) ≥ 4.

In Drawing 10014-C04, the Licensee specifies that particle size distributions used in layers of the cover system must satisfy all of these criteria. Thus, the Division concludes that the design criteria necessary to protect against internal erosion will be satisfied.

Using these criteria, the interstitial water velocities were projected to be about 0.12 ft/sec for the top slope and about 0.055 ft/sec for the side slopes. The Division agrees that these velocities are small and would not contribute to piping instabilities.

**Maintain Material Stability/Withstand External Erosion**

Design criteria to ensure stability against external erosion for design basis normal and abnormal conditions, for assessing the potential for external erosion of the CAW Embankment cover, are similar to those used in the CAN embankment and the previously proposed CAC embankment. The criteria are presented in Section 3.1.2 and Tables 3.2 and 3.3 of the CAW Embankment LAR. The analysis of normal conditions would be bounded by the abnormal condition analyses. Therefore, analyses were performed for assessing material stability and ability of the CAW embankment cover to withstand external erosion under assumed abnormal conditions, for a 200- to 1,000-year cover life span. For evaluating the external erosion protection capability of the CAW Embankment cover, the Licensee assumed a 100-year, 24 hour storm event as the normal precipitation condition, and a probable maximum precipitation (PMP) 1-hr value of 6.1 inches of rain, as the abnormal precipitation condition (Table 3.2 of the CAW Embankment LAR) .

The Licensee also performed additional calculations to determine the characteristics of the PMP at the Clive Facility considering meteorological information and using procedures contained in two State of Utah Climate Center publications (Jensen 1995 and Jensen 2003). When estimating the PMP for the area of concern in designing high and moderate hazard dams in Utah, State regulations (R655-11-4) require the use of HMR 49, as well as assessment information from these two studies issued by the Utah Climate Center. Calculations based on the procedures from the Utah Climate Center, were completed as a cross check and for comparison with PMP conditions determined previously using the approach prescribed in HMR 49 (Hansen et al. 1984). Results of the updated PMP computations demonstrated that the 1-hour PMP of 6.1 inches as computed directly from HMR 49 in 1996 is the larger, more conservative PMP value.

Rock cover design calculations were conducted for the CAW Embankment LAR using the methodologies described in NUREG-1623 and NUREG/CR-4620. A revised updated erosion protection methodology developed by Abt et al. (2008) for rounded, shaped riprap was applied to the evaluation of the long-term erosional stability of the CAW embankment. The Licensee used the more conservative, larger calculated PMP value in all rock cover calculations.

Based on the information summarized above, the Division concludes that the Licensee's proposed design criteria and justification supporting those design criteria and the normal and abnormal design basis conditions used in analyses for demonstrating material stability and ability of the embankment cover to withstand external erosion are acceptable.

**Ensure Structural Stability – Settlement**

Sections 3.2.2 and 3.2.3 of the CAW Embankment LAR and Section 4 of Attachment 5 to the CAW Embankment LAR address embankment settlement within foundation materials, waste placement, backfill, and cover system. Design criteria specified for embankment settlement are that: (1) settlement not result in slope reversal and/or ponding of surface water in the final cover system (i.e., that long-term positive drainage from the cover be maintained with no active maintenance); and (2) maximum total settlement not exceed 15% of the embankment's height. The former criterion will help ensure that infiltration into the cover will be minimized and the latter criterion has been reported to be acceptable for highway embankments and major waste storage embankments (Energy*Solutions* 2012a; 2011b, Table 3.2).

Total long-term differential settlement above different waste types, including compressible debris lifts is discussed in Section 4.4.1 of Attachment 5 to the CAW Embankment LAR. In addition, settlement data acquired by Energy*Solutions* have been analyzed and a projection of total differential settlement of the CAW Embankment of less than 0.007 ft/ft is projected (Section 4.4 of Attachment 5 to the CAW Embankment LAR), indicating that slope reversal is not expected to occur on the top slope portion of the CAW Embankment. Design-basis conditions assumed for evaluating settlement of the CAW Embankment and cover (an evenly distributed weight loading as the normal condition; creep of compressible waste and additional secondary settlement of soils after a 100-year institutional control period; no accident condition assumptions required as per NUREG-1199) are the same as those assumed for the CA and CAN embankments (URS Corporation 2005a; b) and for the previously proposed CAC embankment (AMEC 2005a; 2005b). The settlement evaluation methodology used for the CAW Embankment LAR is the same as that approved for the CA and CAN embankments (URS Corporation 2005a; 2005b). The conditions upon which the settlement calculations are based are similar, with consideration of more recent and planned ongoing interim cover settlement data providing additional evidence for comparing results of the calculations to observed settlement behavior in the CA and CAN embankments, and ultimately for demonstrating the technical appropriateness and adequacy of the settlement calculations. The evaluation presented in Attachment 5 to the CAW Embankment LAR demonstrates that the CAW embankment will perform at least as well as corresponding items reviewed for the CA and CAN embankments and reviewed for the previously proposed CAC embankment (AMEC 2005a; 2005b) with respect to minimizing embankment settlement.

Based on the information summarized above, the Division concludes that the Licensee's proposed design criteria, justification supporting those design criteria and design basis conditions used for demonstrating that the CAW embankment will maintain structural stability with respect to the required function of mitigating settlement, are acceptable.

**Ensure Structural Stability – Maintain Slope Stability**

The minimum factors of safety of 1.5 under static conditions and 1.2 under dynamic (i.e., earthquake) conditions that the Licensee selected are contained in the State of Utah Statutes and Administrative Rules for Dam Safety, Rule R625-11-6.

The normal condition considers the performance of the embankment under static conditions. The evaluation for abnormal conditions compares the calculated safety factor inherent to the embankment design against the expected peak ground acceleration due to an earthquake that might affect the site, the assumed design earthquake. The Licensee did not perform analyses of reduced structural stability associated with accidents as such analyses are not required per NUREG-1199, Section 3.2 [NRC 1999]. Results of the static and seismic stability slope analyses for the CAW embankment are described in Section 4.3.2 below

The Division held discussions with the Licensee regarding the Division's request to update the seismic hazard evaluation for the site to incorporate updated published seismic attenuation prediction models and to validate that the seismic design criteria, used by AMEC for assessing the geotechnical stability of the proposed CAW Embankment, remain technically appropriate. As a result, the Division prepared independent deterministic and updated probabilistic seismic hazard analyses. The analyses were used to check previous deterministic analysis results obtained by AMEC, as reported in the February 15, 2011,"Geotechnical Update Report," and to complete an independent probabilistic analysis of seismic hazard potential at the site.

Under contract to the Licensee, AMEC presented an updated assessment of the seismic hazard for the site consistent with the requirements of URCR R313-25-8(5) and the information requested in a Round 3 Interrogatory (AMEC 2011a; 2011b; 2011 c; 2011d; AMEC 2012a). The updated seismic hazard assessment is based on an updated determination of the peak ground acceleration (PGA) associated with the Maximum Credible Earthquake (MCE) for known active or potentially active faults in the site region. The PGA is determined from a probabilistic seismic hazard analysis (PSHA) for earthquakes that may occur on unknown faults in the area, referred to as background seismicity, surrounding the project site. The PGA is calculated at the 84th percentile level and is based on the maximum rupture length and rupture area for each fault. The return period for ground motions resulting from a background earthquake is identified as 5,000 years, equal to a one percent probability of exceedance in 50 years. The approach to select a MCE PGA from the larger of the values associated with the deterministic MCE for faults or the PSHA result for background earthquakes at a 5,000 year return period is consistent with the recommendations of the Utah Seismic Safety Commission (2003) and as required by the Utah Division of Water Rights (Dam Safety Section) for assessment of dams.

AMEC used the following Next Generation Attenuation (NGA) relationships for conducting their analyses:

- Abrahamson and Silva (2008)
- Boore and Atkinson (2008)
- Campbell and Bozorgnia (2008)
- Chiou and Youngs (2008)

All of these relationships are considered to be applicable for the site conditions and types of potential sources of seismic activity in Utah and the Intermountain Region. Additional

parameters for attenuation relationships include site shear wave velocity, VS30, taken as 305 m/s as described in the October 25, 2011 letter, and depth to top of bedrock (Z1.0 and Z2.5), taken as default values calculated from the site VS30 as recommended by the authors of the NGA relationships and as described in a letter from AMEC dated October 25, 2011 (AMEC 2011c; 2011d). For the Stansbury fault, the maximum magnitude is assessed as M 7.3 based on consideration of the maximum rupture length, fault width, and maximum fault displacement identified in previous investigations. The maximum of the 84th percentile PGA values for the maximum Magnitude (Mmax) events on the fault sources was calculated to be 0.24 g, as obtained for the Stansbury and the Skull Valley faults.

For the PSHA, the current version (Ver. 7.62) of commercial program EZ-FRISK® was used to calculate the PGA for the background earthquake. The program contained prepared input fault and background seismicity files for Utah for use in calculating seismic hazard. These files are based on the same fault source parameters and independent seismicity catalog used by the U.S. Geological Survey (USGS) to prepare the 2008 National Seismic Hazard Maps. The PGA, calculated as the weighted average of the mean values for the four NGA relationships at a return period of 5,000 years, was determined to be 0.24 g.

An independent seismic hazard analysis (Wong 2012) was also performed, and the results of this analysis were used to check the value of the 84$^{th}$ percentile peak ground acceleration (PGA) value calculated by AMEC for the controlling deterministic source, which was an earthquake of moment magnitude (M) 7.5 on the Stansbury fault at a rupture distance of 30.4 km. from the Clive Facility site. For the updated deterministic hazard analysis, the Pacific Earthquake Engineering Research Center (PEER) Next Generation Attenuation (NGA) spreadsheet, version 19, as well as the NGA models contained in a PEER verified and validated PSHA code (HAZ38) were used. The updated deterministic analysis calculated an 84$^{th}$ percentile geometric mean PGA for the Stansbury fault M 7.5 of 0.257 g (Wong 2012), compared to a PGA value calculated by AMEC of 0.23 g. This difference notwithstanding, the design basis PGA of 0.28 g is conservative.

As was recommended by the Division to AMEC, the updated PSHA was performed using background seismicity to assess the hazard from assumed background earthquakes. The background seismicity was extracted from the URS Corporation (URS) seismic source model of the Wasatch Front, which has been continually updated since the original model was developed by URS, the Utah Geological Survey, and the University of Utah (Wong, et al. 2002). Two approaches were used to treat the background seismicity in the URS model: a uniform zone and gridded seismicity weighted 0.3 and 0.7, respectively. The PGA for a return period of 10,000 years (the return period used by AMEC) was calculated to be 0.18 g. The PGA for a return period of 5,000 years (as used by Utah Division of Water Resources) was calculated to be 0.14 g. Both the 5,000- and 10,000-year return period PGAs are below the 0.28 g design value assumed by AMEC in the Geotechnical Update Report (Attachment 5 to Energy*Solutions* 2011b).

Based on the results of updated deterministic and probabilistic seismic hazard analyses, the design PGA of 0.28 g recommended by AMEC in the Geotechnical Update Report (Attachment 5 to Energy*Solutions* 2011b) and used for embankment stability calculations was found to be acceptable.

The slope stability analysis performed for the CAW cover is the same type of analysis as the analysis that was approved for the CA and CAN embankments. The analyses demonstrate that the CAW Embankment will perform at least as well as corresponding items approved for the Class A and CAN embankments with respect to long-term slope stability (Energy*Solutions* 2011b and Energy*Solutions*, 2011b).

Based on the information summarized above, the Division concludes that the Licensee's proposed CAW Embankment LAR slope stability analysis approach is acceptable. Also, the Division concludes that the Licensee's proposed design criteria, justification supporting those design criteria, and design basis conditions used for demonstrating the long-term slope stability of the CAW Embankment are acceptable.

Table 4-11 below provides a summary of the design criteria assumed for the cover and provides information on procedures to be used and/or other justification for ensuring that the specified cover design criteria will be achieved.

**Table 4-11 – Summary of Justification for Design Criteria Used for Design of Cover.**

| Required Function(s) of Cover | Design Criteria | Design Criteria Justification |
|---|---|---|
| Minimize Infiltration | Average infiltration rate through cover < 0.036 inches/year (0.09 cm/year) top slope area; and 0.066 inches/year (0.168 cm/year) side slope areas (Whetstone Associates 2011b) | Infiltration through the CAW cell was modeled using the EPA Hydrologic Evaluation of Landfill Performance (HELP) model (version 3.06). The Infiltration and Transport Modeling Report (Whetstone Associates 2011b) requires an average infiltration through the cover to be less than or equal to 0.09 cm/year in the top slope and less than or equal to 0.168 cm/year in side slope areas to limit water seepage into the waste to levels required for meeting embankment performance objectives. |
| Encourage run-off | • Maintain positive drainage<br>• Ensure maximum design velocity within the drainage layer is greater than the calculated drainage velocities<br>• Must not allow water accumulation to occur on or within the cover | Drainage calculations performed illustrate that drainage will be maintained under all conditions and meet NUREG-1199 criteria |
| Prevent desiccation | Prevent desiccation-induced | Infiltration design criteria will |

**Table 4-11 – Summary of Justification for Design Criteria Used for Design of Cover.**

| Required Function(s) of Cover | Design Criteria | Design Criteria Justification |
|---|---|---|
| | cracking in the radon barrier layer | be maintained under all conditions and meet NUREG-1199 criteria |
| Limit frost penetration | The thickness of rock/filter/sacrificial soil zones must be greater or equal to the maximum frost depth (3 ft) | Infiltration design criteria will be maintained under all conditions and meet NUREG-1199 criteria |
| Limit biointrusion | Must limit biointrusion as to not cause increased infiltration into the cover | Infiltration design criteria will be maintained under all conditions and meet NUREG-1199 criteria |
| Reduce Exposures/Surface dose rates | Limit TEDE to ≤ 100 mrem | Complies with URCR R313-15-301 requirements |
| **Ensure Cover Integrity** | | |
| Mitigate differential settlement | The specified maximum allowable distortion criteria for the cover will not be exceeded. | Settlement Monitoring Data<br><br>Proposed laboratory testing of compacted clay soil layer comprised of on-site clayey soils |
| Prevent internal erosion | Run-off water velocity shall be < 3 ft/sec on surface of radon barrier and to minimize piping, particle size specification for Type B Filter Zone material shall conform to the following:<br>$D_{15}$ (filter)/$D_{85}$ (soil) shall not exceed 5;<br>$D_{50}$ (filter)/$D_{50}$ (soil) must be ≤ 25; and<br>Upward migration of fines will be prevented :<br>$D_{15}$(filter)/$D_{85}$(soil) must be ≥4 | NUREG/CR-4620<br><br>Cedegren 1989<br><br>DOE 1989<br><br>NRCS 1994 |
| Exhibit material stability and resist external erosion | Rock erosion barrier shall exhibit internal stability and endure weathering/external erosion for at least 1,000 years | Rock Cover Design Calculations (Energy*Solutions* 2012c)<br><br>NUREG-1623 |
| **Ensure Structural Stability** | | |

**Table 4-11 – Summary of Justification for Design Criteria Used for Design of Cover.**

| Required Function(s) of Cover | Design Criteria | Design Criteria Justification |
|---|---|---|
| Limit embankment settlement to within acceptable levels and maintain long-term positive drainage from Cover | Ensure long term cover drainage and avoid cover slope reversal and ponding | Settlement calculations performed demonstrate that ponding of the cover will be minimized and slope reversal will not occur |
| | Maximum Total Settlement is less than or equal to 15% of the Embankment Height, 8.4 ft for the LARW and 9.2 ft for Class A | Settlement of 15% of the embankment height has been proven as adequate performance in highway embankments and major waste storage embankments |
| Maintain slope stability | Ensure a Static Safety Factor greater than to equal to 1.5 and a Seismic Safety Factor less than or equal to 1.2 | Safety factors calculated meet and satisfy State of Utah Statutes and Administrative Rules for Dam Safety, Rule R625-11-6 |

***References:***

Abrahamson and Silva, 2008

Abt et al., 2008

AMEC Earth & Environmental Inc., 2000; 2005a; 2005b

Bertram, 1940

Boore and Atkinson, 2008

Campbell and Bozorgnia, 2008

Cedegren, 1989

Chiou and Youngs (2008

DOE, 1989

Cline, 1979

Cline, et al., 1980

Cline, et al., 1982

Energy*Solutions*, 2006; 2011a; 2011b; 2011d; 2011e

Gano and States, 1982

Hansen et al. 1984

Jensen 1995; 2003

Montgomery Watson, 1998; 2000

Nelson, et al., 1986

NRC 2002

NRC, 1991

NRC, 2004

Reichman, et al., 1990

Reynolds and Wakkinen, 1987

Reynolds and Laundre, 1988

URS Corporation, 2005a; 2005b; 2012

Whetstone Associates 2000b; 2006; 2011a; 2011b

Wong, et al., 2002

Wong, 2012

#### 4.2.1.4 Drainage Systems

##### 4.2.1.4.1 Description of Design Feature – Drainage Systems

**Requirement 2507-2**: Descriptions of the design features of the land disposal facility and of the disposal units for near-surface disposal shall include those design features related to infiltration of water; integrity of covers for disposal units; structural stability of backfill, wastes, and covers; contact of wastes with standing water; disposal site drainage; disposal site closure and stabilization; elimination to the extent practicable of long-term disposal site maintenance; inadvertent intrusion; occupational exposures; disposal site monitoring; and adequacy of the size of the buffer zone for monitoring and potential mitigative measures [URCR R313-25-7(2)].

**Basis**: Proposed drainage systems are described in Sections 3.1.5 and 3.2.5 and are depicted on Drawings 10014-C01, 10014-C03, Rev. 2, and 10014-C04, Rev. 2, of the CAW Embankment LAR (Energy*Solutions* 2011b; 2011e). The drainage systems are included in the design to control precipitation and surface water run-on and run-off during and after operations. Drainage system components include a minimum 4-foot-deep "V"-shaped drainage ditch, constructed with 5H:1V side slopes, to be installed adjacent to the CAW embankment. Bottoms (bases) of drainage ditch segments would be constructed of either in-place or imported clay (CL) or silt (ML) soil compacted to at least 95% of the Standard Proctor density for the soils. The compacted bases would be overlain by a minimum 6-inch-thick layer of "Type A" filter material, which in turn, would be overlain by an 18-inch-thick layer of Type A riprap material. The specifications for the Type A filter materials and Type A riprap would be identical to the material specifications in the cover system.

The description of the proposed drainage system is consistent with NRC guidelines and requirements (NRC 2002) and the drainage system design is very similar to that reviewed for the previously proposed CAC disposal embankment (Energy*Solutions* 2006), except for a slightly different overall total length of the drainage system.

Based on the information summarized above, the Division concludes that the Licensee's description of the proposed CAW embankment drainage system is acceptable.

***References:***

Energy*Solutions*, 2006; 2011b; 2011e

NRC, 2002

#### 4.2.1.4.2 Principal Design Criteria – Drainage Systems

**Requirement 2507-3:** Descriptions of the principal design criteria and their relationship to the performance objectives [URCR R313-25-7(3)].

**Basis**: Sections 3.1.5 and 3.2.5 of the CAW Embankment LAR provide information regarding the design criteria pertinent to the drainage systems for the proposed embankment. Table 3.2, "Design Criteria of the Principal Design Features," of the CAW Embankment LAR, summarizes the principal design criteria for the drainage systems and provides a summary of the design basis conditions used in analyses to assess the projected performance of the drainage systems.

The principal design criteria proposed for the CAW drainage system have incorporated a revised criterion and associated methodology (Johnson and Abt 1998) recommended in NUREG-1623 (NRC 2002). The criteria is for determining the minimum median rock size in the uppermost riprap layer to resist movement under peak flow (peak stress) conditions expected to occur in the drainage ditches (Energy*Solutions* 2011b). The design criteria used in designing the drainage systems are summarized in Table 3.2 of the CAW Embankment LAR and further described in Section 3.1.4 of Energy*Solutions*' 2005 LRA are as follows:

- Facilitate flow of precipitation away from the embankment;
- Minimize infiltration under flood conditions and,
- Ensure ditch integrity and prevent internal erosion.

The Licensee provided revised drainage ditch calculations dated November 14, 2011, in Attachment 3 to "Supplemental Response to Round 1 Interrogatories" (Energy*Solutions* 2011e) The revised calculations utilize methodologies presented in NUREG-1623 (NRC 2002) and NUREG/CR-4620 (Nelson et al. 1986) and consider a 25-year and a 100-year event and information obtained from NOAA Atlas 14.

The Licensee also completed an analysis of shear stresses around corners (bends) in the proposed drainage ditch system and completed a set of revised drainage ditch calculations, in Attachment 3 to Energy*Solutions* 2011e, to assess potential for super elevation of water in the ditches around such bends. The required size of the riprap rock was calculated based on these shear stresses.

Based on the information summarized above, the Division concludes that the Licensee's specified design criteria for the drainage systems for the proposed CAW Embankment are acceptable.

***References:***

Energy*Solutions*, 2011a; 2011b; 2011e

Johnson and Abt., 1998

Nelson, et al., 1986

NRC, 2002

#### 4.2.1.4.3 Design Basis Conditions and Design Criteria Justification – Drainage Systems

**Requirement 2507-4:** Descriptions of the natural events or phenomena on which the design is based and their relationship to the principal design criteria [URCR R313-25-7(4)].

**Basis:** Table 3.2 of the CAW Embankment LAR summarizes information regarding the natural (meteorological, biological, and seismic) normal and abnormal conditions, and accident (as applicable) conditions under which the drainage systems of the proposed CAW Embankment were evaluated. In developing the CAW Embankment LAR, the Licensee used applicable guidance issued by the NRC, including guidance described in NRC NUREG-1199 (NRC 1991) pertaining to normal, abnormal, and accident (where applicable) conditions, that should be considered during design of NRC-licensed LLRW disposal facilities.

Table 3.4 of the CAW Embankment LAR summarizes the design criteria considered in the design of the drainage systems principal design feature and summarizes the results of evaluations conducted to assess the projected performance of the drainage systems with respect to the established design criteria. The design basis conditions and design criteria justification proposed for the CAW embankment drainage system are very similar to those approved for the CA and CAN embankments and included 25-year and 100-year storm events for representing normal and abnormal run-off conditions, downstream blockage as representing a potential accident condition, where applicable, and a 100-year flood for evaluating potential infiltration conditions.

**Facilitate Flow of Precipitation Away from Embankment**

The conditions upon which the drainage system design is based are similar to the conditions assumed for design of the CA and CAN embankments (URS Corporation 2005a; 2005b) and for the previously contemplated CAC embankment (Energy*Solutions* 2006), except for the overall length of the drainage system and use of information from NOAA Atlas 14 which is more recent than NOAA Atlas 2 used in previous analyses. Results of analyses and Section 4..2.2 of this document demonstrate that the drainage system of the CAW embankment will perform at least as well as corresponding items previously approved for the CA and CAN embankments (e.g., see URS Corporation 2005a, Section 5.4.2). The normal condition evaluated by the Licensee for the complementary function "facilitate flow of water away from the embankment" included an analysis of the drainage ditch design with respect to impacts of the 25-year, 24-hour storm event for the site. The 25-year, 24-hour storm event was identified as representing the probable worst-case precipitation event that might be encountered during active site operations.

The abnormal condition evaluated by the Licensee for the complementary function "facilitate flow of water away from the embankment" included an analysis of the drainage ditch design with respect to impacts of the 100-year, 24-hour storm event for the site.

The Licensee selected the design criteria of ensuring that storm water remain within the drainage ditch system with a minimum of 0.5 ft freeboard, and ensuring that the drainage ditch system

have sufficient slope to allow drainage away from the embankment, under these conditions, to promote the collection of precipitation as well as promote flow away from the embankment. These choices minimize standing water adjacent to the embankment and potential infiltration into the waste" (see the discussion in Section 1.4.1.1 of Energy*Solutions* 2006).

Revised calculations, contained in Attachment 3 to the Supplemental Responses to Round 1 Interrogatories (Energy*Solutions* 2011e), using geometry and slope of the ditches and Manning's formula, address the design criteria established for the function of facilitating flow away from the embankment. Results of those calculations in Section 4.1.2 of this SER indicate that the ditch has been designed to have adequate capacity to contain normal and abnormal flow conditions storm event run-off volumes with ≥ 0.5 ft of freeboard.

**Minimize Infiltration Under Flood Conditions**

The infiltration minimization criterion proposed for the CAW embankment is identical to that approved for the CA and CAN embankments. Performance of the drainage systems related to normal conditions was not analyzed because the performance is bounded by the abnormal conditions analysis for minimizing infiltration under flood conditions. The Licensee referenced results of HEC 1 and HEC 2 Modeling analyses conducted by Bingham Environmental providing data pertaining to the depth of water expected from a PMF for the watershed encompassing the Clive site (Bingham Environmental 1996). That analysis indicated a calculated depth of the PMF across the site at approximately 1 foot above grade. The Licensee noted that the depth of the 100-year flood would be considerably less. Based on the geometry of water accumulation in the ditch, with respect to the embankment, the Licensee concluded that the abnormal flood event would not cause water to accumulate above the toe of the waste in the embankment and that the drainage system is adequately designed to minimize infiltration of water through the waste under both normal and abnormal conditions.

**Ensure Ditch Integrity**

The Licensee's evaluation of ditch integrity focused on evaluation of the drainage ditch's ability to resist disruption under anticipated normal and abnormal surface water flow conditions. The design criterion that the size of the rock used to line the ditches be able to handle projected peak flows without movement, was selected based on guidelines contained in NUREG/CR-4620 (Nelson, et al. 1986) and NUREG-1623 (NRC 2002) and Johnson and Abt (1998).

The Licensee evaluated a normal design condition that included evaluation of drainage system performance for different flow paths in the system under a 25-year storm event, and an abnormal design condition that included evaluation of drainage system performance under a 100-year storm event (Attachment 4 to Energy*Solutions*, 2011b). The rock size calculations considered both straight flow sections and flow around bends. Based on results of the calculations (Section 4.3.2 below), the Licensee concluded that no disruption of the drainage ditches would occur under the evaluated normal and abnormal conditions.

Based on its review of the information summarized above, the Division concludes that the Licensee's proposed design basis conditions and design criteria justification for the proposed CAW Embankment drainage system are acceptable.

***References:***

Bingham Environmental, 1996

Envirocare of Utah, LLC, 2004b

Envirocare of Utah, LLC, 2005a

Energy*Solutions*, 2006

Energy*Solutions*, 2011b; 2011e

Johnson and Abt., 1998

Nelson, et al., 1986

URS Corporation, 2005a

NRC, 1991

NRC, 2002

#### 4.2.1.5 Buffer Zone

##### 4.2.1.5.1 Description of Design Feature – Buffer Zone

**Requirement 2507-2**: Descriptions of the design features of the land disposal facility and of the disposal units for near-surface disposal shall include those design features related to infiltration of water; integrity of covers for disposal units; structural stability of backfill, wastes, and covers; contact of wastes with standing water; disposal site drainage; disposal site closure and stabilization; elimination to the extent practicable of long-term disposal site maintenance; inadvertent intrusion; occupational exposures; disposal site monitoring; and adequacy of the size of the buffer zone for monitoring and potential mitigative measures [URCR R313-25-7(2)].

**Basis**: The buffer zones associated with the CAW disposal embankment are described in Section 3.1.11 of the CAW Embankment LAR (Energy*Solutions*, 2011b) and are justified by the fact that the applicable CAW embankment conditions are nearly identical to those approved by the Division for CA and CAN disposal embankments. Sections 3.1.5 and 3.3.5 of the 2005 LRA discuss the design criteria, including the justification and the conditions evaluated. The buffer zones are depicted as strips of ground lying between the edges of the disposal cell footprint (waste limits of the proposed embankment) and the respective fencelines, as shown on Drawings 10014-C01 and 10014-U01 included in Energy*Solutions* (2011a and 2011b). Drawing 10014-U01 also includes the northing and easting coordinates of the proposed CAW embankment buffer zone. As described in responses to Division interrogatories, the outer limit of the buffer zone will be located so that a minimum of 97.7 ft will exist between the design waste limit and the inner boundary of the buffer zone surrounding the CAW embankment. This buffer zone width exceeds the design requirement of 94 ft.

The distance from the toe of waste to any property boundary is no less than 300 ft, in compliance with the facilities Conditional Use Permit issued by Tooele County.

Groundwater monitoring wells are located within the buffer zones.

The dimensions of the proposed CAW buffer zones equal or exceed those approved for the CAN embankment and the 2005 LRA. The conditions upon which the buffer zone is based are similar. The CAW embankment information and analyses demonstrate that the buffer zones of the CAW embankment will perform at least as well as corresponding items approved for the CAN embankments and the 2005 LRA (2005 CAN SER Sections 1.0 and 3.0; 2005 LRA SER Sections 3.1.5 and 3.3.5; URS Corporation 2005a; 2005b).

Based on the information summarized above, the Division concludes that the proposed buffer zones for the CAW embankment are acceptable.

***References:***

Energy*Solutions*, 2011a; 2011b

URS Corporation, 2005a; 2005b

#### 4.2.1.5.2 Principal Design Criteria – Buffer Zone

**Requirement 2507-3:** Descriptions of the principal design criteria and their relationship to the performance objectives [URCR R313-25-7(3)].

**Basis**: The design criterion, established for the buffer zone, is that it be adequately sized to allow site monitoring and corrective measures to be performed, if necessary.

The dimensions of the proposed CAW buffer zones exceed those approved for the CAN embankment and the 2005 LRA. The conditions upon which the buffer zones are based are similar. The CAW LAR analyses demonstrate that the buffer zones of the CAW embankment will perform at least as well as corresponding items approved for the CAN embankments and the 2005 LRA (2005 CAN SER Sections 1.0 and 3.0; 2005 LRA SER Sections 3.1.5 and 3.3.5 [URS Corporation 2005a; 2005b]).

Based on the information summarized above, the Division concludes that the Licensee's proposed CAW buffer zones are acceptable.

***References:***

URS Corporation, 2005a; 2005b

#### 4.2.1.5.3 Design Basis Conditions and Design Criteria Justification – Buffer Zone

**Requirement 2507-4:** Descriptions of the natural events or phenomena on which the design is based and their relationship to the principal design criteria [URCR R313-25-7(4)].

**Basis:** Justification provided by the Licensee for the selected buffer zone criteria and a buffer zone width no less than 94 ft included consideration of the following factors:

- Site monitoring is required during the 100-year period of institutional control to confirm performance of the disposal facility;
- Should unacceptable migration of radionuclides be identified, through the above monitoring program, adequate area must be available for implementation of corrective measures;

- Utah's Water Quality Rules state: "The distance to the compliance monitoring points must be as close as practicable to the point of discharge." The location of the monitoring wells, therefore, is determined by the cell geometry and other related cell configuration;
- Section 4.3.6 of SRP 4.3, "Waste Disposal Operations,) of NUREG-1200 (NRC 1994), states, "An acceptable buffer zone shall be a minimum of 30 meters wide around the entire facility." Although the proposed buffer zone is slightly less than that identified by the NRC as acceptable, the Division has assessed and has accepted the minimum distance of 97.7 ft between the toe of waste and the outer limit of the buffer zone. Additionally, the Licensee's property boundary is at a distance of at least 300 ft from the limits of waste disposal; and
- The 90-foot distance to a monitoring well found in the Statement of Basis for the Licensee's Groundwater Quality Discharge Permit (GWQDP), No. UGW450005 (LRA Section 3.3.5 [URS Corporation 2005b]).

The normal design condition evaluated by the Licensee for the buffer zone includes the condition where site-monitoring activities are performed and no unacceptable releases occur from the embankment. Under the normal condition of no releases, the Licensee noted, in Section 3.3.5 of the 2005 revision of the LRA, that the monitoring network within the buffer zone would not be necessary and the design of the buffer zone and system would be adequate.

The abnormal design condition evaluated for the buffer zone assesses adequacy of the buffer zone allowing response to a hypothetical contaminant release. The Licensee referred to groundwater infiltration and transport modeling showing that no contaminants would reach the compliance groundwater monitoring wells within 500 years, provided that Class A waste radionuclide inventories for certain radionuclides are limited to be at or below maximum allowable values as determined through by the modeling (Whetstone Associates 2011b) as described in Section 4.3.1 of this SER. The groundwater monitoring wells would be located approximately 90 ft from the edge of the waste embankments, within the boundary of the buffer zone. Based on this finding, the Licensee concluded that if contaminants were to be detected at the monitoring wells within the 100-year monitoring period, remediation measures could easily be accommodated due to the extremely slow linear velocity of the groundwater underlying the site area (2.74 ft/year, derived in Section 6.2.4 in Whetstone Associates 2011b). The Licensee has also indicated that the Licensee's property boundary is located at least 300 ft from the edge of waste; allowing adequate space as well as time for implementation of remedial measures.

The Licensee did not conduct an analysis of any accident condition for the buffer zone since such analyses are not indicated by NUREG-1199 (NRC 1991).

Based on the foregoing summary of information contained in the CAW Embankment LAR and other relevant documents the Licensee has submitted, the Division concludes that the requirements of URCR R313-25-7(4) as they pertain to the buffer zone have been met.

***References*:**

US Nuclear Regulatory Commission, 1991; 1994

Whetstone Associates Inc., 2011b

### 4.2.2 Description of Site Closure Plan

**Requirement 2507-7:** The application shall include certain technical information. The following information is needed to determine whether or not the applicant can meet the performance objectives and the applicable technical requirements of URCR R313-25: A description of the disposal site closure plan, including those design features which are intended to facilitate disposal site closure and to eliminate the need for active maintenance after closure [URCR R313-25-7(7)].

**Basis:** Fundamentally, the Licensee's proposed procedures for completing site closure, including closure of the proposed CAW embankment, are unchanged from those already approved for the CA and CAN embankments (URS Corporation 2005a; 2005b). Due to larger size of the proposed CAW embankment, the timing and phasing of final closure activities associated with the proposed CAW embankment will necessarily change relative to the previously proposed CA and CAN embankment timetables (Energy*Solutions* 2011a; 2011b). Before the final portion of the CAW embankment is closed, all on-site facilities will be decommissioned and demolished. Decommissioning and demolition may involve any of the following activities:

- Decontamination as necessary prior to release,
- Demolition,
- Disposal on site,
- Release for unrestricted use and
- Restoration to required final condition.

Once all decommissioning waste, requiring on-site disposal, has been placed in the CAW embankment, the interim cover will be placed and monitored as required for differential settlement.

The CAW embankment will be progressively closed as waste placement in portions of the embankment is completed. An interim cover system is first applied and allowed to settle, consolidate, and stabilize for at least one year. Once the interim cover is demonstrated to be stable within acceptable limits, settlement monitors will be placed and the final cover system constructed.

The design and construction of the CAW embankment will facilitate disposal site closure and are intended to eliminate the need for active maintenance after closure. Principal design features and their characteristics were chosen to support the final condition that the facility and its components must achieve as regards to stability and limits on environmental releases. This condition is required without the assistance or intervention of any individual or organization following closure.

The information contained in relevant documents the Licensee has submitted to support its proposal to develop and operate the CAW embankment indicate that the requirements of URCR R313-25-7(7) will have been met to the extent possible at the date of issuance, well in advance of actual facility closure. A description of decontamination and decommissioning procedures is provided in Appendix U of the 2005 LRA and applies to the proposed CAW embankment.

The site closure plan is nearly identical to that previously approved for use in the CA and CAN disposal embankments and is also acceptable for use in the CAW Embankment LAR. Based on

the information summarized above, the Division concludes that the Licensee's proposed closure plan for final closure of the proposed CAW embankment is acceptable.

***References:***

Energy*Solutions*, 2011a; 2011b

URS Corporation, 2005a; 2005b

### 4.2.3 Quality Assurance Programs

**Requirement 2507-10**: The application shall include certain technical information. The following information is needed to determine whether or not the applicant can meet the performance objectives and the applicable technical requirements of URCR R313-25: Descriptions of quality assurance programs, tailored to low-level waste disposal, including audit and managerial controls, for the determination of natural disposal site characteristics and for quality control during the design, construction, operation, and closure of the land disposal facility and the receipt, handling, and emplacement of waste [URCR R313-25-7(10)].

**Basis:** The Licensee's QA Program is largely unchanged from the approved 2005 LRA. The information contained in the 2005 LRA, and other relevant documents the Licensee submitted, indicate that the requirements of URCR R313-25-7(10) have been met. The Quality Assurance Manual (QAM) in Appendix T of the 2005 revision of the LRA document provides a general description of the QA program. Although the Quality Assurance Program (QAP) document does not reference specific QA and implementing procedures tailored to LLRW disposal, Section 3.0 of the 2005 revision of the LRA discusses the CQA/QC Manual. These documents are tailored to a LLRW disposal facility. In addition, the operating procedures in the 2005 LRA supplement the general requirements of the QAP.

The Licensee's description of the QAP to be used for the ongoing activities relies on the same description presented above and related appendices of the 2005 revision of the LRA. The QAP is defined by the following documents:

- Quality Assurance Manual;
- Operating Procedures Manual;
- Safety and Health Manual and the
- Construction Quality Assurance/Quality Control Manual.

Implementation of the procedures in these documents provides adequate controls to ensure the quality of activities during the design, construction, operation and closure of the LLRW disposal facility and during the receipt, handling, and emplacement of waste.

Section 9.0 of the 2005 revision of the LRA provides a general description of the QAP. This section describes how the Licensee ensures the independence and authority of the QA program and the QA personnel. It also describes the reporting relationship between contractor QA personnel, the Licensee's QA personnel and the Licensee's management.

The QAP is presented in Appendix T of the 2005 revision of the LRA. The QAP commits to implement managerial controls to ensure the accuracy, reproducibility, and documentation of quality affecting activities. The CQA/QC Manual describes the procedures used to ensure the

quality of construction activities. The CQA/QC Manual provides a description of procedures that control inspection, approvals, change control, documentation, and construction project plans.

The Operating Procedures are presented in Appendix C of the 2005 revision of the LRA. These procedures describe the steps used to ensure and document quality affecting operational activities. Waste receipt, handling, and emplacement procedures are in the LLRW Operations Manual. As procedures are revised copies are given to the Division,

Appendix T of the 2005 revision of the LRA describes how audits are scheduled, implemented, reported, and documented. The controls used to ensure the independence, control, and reporting relationships of auditing personnel are described in the manual. In addition, response to non-conformances and corrective action requests are described in the manual.

The QAP, as described in the 2005 LRA, contains adequate controls to ensure the quality of activities performed at the Clive Facility.

***References:***

Energy*Solutions*, 2012

### 4.2.4 Environmental Monitoring Program

**Requirement 2507-12:** The application shall include certain technical information. The following information is needed to determine whether or not the applicant can meet the performance objectives and the applicable technical requirements of URCR R313-25. A description of the environmental monitoring program to provide data and to evaluate potential health and environmental impacts and the plan for taking corrective measures if migration is indicated [URCR R313-25-7(12)].

**Basis:** The information contained in the CAW Embankment LAR, and supporting documents to Round 1 and Round 2 Interrogatories the Licensee has submitted, indicate that the requirements of URCR R313-25-7(12) have been met.

The Licensee demonstrates in the CAW embankment LAR that the monitoring network is situated within (beneath) the proposed CAW embankment footprint and within the buffer zone. Construction of the CAW embankment will require removal of some monitoring locations as they are located within the footprint of the proposed CAW embankment (Energy*Solutions* 2011b, Figures 10014 C01 and 10014 U02. extracts from those two figures are reproduced below in Figure 4-1, and Figure 4-2). Specifically, the existing "Environmental Monitoring Plan" will require some modifications to remove certain existing monitoring wells and certain existing or proposed lysimeters that, if not removed, would be covered with waste since they are located within the footprint of the proposed CAW Embankment. A list of environmental monitoring devices that will be abandoned and/or relocated is provided in Table 4-12. A series of new monitoring wells will be installed to replace those wells that will require removal with construction of the CAW embankment. The locations of the proposed new wells (GW-142 through GW-147, GW-148 and GW-148D, GW-149, and GW-150) are depicted on Figure 4-1, and Figure 4-2. Four existing or previously proposed lysimeters, CL-W1, CL-W2, Cl-W3, and CL-N5, will require removal as their locations lie within the proposed CAW Embankment footprint. Nine new lysimeters (CL-C1 through CL-C8 and CL-N3) are proposed for installation

at various locations under the northern portion of the proposed CAW Embankment. Changes to the analytical parameters, matrices, or sampling/monitoring frequency, for the existing and new monitoring devices are not required or anticipated.

**Table 4-12 – Environmental Monitoring Stations to be Abandoned/Relocated.**

| Type | Location | Northing | Easting | Required Action |
|---|---|---|---|---|
| Air Monitoring Station | A-6 (At same location as device S-75) | See Drawing 07007 J01, January 5, 2012 (in Attachment 1 to Energy*Solutions* 2012a) | See Drawing 07007 J01, January 5, 2012 (in Attachment 1 to Energy*Solutions* 2012a)_____ | Install new Air Monitoring Station A-6 |
| Groundwater Monitoring Wells | GW-81 | See Drawing 10014 U02 | See Drawing 10014 U02 | Remove- inside footprint |
| | GW-82 | See Drawing 10014 U02 | See Drawing 10014 U02 | Remove- inside footprint |
| | GW-83 | See Drawing 10014 U02 | See Drawing 10014 U02 | Remove- inside footprint |
| | GW-84 | See Drawing 10014 U02 | See Drawing 10014 U02 | Remove- inside footprint |
| | GW-85 | See Drawing 10014 U02 | See Drawing 10014 U02 | Remove- inside footprint |
| | GW-86 | See Drawing 10014 U02 | See Drawing 10014 U02 | Remove- inside footprint |
| | GW-109 | See Drawing 10014 U02 | See Drawing 10014 U02 | Remove- inside footprint |
| | GW-110 | See Drawing 10014 U02 | See Drawing 10014 U02 | Remove- inside footprint |
| | GW-111 | See Drawing 10014 U02 | See Drawing 10014 U02 | Remove- inside footprint |
| | GW-112 | See Drawing 10014 U02 | See Drawing 10014 U02 | Remove- inside footprint |
| | GW-137 | See Drawing 10014 U02 | See Drawing 10014 U02 | Remove- inside footprint |
| | GW-138 | See Drawing 10014 U02 | See Drawing 10014 U02 | Remove- inside footprint |
| | GW-139/139D | See Drawing 10014 U02 | See Drawing 10014 U02 | Remove- inside footprint |
| | GW-140 | See Drawing 10014 U02 | See Drawing 10014 U02 | Remove- inside footprint |
| | GW-141 | See Drawing 10014 U02 | See Drawing 10014 U02 | Remove- inside footprint |
| Lysimeters | CL-W2 | See Drawing 10014 C01 | See Drawing 10014 C01 | Remove- inside footprint |
| | CL-W3 | See Drawing 10014 C01 | See Drawing 10014 C01 | Remove- inside footprint |
| | CL-W4 | See Drawing 10014 C01 | See Drawing 10014 C01 | Remove- inside footprint |
| | CL-N5 | See Drawing 10014 C01 | See Drawing 10014 C01 | Remove- inside footprint |

The Licensee provided documentation regarding an evaluation of the spacing of the groundwater monitoring wells, in Attachment 6 to the Energy*Solutions* 2011a LAR and in response to Round 1 and Round 2 interrogatories (Energy*Solutions* 2011b and Energy*Solutions* 2012a, respectively). The purpose of the evaluation was to demonstrate the efficiency of the proposed monitoring well network for detecting potential releases of constituents from the proposed CAW embankment. The information provided included a groundwater flow simulation using the Monitoring Efficiency Model (MEMO) Code to determine optimum well locations to detect potential releases with at least 95% efficiency. Initial modeling simulations used a series of model input parameters that were derived or estimated as described in Attachment 6 to Energy*Solutions* 2011a.

Specific information provided by the Licensee in response to Division requests related to the monitoring well spacing evaluation included a discussion of the basis for selecting the initially estimated values of 129.1 ft and 12.9 ft, respectively, for the longitudinal and transverse dispersivity values that were used in the initial MEMO Model simulations. These values were developed based on extrapolation of a correlation by Gelhar, et al 1992). Also, information by the Licensee included an alternative derivation of longitudinal and transverse dispersivity, based on a relationship developed by Xu and Eckstein 1995, resulting in revised values of 27.2 and 2.72 ft, respectively. The licensee provided a rationale for use of a hypothetical release source width of 3 ft and results of a sensitivity analyses using additional MEMO Model simulations using this assumed source width and the revised smaller (more conservative) longitudinal and transverse dispersivity values. The sensitivity analysis simulation results demonstrate that the effective efficiency of the proposed monitoring well network is equal to or greater than the targeted efficiency of 95%.

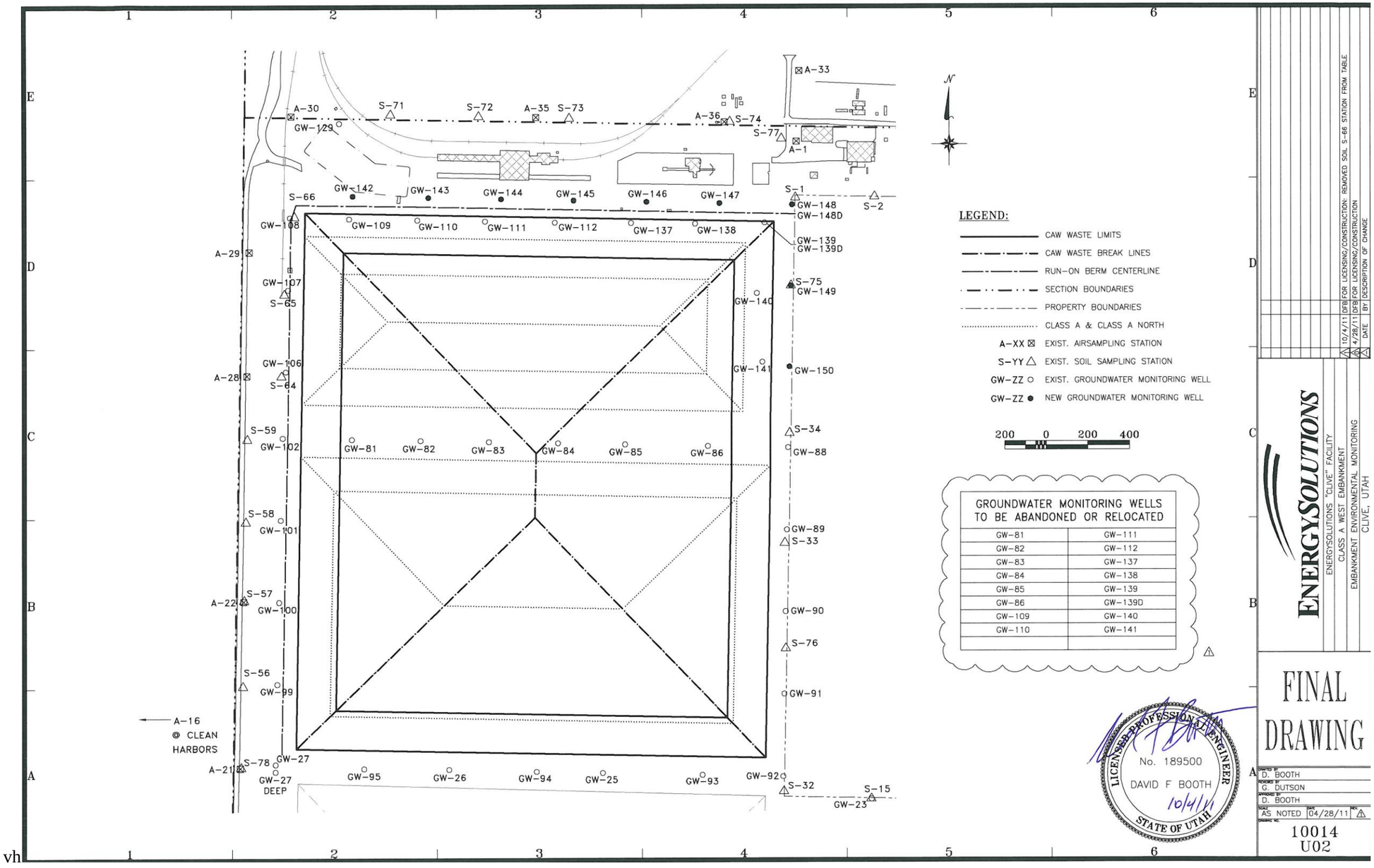


**Figure 4-1 – Locations of Monitoring Wells to be Removed and Proposed New Monitoring Well Locations.**

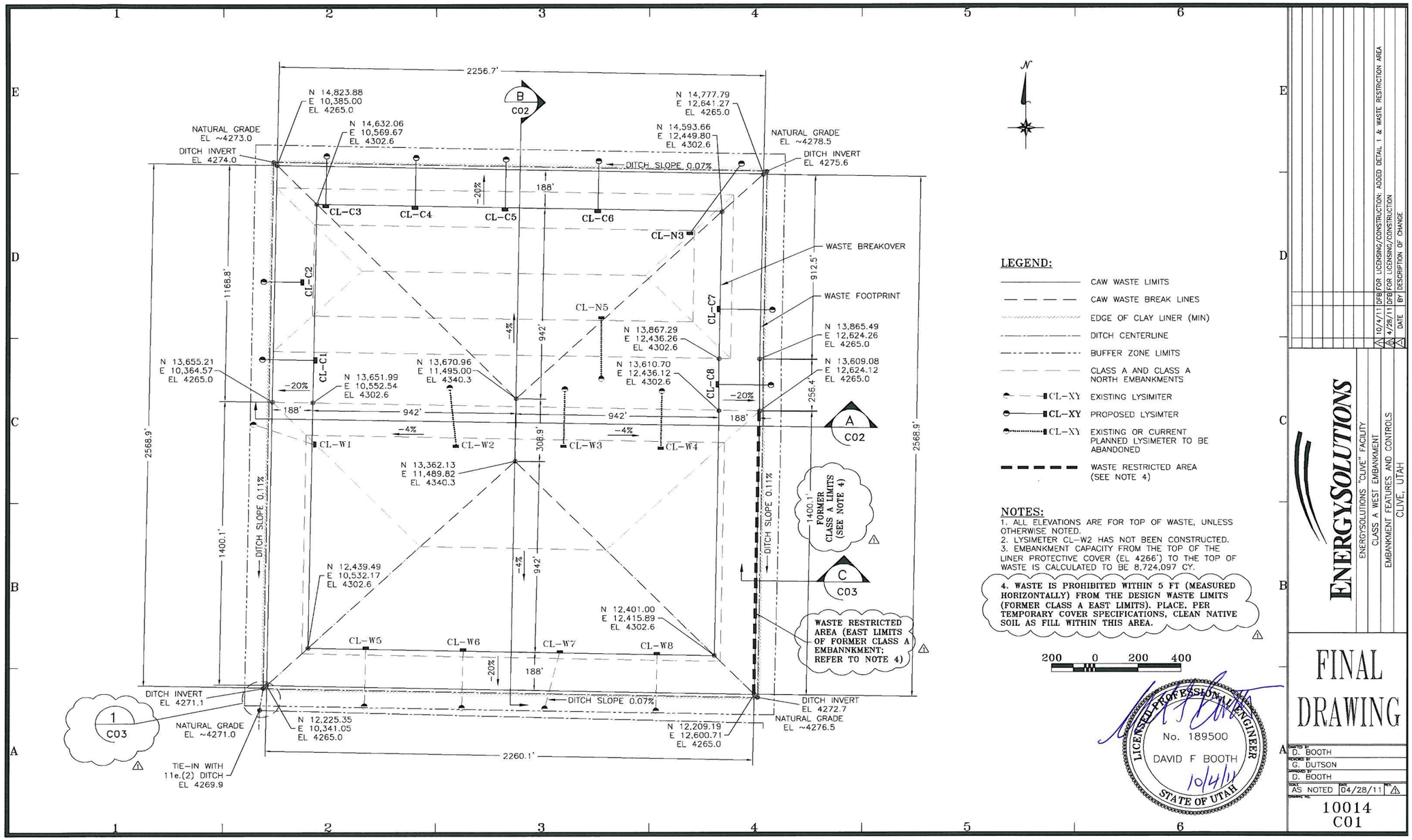


**Figure 4-2 – Locations of Lysimeters to be Removed and Proposed New Lysimeter Locations.**

**Air Monitoring**

To provide an additional level of monitoring for assessing potential airborne movement of contamination from the CAW embankment operations to the VITRO Facility to the east, the Licensee proposes to install an additional air monitoring station (A-6) on the east side of the proposed CAW embankment (see Attachment 1 to Energy*Solutions* 2012a.). The location for this station, at the same location as soil monitoring location S-75, was determined based on analysis of wind rose data indicating that the highest frequency wind speeds and directions generally occur from the south-southwest and from the northeast. Station A-6 was placed so that emissions generated near the VITRO fence could be identified. Station A-6 will be used as a data trending location not as a compliance monitoring point, and it will be monitored at the same frequency and schedule as the current air monitoring compliance network. Details regarding the proposed new Air Monitoring Station A-6 are included in a proposed revision to the Environmental Monitoring Plan, January 5, 2012, in Attachment 1 to Energy*Solutions* 2012a . The proposed location of the new device is shown on Drawing 07007 J01 dated January 5, 2012, in that document.

Based on the information summarized above, the Division concludes that the Licensee's proposed environmental monitoring plans and procedures for the CAW Embankment are acceptable.

***References:***

Energy*Solutions*, 2011a

Energy*Solutions*, 2011b

Energy*Solutions*, 2012a

## 4.3 URCR SECTION R313-25-8. TECHNICAL ANALYSIS

The CAW Embankment LAR involves limited aspects of URCR Section R313-25-8. The applicability of URCR Section R313-25-8 provisions to the review of the CAW Embankment LAR are summarized in Table 4-13. Those sections that do apply to the CAW Embankment LAR are addressed in the sections following the table.

**Table 4-13 – Applicability of URCR R313-25-8 Provisions to CAW Embankment LAR.**

| URCR R313-25-8 Section | | CAW Embankment LAR Requires Review? | Justification |
|---|---|---|---|
| **Number** | **Topic** | | |
| 8(1)<br>8(2)<br>8(3) | Site-Specific Performance Assessment (Recently promulgated requirements inserted in URCR R313-25-8, forcing previously existing requirements to be incremented) | No | CAW Embankment LAR does not involve disposal of waste addressed by this provision |
| 8(4)(a) | Performance Objectives; Protect the General Public | Yes | The CAW Embankment potentially affects releases from the disposal facility and therefore exposures received by the general public |
| 8(4)(b) | Performance Objectives; Protect Inadvertent Intruders | Yes | The CAW Embankment involves a thicker cover system that provides slightly greater protection to inadvertent intruders |
| 8(4)(c) | Performance Objectives; Protect Individuals During Operations | No | The Division has previously reviewed and approved operations that affect individuals during operations; the CAW Embankment does not change or affect operations |
| 8(4)(d) | Performance Objectives; Long-Term Stability | Yes | The CAW Embankment LAR changes the design of the CAN and CA cover systems; additional analyses of stability must be reviewed |
| 8(5) | Concentrated Depleted Uranium | No | The CAW Embankment LAR does not involve concentrated depleted uranium |

### 4.3.1 General Population Protection

**Requirement 2508-4(a):** The specific technical information shall also include the following analyses needed to demonstrate that the performance objectives of URCR Rule R313-25 will be met: Analyses demonstrating that the general population will be protected from releases of radioactivity shall consider the pathways of air, soil, ground water, surface water, plant uptake,

and exhumation by burrowing animals. The analyses shall clearly identify and differentiate between the roles performed by the natural disposal site characteristics and design features in isolating and segregating the wastes. The analyses shall clearly demonstrate a reasonable assurance that the exposures to humans from the release of radioactivity will not exceed the limits set forth in URCR Section R313-25-19 [URCR R313-25-8(4)(a)].

**Basis:** The protection provided to members of the general public is largely unchanged from what the Division approved following its review of the 2005 LRA. The information contained in the LRA, and other relevant documents the Licensee submitted, indicate that the requirements of URCR Subsection R313-25-8(1) have been met. Each of the major media pathways of this requirement is addressed in the following paragraphs. The principal sources of information for the exposure assessment are Sections 6.3 and 6.4 of the 2005 revision of the LRA, Appendix A of the 2005 revision of the LRA, and Section 5.3, Appendix F, Appendix J, and Appendix K of the License Amendment [LA] document (for the previously proposed disposal of Classes A, B & C waste) dated December 13, 2000 (ABC LA document) (Envirocare 2000c). Both normal operating conditions (Section 6.3.1 of the 2005 revision of the LRA) and accident scenarios (Section 6.3.2 of the 2005 revision of the LRA) were evaluated.

## Air Pathway

The potential releases of radionuclides through the air pathway were assessed for the facility. During operation of the facility, the transport of dust to the site boundary is affected mainly by the natural site characteristics. These characteristics include the wind speed, wind direction, and atmospheric stability conditions. The highest dose to the public is estimated to occur during operations from the atmospheric pathway at 10.2 mrem/yr. The Licensee states in LRA Section 6.3.1.1, "Control of Windborne Dispersion," that engineering and operational controls are in use to prevent the resuspension and dispersion of particulate radioactivity. Waste generators are normally required to ship bulk soil-type waste at a moisture content that allows movement without creating visible dust. Water spray is used in the cells as needed to prevent resuspension of radioactivity. The railcar rollover facility is now an enclosed area, further reducing the potential for a measurable airborne release at the boundary. Haul roads are wetted and maintained to prevent the resuspension and dispersion of particulate radioactivity. Polymers are spread on inactive, open areas to bind the surface and prevent resuspension. The Licensee also placed air samplers and reviewed the data to identify if an airborne situation is developing that might require corrective actions.

After final placement of the waste and closure of the disposal embankment, the facility design prevents any further migration of radioactivity through the air pathway because all waste will be beneath a thick earthen cover.

As discussed in Appendix A to the 2005 revision of the LRA, the Licensee demonstrated that the maximum dose to a member of the public was less than 25 mrem/yr, even if the individual is continually present at the disposal site boundary. The analysis estimates the quantities of radioactively contaminated dust suspended into the atmosphere from the unloading facilities, the hauling activities, and from waste placement in the disposal cells – under normal operating conditions. The waste concentrations used as the source term in the atmospheric transport

calculations are the average concentrations accepted at the facility in the past as listed in Appendix J of the 2005 revision of the LRA.

Radon releases will be negligible because the cover design includes a clay radon barrier designed to limit the surface radon flux to less than 20 $pCi/m^2$-s, resulting in potential radon exposures well within limits. The design is based on the disposal of uranium mill tailings, which are higher in radium-226 than the Class A waste.

For accident conditions, dust or particulate matter could be released to the atmosphere and inhaled by individuals. The application evaluates a tornado and severe wind, train derailment, truck turnover or collision, and truck fire. All analyses show that the maximum dose to a member of the public is less than 25 mrem/yr, even if the individual is continually present at the disposal site boundary.

In public comments during hearings on the Division's previous Siting Evaluation Report for the proposed Class A and Class B disposal facility, concern was expressed over the potential that the proximity of the U.S. Air Force bombing test range might create conditions inconsistent with the safe operation of the proposed facility. In its response to Interrogatory 2523-11, the Licensee provided information to defend the proposed licensing action. The Licensee defends the safety of the proposed facility by asserting that ". . . the probability of a military aircraft crash or accidental bomb drop onto the site is extremely remote. . ." The Licensee also compares the probability of such an incident to that nearer Hill Air Force Base, where the consequences would be much more severe. Given the occurrence of such an incident, the Licensee argues that the potential dispersal of radioactive materials would be limited to the immediate vicinity of the proposed facility and would be cleaned up at the expense of some other entity. The Licensee demonstrates that the proposed facility is located outside restricted airspace and concludes that the probability of such an accident involving the facility is insignificant.

## Soil Pathway

The soil pathway involves the exposure of the public to contaminated soil from the facility. If an exposure occurred, doses could result from external radiation or ingestion of soil on dirty hands. The primary site characteristics that prevent the likelihood of such exposures during operations is the site's remote location, the low population density in the site vicinity and the lack of natural resources to provide for population expansion. Therefore, this pathway was not considered.

The design of the embankment also contributes to minimizing exposures to contaminated soil by members of the public. After closure of the embankment, all contaminated soil will be covered in the disposal cells. The cover system contains a surface layer of riprap to protect against erosion and human intrusion. Beneath the riprap, the cover system contains a drainage layer and a clay radon barrier. The thickness of the cover system prevents penetration of the waste by roots or burrowing animals. No contaminated soil material is expected to rise to the ground surface, or be otherwise removed from the disposal cell.

During operation, the facility will be monitored as described in Appendices Q and R of the 2005 revision of the LRA, to ensure that no releases or doses have occurred via the soil pathway.

## Groundwater Pathway

The groundwater pathway was analyzed in Whetstone Associates, Inc. (2011b, 2012). The primary site characteristics that prevent public exposures via the groundwater pathway are the very poor groundwater quality at the site, the low population density, and the relatively slow groundwater flow velocities. The groundwater is not potable because of its very high concentration of salts. This characteristic alone prevents any appreciable consumption of the water by humans or livestock. The horizontal groundwater flow velocity is approximately 0.8 meters per year, resulting in groundwater travel times of approximately 33 years from the toe of the side slope of the embankment to the compliance well. .

Additionally, several embankment design features provide protection of the public from exposure via the groundwater pathway. The cover system to be placed over the disposal waste allows very little water to flow into the disposed waste. This limits the contamination of the groundwater by minimizing the contact of water with the waste. Another design feature of the disposal embankment is the bottom clay liner below the disposed waste. The clay absorbs many of the radionuclides and slows their potential release from the cell and subsequent transport to the water table aquifer.

In its assessment of the groundwater pathway, the Licensee demonstrated that the infiltration and radionuclide transport models show that any disposed Class A waste will satisfy all of the groundwater protection criteria, provided that the concentrations of six radionuclides (Bk-247, Ca-41, Cl-36, I-129, Re-187, and Tc-99) are limited to the concentrations used in the transport model. The six modeled radionuclides in Class A concentrations were projected to exceed the groundwater protection criteria at the compliance wells located 90 ft from the nearest edge of waste, in less than 500 years, based on the side slope cover design infiltration rate of 0.168 cm/yr. All other radionuclide concentrations are limited only by what is necessary for the waste to qualify as Class A waste. The groundwater model provides a conservative estimate for the groundwater exposure scenario. The results of the model, presented in the CAW LAR, determined that the thickness of the radon barrier does not change the results.

Infiltration through the cover system was modeled with the HELP code. The model used precipitation data from over seventeen years of measurements at Clive Utah. The average annual precipitation measured at Clive, from 1993 to 2009, is 8.53 inches per year. Based on site specific evaporation, precipitation, temperature, and solar radiation data 100 years of synthetic data were generated using a synthetic weather generator. The HELP model used the measurements and generated synthetic rainfall data that varied from year to year about the appropriate long term average for Clive. The rainfall totals used in the HELP model vary from year to year in the same way that actual rainfall varies from year to year. This approach is more realistic because it allows the calculations to account for yearly variations about the mean rainfall. Both the top slope and side slopes of the cell were evaluated. The net water infiltration through the cover is calculated as 0.09 cm/yr for the top slope and 0.168 cm/yr for the side slopes.

Infiltration modeling using the HELP codes is sensitive to the choice of value for the evaporation zone depth, (EZD) parameter that represents the depth below which evaporation at the cover surface has no effect on moisture movement. The EZD influences the storage of water near the

surface of the cover which affects the computation of evaporation and runoff. The choice of a value for EZD has been the object of much discussion between the Licensee and the Division. To address the uncertainty surrounding the choice of value for EZD, the Licensee designed and acquired data for many years from a Cover Test Cell (CTC) with the objective of investigating moisture movement within the cover system on surface conditions. The Division's assessment of the CTC data revealed problems that require the Licensee's attention. The Division is working with the Licensee to resolve problems encountered in assessing CTC data. Until such time as the concerns with the CTC are resolved, the EZD depth used by the Licensee in any HELP infiltration modeling will be considered an unresolved issue to the Division. To allow resolution of this issue, a new license condition will be added to the facility's license to require the Licensee to eliminate the concern by designing a modified cover system and submitting a performance assessment for that cover system that demonstrates that the modified cover system provides equal or better performance than that modeled in the infiltration and transport model for the currently propose cover design, as described in this SER.

A UNSAT-H model was used to calculate the moisture contents of the soils and waste from the ground surface down to the shallow unconfined aquifer. The moisture contents were necessary to calculate the flow velocity of infiltrating water through the soil and waste profile. The UNSAT-H model was run numerous times to approach quasi-steady-state conditions. The resulting moisture content represented the expected long-term moisture content in the CAW embankment and underlying subsurface materials. The CAW embankment cover and liner clay layers retain high volumetric moisture contents (approximately 0.42 v/v) while waste and native soil layers retain relatively low moisture contents (less than 0.05 v/v). For the modeled top slope, with 0.090 cm/yr infiltration, the average moisture content stabilized at 0.0501 v/v for the waste, and 0.0362 v/v for the native soil below the embankment. The predicted volumetric moisture contents for the CAW embankment modeled side slope is slightly higher than for the modeled top slope, due to a higher infiltration rate. For the modeled side slope, with 0.168 cm/yr infiltration, the average moisture content in the waste stabilized at 0.0541 v/v, and in the native soil below the embankment at 0.0420 v/v. The final moisture content from the UNSAT-H model is used as input in the (PATHRAE) contaminant transport model.

Radionuclide transport was modeled with the PATHRAE-RAD code. The model calculated the release and transport of radionuclides from the bottom of the waste cell, through the unsaturated zone, and horizontally through the shallow unconfined aquifer to a compliance-monitoring well located 90 ft from the edge of the disposal facility. The groundwater model included many conservative assumptions that helped to ensure that the radionuclide concentrations at the compliance monitoring well were not underestimated. For example, the distance from the bottom of the waste to the water table of the aquifer was decreased from its actual value by 2.04 ft to conservatively account for the effects of the capillary fringe at the water table and to account for variations in the water table level. No delay factors for waste container life were used to delay the onset of radionuclide releases from Class A waste under side slopes.

The transport modeling shows that, for most radionuclides at the Class A limits, groundwater protection levels are met for 500 years after disposal of the waste. Groundwater protection levels are met for all radionuclides, provided that specified concentration limits in the waste are imposed, depending on the waste placement area within the proposed CAW embankment, for

either Bk-247, Ca-41, and Cl-36 (topslope area), or Bk-247, Ca-41, Cl-36, I-129, Re-187, and Tc-99 (sideslope area). Even though the groundwater is not potable, potential doses to the public from groundwater were calculated and meet all applicable limits.

Another conservative assumption is that the water table gradient is 0.001 (Whetstone Associates, Inc., 2012). The hydraulic conductivity was based on measured values from the site. The value used in the model is 7.53 x 10-4 cm/sec. which is the value at the geometric mean, which is 6.16 x 10-4 cm/sec., plus one standard deviation. This resulted in the model using a horizontal interstitial groundwater velocity of 0.819 m/year.

With few exceptions, the Class A radionuclide concentrations were set at the Class A limits specified in 10 CFR 61. Exceptions were made for radionuclides whose specific activities were less than the Class A limit, in which cases the lesser specific activity was used. The only other exceptions were the radionuclides mentioned above (Bk-247, Ca-41, Cl-36, I-129, Re-187, and Tc-99) whose concentrations were set lower than the applicable Class A limit in order to meet the groundwater protection criteria.

## Surface Water Pathway

Due mainly to the natural site characteristics, there are no radioactive releases expected through the surface water pathway. The annual precipitation is low and the evaporation is high. No permanent surface water bodies exist in the site vicinity. In addition, the site is far from populated areas. The Class A embankment design features also minimize the potential for releases by the surface water pathway. Embankment design includes drainage ditches around the waste disposal areas. After precipitation events, the ditches divert run-off from the disposal cell cover to areas away from the disposal cells to minimize contact of water with waste.

## Vegetation

The application evaluated the effects of vegetation on the cover system. Vegetation had two primary effects on the cover system: increasing the hydraulic conductivity of the cover material and root clogging of the lateral drainage layers. During operation of the embankment, releases and doses through the plant pathway are limited by the design, operation, and maintenance of the facility. Plants on the site will be removed and prevented from contacting waste materials. After final placement of the cover, releases and doses from the plant pathway are limited by the site's natural characteristics, which include low rainfall, thin plant cover, and the presence of plants that are highly efficient at removing water from the soil and transpiring the moisture back to the atmosphere.

The plant uptake pathway is not a viable exposure pathway at the embankment because of natural site characteristics and design features of the embankment. Exposure by the plant uptake pathway could occur by: (1) the production of food crops in contaminated soil at the site, and (2) root intrusion into the waste by native plants that are subsequently consumed by humans or animals.

The natural site characteristics help prevent exposures via the plant uptake pathway because there is insufficient water at the site to produce food crops. In addition, saline soils present at the site limit the number and type of plant species that can tolerate such conditions. Additionally,

there are few deep-rooted native plants in the site vicinity and relatively few plants of any kind are predicted to become established on the rock riprap-capped CAW embankment cover system at and following closure of the embankment.

Design features of the facility also help prevent exposures via the plant uptake pathway. A thick earthen cover will be placed over the disposal cells to make the waste inaccessible to plant roots after closure of the facility. The possibility of native plants extending their roots into the waste is prevented by the configuration of the earthen cover with the lower Type B filter functioning as a capillary break with minimal moisture storage to attract or even support plant roots. After closure, some limited plant species may set roots in the overlying sacrificial soil, which possesses a higher moisture storage capacity. The overall scarcity of deep-rooted plant species in the site vicinity and the configuration of the earthen cover will offer an inhospitable environment for extension of these types of roots into the waste.

**Burrowing Animals Pathway**

Burrowing animals are not considered a viable exposure pathway, given the combination of site characteristics and design features. Burrowing animals at the site include jackrabbits, mice, foxes, and ants. The first deterrent to burrowing animals is the riprap erosion barrier. While this may be only partially effective in deterring animals, the primary protective barrier is the clay radon barrier. The burrowing species at the site are not known to dig to such a depth that their burrows could penetrate through the entire cover and into the waste. During operation of the facility, releases and doses from the burrowing animal pathway will be prevented by the design, operation, and maintenance of the facility. Burrowing animals will be prevented from contacting the waste materials. After final placement of the cover, the design features of the facility, primarily the thick soil cover that isolates the waste from burrowing animals, will control releases and doses. Because of this, the likelihood of any animals burrowing through the entire 0cover and exhuming waste materials is sufficiently low that it was not included in the safety assessment calculations. As such, the burrowing animals' pathway is not expected to result in any exposures to humans.

**Doses to the Public**

Appendix A of the 2005 revision of the LRA shows that doses to members of the public will be within established regulatory limits. The highest dose to the public is estimated to occur during operations from the atmospheric pathway at 10.2 mrem/yr. The groundwater pathway is not viable because of the high salinity and general poor quality of the groundwater; however, it was evaluated via the groundwater modeling and found to be less than 4 mrem/yr.

***References*:**

Envirocare of Utah, Inc. to Utah Division of Radiation Control, 2000c

Whetstone Associates, Inc., 2011b, 2012

### 4.3.2 Protection of Inadvertent Intruders

**Requirement 2508-4(b):** The specific technical information shall also include the following analyses needed to demonstrate that the performance objectives of URCR R313-25 will be met: Analyses of the protection of inadvertent intruders shall demonstrate a reasonable assurance that the waste classification and segregation requirements will be met and that adequate barriers to inadvertent intrusion will be provided [URCR R313-25-8(4)(b)].

**Basis**: Utah regulations require special provision to protect inadvertent intruders from disposed LLRW only for Class C LLRW. Since only Class A waste will be disposed of in the proposed CAW embankment, no special intruder barrier, as defined by Utah regulations, is required. In a more general sense, however, intruder protection is required by the performance objective stated in URCR R313-25-20. The intruder protection requirement is satisfied by:

- Remoteness of the facility from large population centers,
- Lack of resources at the site,
- Provision of a cover system to separate the waste from the atmosphere,
- Use of CLSM,
- Erection and maintenance of physical access barriers at the closed facility,
- Maintenance of access controls at the closed facility and
- Placement of monuments denoting the locations of embankment boundaries.

The NRC evaluated the long-term hazards of LLRW disposal in its draft and final environmental impact statements of the regulation of LLRW disposal (NUREG/CR-4370). Radiation hazards associated with Class A waste are such that, should intrusion into disposed waste occur following the 100-year institutional control period, doses were projected to be within acceptable limits.

Since the Licensee will dispose only Class A LLRW, it implicitly complies with this regulatory requirement. Based on the information summarized above, the Division concludes that the Licensee's proposed CAW embankment provides adequate intruder protection.

***References*:**

Envirocare of Utah, Inc., 2005c

Streamline Consulting, LLC, 2005

### 4.3.3 Long-Term Stability of Disposal Site

**Requirement 2508-4(d):** The specific technical information shall also include the following analyses needed to demonstrate that the performance objectives of URCR R313-25 will be met: Analyses of the long-term stability of the disposal site shall be based upon analyses of active natural processes including erosion, mass wasting, slope failure, settlement of wastes and backfill, infiltration through covers over disposal areas and adjacent soils, and surface drainage of the disposal site. The analyses shall provide reasonable assurance that there will not be a need for ongoing active maintenance of the disposal site following closure [URCR R313-25-8(4)(d)].

**Basis:** The licensee has evaluated the long-term stability of the proposed CAW embankment, including analyses of the effects of natural processes that include erosion, mass wasting, slope failure, foundation settlement and settlement of wastes and backfill, infiltration through the cover and adjacent soils, and surface drainage at the disposal site. The analyses were developed to provide reasonable assurance that there will not be a need for ongoing active maintenance of the CAW Embankment cell and associated drainage features following final closure of the CAW Embankment. Collectively, the analyses completed for the proposed CAW Embankment demonstrate, to the Division's satisfaction, as further described below, that long-term stability of the CAW Embankment will be achieved with reasonable assurance.

The information provided in the Energy*Solutions'* Responses to Round 1, 2, and 3 Interrogatories (Energy*Solutions* 2011b; 2012a; 2012b), in the CAW Embankment LAR (Energy*Solutions* 2011a; 2011b) and in supporting analyses indicate that the requirements of URCR R313-25-8(4) have been or will be met, contingent upon the successful resolution of issues related to the EZD value and the resulting requirement for a modified embankment cover design, and the expected distortion of the cover radon barrier layer (see Section 5.0) . The basis for this affirmative finding, with the resolution of these stated contingencies, is presented in:

- Descriptions and justifications of the principal design features of the proposed facility provided in Sections 3.1 through 3.4 of the CAW Embankment LAR; and in subsequent Licensee submittals as described in this SER;
- Summaries of the principal design features, design criteria, and projected performance of the principal design features related to long-term stability provided in updated Tables 3.2 through 3.4 of the CAW Embankment LAR and in subsequent Licensee submittals as described in this SER; and
- Information submitted by the Licensee pertaining to the principal design features design criteria, and projected performance of the principal design features for the previously proposed CAC embankment (e.g., see AMEC 2005a and 2005b; Energy*Solutions* 2006) addressing long-term stability of that proposed embankment.

Table 3-2, Table 3.4 and the text of the CAW Embankment LAR were revised and updated from the information presented in the 2005 LRA to reflect: (1) information published after the 2005 LRA was submitted that is relevant to the design methodologies used for designing the CAW embankment; and (2) changes in the design of some principal design features that have been incorporated into the CAW Embankment design compared to the previously proposed CAC embankment design (Energy*Solutions* 2006). Such changes include:

- Change in thickness and gradation of the riprap layer lining the side slopes of the perimeter drainage ditch adjacent to the CAW embankment;
- Change in the thickness of, and particle gradation (filter) requirements for, the Type B Filter Zone layer used in the topslope and sideslope portions of the cover layer for the CAW Embankment; and
- Change in thickness of riprap used to line the sideslope portion of the CAW embankment perimeter drainage ditches.

Additionally, a possible change, depending on results of planned future testing of on-site soils proposed for use in constructing the CAW embankment cover, in the design criterion for

maximum allowable distortion of the cover may be invoked and applied to the CAW embankment design prior to constructing the cover to further mitigate against possible effects of long term differential settlement within the embankment. The principal design features have been designed in accordance with applicable guidelines that are appropriate for this type of facility to perform their required functions over the period of hundreds of years, such that the need for performing ongoing active maintenance of the proposed facility following facility closure will be minimized.

#### 4.3.3.1 Erosion

The Licensee submitted an updated set of rock cover design calculations and updated determinations of the PMP that demonstrate that the proposed CAW embankment cover has been designed to provide long-term stability of the embankment and to ensure that the cover will be capable of resisting damage by erosion resulting from surface water flows expected to occur during normal and abnormal precipitation conditions at the site (Attachment 10 to Energy*Solutions* 2012a and 2012bc). As described in Section 4.2.1 above, for evaluating potential erosion in the cover, the Licensee assumed a 100-year, 24 hour storm event for the normal precipitation condition, and a PMP 1-hr value of 6.1 inches of rain, as the abnormal precipitation condition (Table 3.2 of the CAW Embankment LAR. Updated erosion calculations were performed in accordance with guidelines provided in NUREG-1623 and with analytical methodologies recommended or developed in accordance with recommendations provided therein (Attachment 10 to Energy*Solutions* 2012b). These updated calculations include a revised erosion protection-related calculation for the CAW embankment sideslopes to reflect information and procedures that were published after the CAC Embankment LAR was submitted (e.g., Abt et al. 2008). The calculations regarded erosion resistance of round-shaped riprap placed on slopes and included additional refinements to the slope erosion protection analysis methodology (Abt and Johnson 1991) discussed in NUREG-1623 (NRC 2002).

The updated rock cover calculations demonstrate that the $D_{50}$'s of the rock riprap materials, proposed for use on the embankment topslope and sideslopes, exceed the minimum $D_{50}$ rock sizes required for ensuring long-term (1,000 years) erosional stability of the embankment, when evaluated in accordance with requirements and guidelines contained in NUREG-1623 and Abt et al. 2008. Additionally, the current approved version of the CQA/QC Manual requires that rock riprap materials used in the CAW embankment Cover have a weighted average aggregate rock score of 50 or more, in accordance with NRC NUREG-1623 guidelines.

Based on the information above, the Division concludes that the Licensee's analyses of the ability of external erosion protection measures, incorporated into the CAW embankment design, are adequate and that long-term stability of the CAW embankment against erosion will be achieved with reasonable assurance.

##### 4.3.3.1.1 Internal Erosion Within Cover

The Licensee submitted updated rock cover design calculations and used appropriate filter criteria (gradation and permeability criteria) recommended in NUREG/CR-4620, NUREG-1623, Cedegren 1989, and NRCS 1994 that demonstrate that the proposed CAW embankment cover has been designed to provide long-term stability with respect to minimizing potential long-term

internal erosion within the cover layers over the embankment's design life under normal and abnormal precipitation conditions at the site.

The updated calculations submitted by the Licensee demonstrate that the filter layer underlying the riprap meets the $D_{15}/D_{85}$ criteria as described in NUREG/CR-4620 for minimization of migration of the filter layer into the riprap. Furthermore, specifications on the sacrificial soil gradations ensure that migration of material between the sacrificial soil layer and the Type A Filter layer will be minimized. Additionally, the effectiveness of the Type A Filter Zone to minimize internal erosion of the underlying sacrificial soil layer was assessed by calculating the interstitial velocities associated with the rock. The calculations used methods described by Leps, 1973, Abt, et al. 1988, and Codell, et al. 1990. The calculations showed that, when comparing the calculated interstitial velocities to permissible velocities from Table 4.9 of NUREG/CR-4620, worst-case calculated interstitial velocities at the surface of the sacrificial soil layer would not be expected to cause erosion of that layer. Safety factors determined for the interstitial velocity are 1.48/0.20 = 7.40 for the top slope and 1.48/0.49 = 3.02 for the side slopes. The design filter layer, underlying the riprap, provides the necessary protection against rock migration through the layers and erosion of the underlying sacrificial soil layer. The calculations also demonstrate that the lateral drainage layer of the cover will not become plugged and therefore is expected to retain its permeability throughout the life of the embankment and protect the radon barrier from erosion.

#### 4.3.3.1.2 Long-Term Integrity of Drainage Systems

The Licensee submitted calculations that demonstrate that the selected characteristics of the proposed riprap materials, as summarized in Table 3.3 of the CAW Embankment LAR, that would be placed in and used to line the CAW Embankment perimeter ditches would be adequate to resist movement (internal erosion) of the riprap materials under flows projected to occur during normal and abnormal precipitation events at the site (Energy*Solutions* 2011a; Attachment 4 to Energy*Solutions* 2011b). For evaluating potential internal erosion in the ditches, the Licensee assumed (Table 3.2 of the CAW Embankment LAR) a 100-year, 24 hour storm event (2.4 inches) for the normal condition, and the PMP (a 1-hr value of 6.1 inches of rain, verified by calculations in Energy*Solutions* 2012b as being the most conservative PMP value for design use at the Clive site) as the abnormal condition. The updated drainage design calculations (Energy*Solutions* 2011b) were performed in accordance with guidelines provided in NUREG-1623 and with analytical methodologies recommended therein. In the updated calculations, the minimum average $D_{50}$ of the riprap lining the ditches required to prevent failure under abnormal ditch flow conditions was determined using methods (e.g., Johnson and Abt 1998; USACE 1994) recommended in NUREG-1623. In accordance with NUREG-1623 guidance, the "failure discharge" value [assumed flow rate during abnormal conditions] was increased by a factor of 1.35 to provide additional assurance that there would be no rock movement. Since the abnormal flow condition bounds the normal flow conditions, it leads to a more conservative case for evaluating the erosional stability of the drainage ditches.

Based on the information above, the Division concludes that the Licensee's analyses of the effects of erosion on long-term stability of the proposed CAW Embankment and perimeter

drainage ditches are adequate and that long-term stability of the CAW Embankment will be achieved with reasonable assurance.

#### 4.3.3.2 Mass Wasting

The area of the proposed CAW Embankment, at and immediately surrounding the Clive Facility, is relatively flat with no landforms or soil conditions present that would be prone to landslides, rock toppling or rock falls, debris flows, or other forms of mass wasting. Analyses of slope stability of the CAW Embankment (see Section 4.2.1.3.3) and of other disposal embankments at the Clive Facility demonstrate that all slopes will be stable in the long term. Based on this information, the Division concludes that the long-term stability of the proposed CAW Embankment would not be impacted by mass wasting.

#### 4.3.3.3 Slope Failure

The Licensee assessed performance of the CAW embankment under normal (static) and abnormal (seismic) conditions. Slope stability analyses were performed using the computer program GSTABL7® utilizing Spencer's Method for circular modes of failure-associated movement. The calculated minimum static factor of safety, based on use of drained shear strength values for the embankment and foundation materials, was determined to be greater than 1.5 (Attachment 5 to Energy*Solutions* 2011b). For assessing stability under seismic conditions, pseudostatic stability analyses of embankment slope stability were completed. The pseudostatic analyses considered both drained and undrained foundation soil strength parameters, and assumed a Peak Ground Acceleration (PGA) magnitude of 0.28g. The calculated minimum factor of safety for seismic conditions was determined to be greater than or equal to 1.2 (Attachment 5 to Energy*Solutions* 2011b). The most critical failure surface was predicted to extend through the deep clay unit of foundation soils and remains under the "break in slope". For calculated failure surfaces located entirely within the embankment, the lowest calculated factor of safety was found to be at least 1.7. In all cases, the stability of the embankment was found to be governed primarily by the height of the 5H:1V embankment side slope. At a height of 38 ft, the static and seismic stability of the CAW embankment was found to be acceptable. This projected safety factors exceed the safety factors required by the design criteria, *i.e.*, static factor of safety $\geq 1.5$ and seismic factor of safety $\geq 1.2$. The specified design criteria factors of safety of $\geq 1.5$ and $\geq 1.2$ for evaluating static and seismic slope stability are applicable to operating dams in the state of Utah. The Division considers that these factors of safety are conservative for the Lisensee's site and for the CAW embankment because the embankments: (1) are not designed to retain water such as a dam is designed to; and (2) have gentle side slopes (5H:1V) around the entire perimeter and lower total height compared to many dams in the western United States. Based on the foregoing summary of information, the Division concludes that the Licensee's analyses of potential slope failure in the CAW Embankment are adequate, and therefore that the requirements of URCR R313-25-8(4) as they pertain to the long-term stability of the CAW embankment have been met.

#### 4.3.3.4 Settlement

**Basis:** The Licensee estimated potential settlement magnitudes for both the CAW Embankment and the underlying foundation materials. These estimates are included in the 2011 Geotechnical Update Report (Attachment 5 to Energy*Solutions* 2011b). The Energy*Solutions* 2011a study estimated magnitudes and time rates of primary settlement and secondary settlements for the CAW embankment and the foundation materials underlying the embankment, and addressed the uncertainties and variabilities associated with the CAW embankment materials (Energy*Solutions* 2011a; Attachment 4 to Energy*Solutions* 2011b).

##### 4.3.3.4.1 Waste and Backfill Settlement

The 2011 AMEC study concluded that most of the settlement would occur during operations in the waste placement phase, prior to the final cover placement (Attachment 5 to Energy*Solutions* 2011a). The Licensee has proposed a plan to monitor and measure settlement prior to cover placement which will reduce the risk of uncertainties in estimating settlements. In 2005 a settlement study was performed to support design of the previously proposed CAC embankment, which consisted of available settlement data from Vitro and Energy*Solutions* embankments. The Licensee's review of the settlement data was utilized to predict performance of increased height embankment of the CAC embankment relative the Class A and CAN embankments. The results of that settlement analysis are adequate for the CAW embankment due to the CAW embankment's somewhat smaller height but identical 5H:1V sideslope inclinations. The fact that the waste types proposed to be disposed in the CAW embankment and waste placement and compaction procedures are unchanged for the CAW embankment compared to the CAC embankment, indicate that settlements would be expected to be less in the CAW embankment relative to the previously proposed CAC embankment.

##### 4.3.3.4.2 Differential Settlement

Results of analyses of differential settlement for the proposed CAW Embankment (see Section 3.0 and Table 3.4 of the CAW Embankment LAR) indicate that the projected maximum distortion amounts in the Liner of the proposed CAW Embankment are 0.001 and 0.007, under normal and abnormal conditions, respectively; and projected maximum distortion amount in the Radon barrier Layer in the Cover of the proposed CAW embankment under abnormal conditions is less than 0.01, which occurs for the case of bulk waste.

#### 4.3.3.5 Foundation Settlement

Foundation settlement for the proposed CAW embankment was evaluated in the 2005 study for the CAC Embankment and reevaluated in the 2011 CAW Embankment LAR (AMEC 2005a; 2005b and Energy*Solutions* 2011a; 2011b). Subsurface site characteristics as described in Attachment 5 to the 2011 CAW Embankment LAR (Energy*Solutions* 2011b) were used to define material boundaries and soil parameters. The computer program FoSSA® (2.0) was utilized to evaluate settlements of the foundation material due to loads imposed by the proposed CAW embankment (ADAMA Engineering, Inc., Computer program, FoSSA 2.0 Foundation Stress & Settlement Analysis, Copyright 2003 -2007). Results of the analyses indicate that: (1) settlements of the foundations soils are anticipated to be generally on the order of 12 to 16 inches; (2) the

foundations settlements are expected to be complete well before final cover is placed (within a 1-year period after waste placement); (3) monitoring data obtained from the interim cover layer over emplaced wastes is expected to primarily reflect embankment (i.e., waste) settlements and not foundation settlements; and (4) the maximum settlement in the foundation soil may be up to 24 inches. Based on the analysis, AMEC concluded that with primary and secondary foundation settlement incorporated into the cover design criteria, the magnitude and timing of foundation settlements, should not adversely impact drainage of the final CAW embankment cover.

A subsequent analysis identified potentially liquefiable sand-like layers in Unit 3, silty sand layers approximately 9 to 26 ft below the ground surface, and Unit 1, interbedded sand, silt and clay layers approximately 64 ft below the ground surface. The maximum depth investigated was approximately 100 ft. The characteristics of stratigraphic units 1 through 4 are summarized in Table 2.1 of Attachment 5 to Energy*Solutions* 2011a. The layers were evaluated with respect to their potential to liquefy or loose strength as a result of stresses induced by the design seismic event (AMEC 2012a). Post-liquefaction volumetric strain was analyzed in the identified liquefiable layers using a method developed by Ishihara and Yoshimine (1992). The analysis estimated settlements, due to post-liquefaction volumetric strain, ranged from 0 to approximately 0.68-inch. AMEC (2012a). Using relationships developed by Jeffries and Davies (1993) and Tokimatsu and Seed (1987), estimated settlements, due to post-liquefaction volumetric strain, ranged from 0 to less than approximately 0.65-inch.

AMEC (2012a) evaluated the potential for earthquake-induced lateral spread to occur at the site. Result of the evaluation indicated, based on criteria described in Youd et al. 2009, that due to the site's flat topography, the thin, discontinuous nature of liquefiable layers, and the generally dense subsurface soil profile with significant density variability across short distances and at variable depths, the likelihood of liquefaction-induced lateral spread is very low.

Additional analyses completed by AMEC (AMEC 2012a; 2012b) evaluated the potential for cyclic softening of "clay-like" soils underlying the site using the procedures published by Boulanger and Idriss (2004) and Boulanger and Idriss (2007). For the proposed CAW embankment, static factors of safety of 2.65 for a failure surface through Unit 2 and 4.19 for a failure surface through Unit 4 were computed for a hypothetical worst-case failure located near the embankment toe, based on consideration of static shear stresses present within the stratigraphic units under embankment loading conditions, and an embankment height ranging from 0 to 50 ft (25 ft weighted average height). For a hypothetical failure located away from the embankment toe, and for an assumed embankment height ranging from 0 to 5=60 ft (35 ft weighted average height), static factors of safety of 3.42 for a failure surface through Unit 2 and 5.28 for a failure surface through Unit 4 were computed. For evaluating these seismic factors of safety, values of cyclic stress ratio, cyclic resistance, and magnitude scaling factor and stress reduction factor were computed for a design earthquake event having a $M_w$ = 7.3 and a PGA = 0.24g. Similar sets of analyses performed assuming a PGA = 0.28g yielded the same respective factors of safety for all cases. Analyses were also completed for these cases to determine factors of safety against cyclic softening within Units 2 and 4. Results indicate that all computed factors of safety against cyclic softening are greater than or equal to 1.0 in all cases analyzed. AMEC (2012b) concluded that, in the final embankment configuration prior to placement of the final clay cover, 95% consolidation or more will have been achieved in the underlying clay-like units

and the computed factors of safety for this final condition indicate that the potential for cyclic softening to occur is low.

Analyses (AMEC 2012a) also included an evaluation of the potential for cyclic softening using data from six Cone Penetrometer tests (CPTs) performed at the site. The analysis results indicated average undrained shear strength values in the soils tested higher than those computed using a consolidation model (SHANSEP) developed by Ladd and Foott (1974) and used in the other analyses discussed in AMEC 2012a. Based on these findings, AMEC concluded that the undrained shear strength values computed based on the CPT data would result in higher factors of safety than those evaluated using the SHANSEP model.

Based on the information above, the Division concludes that the Licensee's analyses of settlement and analyses of liquefaction- and cyclic softening-related foundation behavior, with respect to the projected performance of the CAW embankment with regard to settlement and slope stability, are adequate.

#### 4.3.3.6 Infiltration and Transport Through Cover and Adjacent Soils

Results of HELP infiltration modeling, conducted for the proposed CAW embankment cover, indicate an average precipitation infiltration rate of 0.036 inches/year (0.09 cm/year) in the topslope area and an average infiltration rate of 0.066 inches/year (0.168 cm/year) in the sideslope areas (Whetstone Associates 2011b). Based on these infiltration results, moisture contents would stabilize at 0.05 v/v in the waste and 0.036 in the native soil below the topslope, and at 0.054 v/v and 0.042 v/v in the waste and native soil, respectively, below the sideslope (Whetstone Associates 2011b).

PATHRAE fate and transport modeling, for the portion of the CAW embankment underlying the top slope area, indicates that all radionuclides modeled would remain below the GWPLs for at least 500 years at a compliance well located 278 ft from the edge of the waste, provided that the concentrations of three radionuclides, Bk-247, Ca-41 and Cl-36, in received waste, are limited to the concentrations listed in the Table 4-14 below. All other modeled constituents would meet the groundwater standard if placed in the top slope area at Class A concentrations limits.

The PATHRAE fate and transport modeling for the portion of the CAW embankment underlying the side slopes having an 18-inch thick Type-B filter and 24-inch thick riprap layer (0.168 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 ft from the edge of the waste, provided that Bk-247, Ca-41, Cl-36, I-129, Re-187, and Tc-99 are received in concentrations not exceeding the concentrations listed in Table 4-14 below All other modeled constituents would meet the groundwater standard if placed under the side slope areas at Class A limits.

Results of separate vertical PATHRAE model runs to evaluate transport of heavy metals from the top slope and side slope areas indicate that all thirteen metals modeled could be placed in the top slope or side slope at the maximum possible concentration based on density, and would meet GWPLs at the water table and, by extension, at a compliance well located 90 ft from the edge of the waste for the 200-year compliance period established for heavy metals.

In addition, as discussed in Section 4.2.1.4 above, based on the design and the geometry of water accumulation in the proposed perimeter drainage ditch system adjacent to the CAW embankment, the Licensee demonstrated that the abnormal flood event would not cause water to accumulate above the toe of the waste in the embankment, and that the drainage system is therefore adequately designed to minimize infiltration of water through the waste under both normal and abnormal conditions.

Based on the information above, the Division concludes that the Licensee's analyses of infiltration and transport of radionuclide and heavy metal constituents from the proposed CAW Embankment demonstrate that GWPLs would not be exceeded in downgradient Point of Compliance monitoring wells. The analysis evaluated a performance period of at least 500 years, for radionuclides, given stated required concentration limits for Bk-247, Ca-41, and Cl-36 for the topslope area and limiting source concentrations for Bk-247, Ca-41, Cl-36, I-129, Re-187, and Tc-99 for the sideslope areas (as listed in Table 4-14) and all other radionuclides at Class A concentration limits. Metals were evaluated for a performance period of at least 200 years. With the previously approved modification of License Condition 55 to include the above six radionuclides at their limiting concentrations, the analyses provide reasonable assurance that there will not be a need for ongoing maintenance of the CAW embankment following its closure.

**Table 4-14 – Limiting Radionuclide Concentrations in the CAW Topslope and Sideslopes.**

| Radionuclide | Topslope (0.09 cm/yr infiltration) Concentration that meets GWPL at Compliance well (pCi./gm) | Sideslope (0.168 cm/yr infiltration) Concentration that meets GWPL at Compliance well (pCi./gm) |
|---|---|---|
| Bk-247 | 0.0065 | 0.00388 |
| Ca-41 | 35,300 | 34.1 |
| Cl-36 | 15.9 | 9.72 |
| I-129 | - | 21.9 |
| Re-187 | - | 19,100 |
| Tc-99 | - | 1,720 |

#### 4.3.3.7 Surface Drainage

The Licensee designed a post-closure drainage system that will surround the proposed CAW embankment to direct water from precipitation or sheet flow away from the disposal unit. The design includes perimeter drainage ditches sloped at a minimum of 0.07 % and 0.11 % (Section 3.1.5 and Drawings 10014 C01 through 10014 C03 of Energy*Solutions*2011a; Drawings 10014 C01, Revision 1 and Drawing 10014 C03, Revision 1 of Energy*Solutions*2011b; and Drawing 10014 C03, Revision 2 of Energy*Solutions* 2011e). In evaluating the ability of the perimeter drainage ditches to facilitate surface water flow away from the CAW embankment, the Licensee assumed a 25-year, 24-hour storm event for the normal condition. For abnormal conditions, a 100-year, 24-hour storm event was evaluated and for accident conditions, a downstream blockage in the drainage system was evaluated (NUREG-1199, NRC 1999). Calculations from the abnormal condition demonstrated that the perimeter ditch segments

surrounding the CAW embankment and the downstream 11e.(2) embankment drainage system are adequately sized to contain and facilitate the flow of surface waters away from the embankments and maintain a freeboards in the perimeter ditches greater than 0.5-ft under unrestricted flow conditions. The calculations demonstrate that surface drainage features will direct surface water drainage away from the CAW embankment and 11e.(2) embankment areas at velocities and gradients which will not result in erosion or excessive infiltration that would require future ongoing active maintenance.

The information provided demonstrates that surface water runoff in the perimeter ditches surrounding the CAW Embankment will be conveyed and merge with the surface water flows in the 11e.(2) drainage ditch near the southwest corner of the CAW Embankment. The surface water conveyed by the entire perimeter drainage ditch system, depicted in the "Clive Facility Class A West (CAW) [Revised] Drainage Ditch Calculations" (Attachment 3 to Energy*Solutions* 2011e) has been designed to discharge in a manner such that during operations, and after closure, discharge velocities and gradients would not be expected to cause excessive erosion to the drainage system components, or otherwise result in erosion that would require ongoing active maintenance in the future. The licensee also provided information and drawings indicating that a minimum 2.89-ft diameter concrete or 2.52-ft diameter plastic culvert would be used to convey flow from the CAW embankment ditch system into the 11e.(2) embankment ditch system and that a minimum 6.54-ft diameter concrete, or 5.69-ft diameter plastic, ultimate drainage outlet culvert (or, alternatively, a series of smaller diameter culverts providing an equivalent total area of flow capacity) would be used for conveying flow from the bottom of the 11e.(2) embankment ditch system to the natural ground surface at the point of discharge of the entire disposal unit area perimeter drainage ditch system (see plan sections and details – Drawing 10014 C01 and Drawing 10014 C03, Revision 2 for the CAW embankment attached to Energy*Solutions* 2011e, and Drawing 9420-04(G) for the 11e.(2) embankment area).

The calculations demonstrate that the ditch design ensures that any concentrated, severe peak storm-induced flows from runoff, from the CAW embankment, will be accommodated by the receiving 11.e.(2) ditch segment without damage to the ditch systems. Based on the information above, the Division concludes that the Licensee's analyses of long-term stability of the proposed CAW embankment drainage ditches and the downstream 11.e.(2) embankment drainage system are adequate and that long-term stability of the CAW embankment drainage system will be achieved with reasonable assurance.

***References*:**

Abt, et al., 1988

AMEC, 2012a; 2012b

Cedegren, 1989

Codell, et al., 1990

Energy*Solutions*, 2011a; 2011b; 2011c; 2011e; 2012a; 2012b

Ishihara and Yoshimine, 1992

Jeffries and Davies, 1993

Johnson and Abt., 1998

Ladd and Foott, 1974

Leps, 1973

Nelson, et al., 1986

NRC, 1991

NRC, 2002

NRCS, 1994

Tokimatsu and Seed, 1987

USACE, 1994

Youd, et al., 2009

Whetstone Associates, Inc., 2011b.

## 4.4 URCR SECTION R313-25-11; REQUIREMENTS FOR ISSUANCE OF A LICENSE

The CAW Embankment LAR involves limited aspects of URCR R313-25-11. The applicability of URCR R313-25-11 provisions to the review of the CAW Embankment LAR are summarized in Table 4-15. Those sections that do apply to the CAW Embankment LAR are addressed in the sections following the table.

**Table 4-15 – Applicability of URCR Section R313-25-11 Provisions to CAW Embankment LAR.**

| URCR R313-25-11 Section | | CAW Embankment LAR Requires Review? | Justification |
|---|---|---|---|
| Number | Topic | | |
| 11(1) | Risk to Public Health and Safety | Yes | |
| 11(2) | Training and Experience | No | The CAW Embankment LAR does not change or effect training and experience required or provided |
| 11(3) | Protect the Public Health and Safety | Yes | The CAW Embankment LAR potentially affects releases from the disposal facility and therefore exposures received by the general public |
| 11(4) | Protect Inadvertent Intruders | Yes | The CAW Embankment involves a thicker cover system that provides slightly greater protection to inadvertent intruders |
| 11(5) | Radiation Protection Standards | No | The CAW Embankment LAR does not change or effect radiation protection standards |

**Table 4-15 – Applicability of URCR Section R313-25-11 Provisions to CAW Embankment LAR.**

| URCR R313-25-11 Section | | CAW Embankment LAR Requires Review? | Justification |
|---|---|---|---|
| Number | Topic | | |
| 11(6) | Long-Term Stability | Yes | The CAW Embankment LAR changes the design of the cover system; additional analyses of stability must be reviewed |
| 11(7) | Satisfy Requirements of URCR R313-25 | Yes | Provides a global requirement to satisfy all requirements of URCR R313-25; Each requirement of URCR R313-25 that requires review is addressed elsewhere in this SER. |
| 11(8) | Institutional Control | Yes | |
| 11(9) | Surety Arrangements | No | The Division has previously reviewed and accepted arrangements for providing financial assurances; the arrangements are not materially changed or affected by the CAW Embankment LAR; the Division reviews and approved adequate financial assurance annually. |

### 4.4.1 Risk to Health and Safety of the Public

**Requirement 2511-1:** A license for the receipt, possession, and disposal of waste containing radioactive material will be issued by the Director upon finding that the issuance of the license will not contribute an unreasonable risk to health and safety of the public [URCR R313-25-11(1)].

**Basis:** The information contained in the CAW Embankment LAR, 2005 LRA and other relevant documents the Licensee has submitted indicate that the requirements of URCR R313-25-11(1) have been or will be met. Analyses submitted in connection with the CAW Embankment LAR and the 2005 LRA show that the groundwater protection requirements will be met for at least 500 years, as required. Doses to off-site members of the public will be below the 25-mrem/yr limit, as described in Section 4.4.2 below and in Section 5.10 of the LRA SER (URS Corporation, 2007).

**References:**

Envirocare of Utah, Inc., 2005b

URS Corporation, 2007

### 4.4.2 Protection to Public Health and Safety

**Requirement 2511-3**: A license for the receipt, possession, and disposal of waste containing radioactive material will be issued by the Director upon finding that the applicant's disposal site, disposal design, land disposal facility operations, including equipment, facilities, and procedures,

disposal site closure, and post-closure institutional control, are adequate to protect the public health and safety as specified in the performance objectives of URCR R313-25-19 (URCR R313-25-11(3)).

**Basis:** The information contained in the CAW Embankment LAR and the 2005 LRA and other relevant documents the Licensee has submitted indicate that the requirements of URCR R313-25-11(3) have been or will be met. The Licensee's disposal site, embankment design, operations, including equipment, facilities, and procedures, disposal site closure, and post-closure institutional control features are addressed under several other requirements in this SER. The CAW LRA shows that the groundwater protection requirements will be met for at least 500 years, as required (Whetstone 2012). Doses to off-site members of the public will be below the 25-mrem/yr limit.

Thus, based on the analyses presented in this SER, the Director would be justified in approving the requested license amendment.

***References*:**

Envirocare of Utah, Inc., 2005b

Whetstone Associates, Inc., 2012

### 4.4.3 Health and Safety Performance Objectives

**Requirement 2511-4:** A license for the receipt, possession, and disposal of waste containing radioactive material will be issued by the Director upon finding that the applicant's disposal site, disposal site design, land disposal facility operations, including equipment, facilities, and procedures, disposal site closure, and post-closure institutional control are adequate to protect the public health and safety in accordance with the performance objectives of URCR R313-25-20 (URCR R313-25-11(4)).

**Basis:** The information contained in the CAW Embankment LAR and the 2005 LRA indicates that the Licensee's disposal site, disposal site design, land disposal facility operations, including equipment, facilities, and procedures, disposal site closure, and post-closure institutional control are adequate to protect the public health and safety in accordance with requirements of URCR R313-25-11(4). The basis for this finding is presented in the description and justification for requiring no intruder barrier. The basis is presented under findings contained in this SER for Requirements 2507-2 through 2507-5 and is addressed in Section 6.0 of the 2005 LRA. Given that these criteria are met, in concert with the other requirements of URCR R313-25-11, it would be appropriate for the Director to approve the requested license amendment.

***References:***

See also Sections of this document discussing requirements 2507-2 through 2507-5.

Envirocare of Utah, Inc., 2005c

### 4.4.4 Long-Term Stability

**Requirement 2511-6:** A license for the receipt, possession, and disposal of waste containing radioactive material will be issued by the Director upon finding that the applicant's disposal site, disposal site design, land disposal facility operations, disposal site closure, and post-closure institutional control plans are adequate to protect public health and safety in that they will provide reasonable assurance of the long-term stability of the disposed waste and the disposal site and will eliminate, to the extent practicable, the need for continued maintenance of the disposal site following closure (URCR R313-25-11(6)).

**Basis:** The information contained in the CAW Embankment LAR, the 2005 LRA and other relevant documents the Licensee has submitted, indicate that the disposal site, disposal site design, land disposal facility operations, disposal site closure, and post-closure institutional control plans are adequate to protect public health and safety in that they will provide reasonable assurance of the long-term stability of the disposed waste and the disposal site and will eliminate to the extent practicable the need for continued maintenance of the disposal site following closure in accordance with the requirements of URCR R313-25-11(6). The basis for this finding is presented in the description and justification of the design of the principal design features planned for the disposal facility as discussed in Section 3.0 of the 2005 LRA. These principal design features have been designed to perform their required functions over an appropriate period of time such that the facility will meet applicable performance objectives without the need for ongoing active maintenance following facility closure. Section 6.4.3 in the 2005 LRA provides additional information concerning site stability, settlement and subsidence, and the prevention of degraded conditions. The basis for this finding is presented under requirements 2507-2 through 2507-5, 2508-4, and 2522-1.

Given that the required criteria discussed above are met, in concert with the other requirements of URCR R313-25-11, it would be appropriate for the Director to approve the requested license amendment.

***References*:**

See also Sections of this document discussing requirements 2507-2 through 2507-5, 2508-4, and 2522-1.

Envirocare of Utah, Inc., 2005c

### 4.4.5 Reasonable Assurance

**Requirement 2511-7:** A license for the receipt, possession, and disposal of waste containing radioactive material will be issued by the Director upon finding that the applicant's demonstration provides reasonable assurance that the requirements of URCR R313-25 will be met ([URCR R313-25-11(7)).

**Basis:** The information contained in the CAW Embankment LAR and the 2005 LRA indicate that the requirements of URCR R313-25 have been or will be met, as described and justified in this document. The basis for this finding is contained in the individual sections addressed in this SER. As demonstrated in the individual sections of this SER section, the Division concludes, with reasonable assurance that each requirement has been or will be met, subject to the license

conditions identified and described in Section **Error! Reference source not found.** of this document.

***References*:**

See also Sections of this document discussing requirements related to URCR R313-25.

Envirocare of Utah, Inc., 2005c

#### 4.4.6 Institutional Control Assurance

**Requirement 2511-8**: A license for the receipt, possession, and disposal of waste containing radioactive material will be issued by the Director upon finding that the applicant's proposal for institutional control provides reasonable assurance that control will be provided for the length of time found necessary to ensure the findings in URCR R313-25-11(3) through (6) and that the institutional control meets the requirements of URCR R313-25-28 [URCR R313-25-11(8)].

**Basis:** The information contained in the CAW Embankment LAR and the 2005 LRA indicate that reasonable assurance exists that control will be provided as necessary to ensure the requirements in URCR R313-25-11(3) through (6) will be met. Also, information provided indicates that reasonable assurance exists that that the provisions for institutional control meet or will meet the requirements of URCR R313-25-28.

Given that these conditions are met, in concert with the other requirements of URCR R313-25-11, it would be appropriate for the Director to renew the license, subject to license conditions stated and described in Section **Error! Reference source not found.** of this document.

***References:***

See also Sections of this document discussing requirements 2511-3 through 2511-6 and 2528.

Envirocare of Utah, Inc., 2005c

## 4.5 URCR SECTION R313-25-19, PROTECTION OF THE GENERAL POPULATION FROM RELEASES OF RADIOACTIVITY

**Requirement 2519-1:** Concentrations of radioactive material which may be released to the general environment in ground water, surface water, air, soil, plants or animals shall not result in an annual dose exceeding an equivalent of 25 mrem (0.25 mSv) to the whole body, 75 mrem (0.75 mSv) to the thyroid, and 25 mrem (0.25 mSv) to any other organ of any member of the public. Reasonable efforts should be made to maintain releases of radioactivity in effluents to the general environment as low as is reasonably achievable [URCR R313-25-19(1)].

**Basis:** The information contained in the CAW Embankment LAR and the 2005 LRA and other relevant documents the Licensee has submitted indicate that the requirements of URCR Subsection R313-25-19(1) have been met. These documents present the results of extensive analyses addressing the potential radionuclide releases to media including groundwater, surface water, air, soil, plants and animals, and discuss potential exposure pathways resulting from these releases. The analyses consider both normal conditions and unusual or accident conditions.

Transport of releases from disposed wastes was evaluated. The annual doses resulting from the postulated releases for reasonably likely conditions were found to be within the regulatory limit of 25 mrem to the whole body, 75 mrem to the thyroid, and 25 mrem to any other organ (Streamline Consulting 2005). The annual doses are found to be in compliance with State rules.

The following text provides a discussion of releases to all environmental media and their corresponding doses. The information on releases and dose assessment presented in the 2005 LRA (e.g., see Streamline Consulting 2005) is qualitatively summarized below to demonstrate that the construction, operation, and closure of Clive operations will satisfy all applicable regulatory dose limits.

The Licensee has demonstrated that the intruder protection requirements have been met. Intruder protection is provided by the cover design, waste placement, remote site location, lack of natural resources, as well as the poor water quality, arid conditions, and institutional controls.

The Licensee's radiological control program has successfully maintained worker exposures as a fraction of the regulatory limit, as demonstrated by worker dosimetry records and calculation of committed effective dose equivalents (CEDE). The Licensee actively reviews work practices, performs operational radiological surveys, and has a functional ALARA review committee. The Division recognizes the Licensee's proactive approach has resulted in successfully maintaining worker doses ALARA.

**Maximum Dose**

The maximum dose for normal conditions at the Clive Facility was estimated to be 10.2 mrem to an individual at location A-21 from dust inhalation at the facility boundary due to operations in the Class A cell. This is a highly unlikely scenario as no credit was given during the analysis for actions taken to minimize releases other than dust control measures. Dust control measures will ensure that the releases are ALARA. The maximum dose for unusual or accident conditions were estimated to be 0.18 mrem to a person at the site boundary following a truck accident of uranium and other nuclides (2005 LRA Section 6.3.2). Although there are no regulatory dose criteria that apply specifically to accident conditions, the dose from the truck fire scenario is below the 25-mrem dose criterion. A complete discussion of the scenarios is present in 2005 LRA Section 6.3.2.

**Groundwater Pathway**

The groundwater protection criteria are based on an annual dose of 4 mrem to an individual drinking groundwater. The expected dose from the groundwater pathway is zero because of the poor groundwater quality. The high salinity of the groundwater, without rigorous treatment, prevents its use for drinking, livestock watering, or crop irrigation. Groundwater protection requirements place limits on the individual radionuclide concentrations in the groundwater at the compliance-monitoring well. The radionuclide concentration limits must not be exceeded for at least 500 years following closure of the facility. Computer modeling of the groundwater pathway shows that the groundwater protection criteria are satisfied for all radionuclides for at least 500 years (2005 LRA Section 6.4.1.1.1, Whetstone 2011b). The waste acceptance criteria, waste

emplacement methods, and water management practices ensure that current and future releases to the groundwater pathway are kept ALARA.

**Surface Water Pathway**

Long-term surface water pathway doses are expected to be zero because of the absence of permanent surface water bodies at the site. The nearest stream channel is about 2 miles east of the facility. Surface water from precipitation is directed away from the waste disposal embankment by drainage ditches and berms. During facility operations, possibly contaminated contact stormwater is recovered and conveyed to evaporation ponds where it is monitored and controlled. No contact stormwater is released off site, thereby maintaining releases from surface water ALARA.

**Air Pathway**

Air pathway doses under normal operations and accident conditions are addressed in Section 6.3 and 6.4 of the 2005 LRA. Under both normal and accident conditions, projected doses are well within the acceptable limits of regulatory requirements. For accident conditions, dust or particulate matter could be released to the atmosphere and inhaled by individuals. The 2005 LRA evaluates doses that result from a tornado and severe wind, train derailment, truck turnover or collision, and truck fire. The highest likely dose rate occurs to an individual near a dry active waste fire for 1 hour. The individual inhales particulate matter from the fire and receives a dose estimated at 0.02 mrem. Other air pathway doses could occur from routine operations. A receptor standing at various locations on the fenceline for 8,760 hr/yr would receive a maximum estimated dust inhalation dose of 10.2 mrem. This is a highly unlikely scenario as no credit was given during the analysis for actions taken to minimize releases other than dust control measures. The regulatory requirements for protecting members of the general public will be met during operation of the Clive Facility.

**Soil Pathway**

Soil pathway doses involve exposure of the public to contaminated soil from the facility. If an exposure occurred, doses could result from external radiation or ingestion of soil on dirty hands. External radiation levels at the top of the final cover will be at or below background radiation for the site, so no doses are anticipated. During operation, the facility will be monitored as described in Appendix R of the 2005 revision of the LRA to ensure that no releases or doses occur via the soil pathway.

**Plant Pathway**

The plant pathway is not expected to cause any doses to humans. Edible crops or animal forage are not expected to grow on the waste embankment. During operations all plants will be prevented from contacting the waste. After closure, the site's low precipitation and its cell cover design will prevent crop production or growth of animal forage on the embankment (2005 LRA, Sections 6.4.1.1.4 and 6.4.2.1.4).

**Animal Pathway**

The burrowing animal pathway is not expected to cause any doses to humans. Burrowing animals at the site include jackrabbits, mice, foxes, and ants. None of these species typically burrow deep enough to penetrate through the cover system and disturb the waste materials (2005 LRA Section 6.4.2.1.4).

The Licensee has committed in Section 6.3.1 of the 2005 revision of the LRA to conduct operations in a manner that keeps exposures and doses ALARA. The Licensee's ALARA Program is defined in Appendix H of the 2005 revision of the LRA.

***References:***

Streamline Consulting, LLC, 2005

## 4.6 URCR SECTION R313-25-20. PROTECTION OF INDIVIDUALS FROM INADVERTENT INTRUSION

**Requirement 2520-1: Design, operation, and closure of the land disposal facility shall ensure** protection of any individuals inadvertently intruding into the disposal site and occupying the site or contacting the waste after active institutional controls over the disposal site are removed [URCR Section R313-25-20(1)].

**Basis:** Occupation of the site by inadvertent intruders after site closure is not likely due to a lack of natural resources in the area, particularly a lack of potable water. Contacting the waste after site closure is not likely due to the lack of natural resources (no reason to drill or dig) and the design of the embankment cover system. The design features and operations will minimize radiation dose to inadvertent intruders, as well. Several design features provide the required protection.

Overall features include:

- Lack of nearby residential population
- Embankment cover system
- CLSM
- Waste form (in the case of containerized waste disposal)

Operations specific features include:

- Fences
- Buffer zone
- Security plan

Post-closure specific features include:

- Granite markers

Based on the information provided, the Division concludes that potential inadvertent intruders are protected as required by regulation.

***References:***

See also Sections of this document regarding requirements 2507-2, 2507-8, 2508-2, and 2525-7.

## 4.7 URCR SECTION R313-25-21. PROTECTION OF INDIVIDUALS DURING OPERATION

**Requirement 2521-1:** Operations at the land disposal facility shall be conducted in accordance with the standards for radiation protection in URCR Rule R313-15, except for release of radioactivity in effluents from the land disposal facility, which are governed by URCR Section R313-25-19. Every reasonable effort shall be made to maintain radiation exposures as low as reasonably achievable, ALARA [URCR R313-25-21].

**Basis:** The information contained in the CAW Embankment LAR and the 2005 LRA and other relevant documents the Licensee has submitted indicate that the requirements of URCR Section R313-25-21 will be met. NUREG-1199 describes the items that together encompass conduct of operations. The topics and references to the components are shown in this SER:

## 4.8 URCR SECTION R313-25-22. STABILITY OF THE DISPOSAL SITE AFTER CLOSURE

**Requirement 2522-1:** The disposal facility shall be sited, designed, used, operated, and closed to achieve long-term stability of the disposal site and to eliminate, to the extent practicable, the need for ongoing active maintenance of the disposal site following closure so that only surveillance, monitoring, or minor custodial care are required [URCR Subsection R313-25-21(1)].

**Basis:** Applicable Utah rules require that a LLRW disposal facility be sited, designed, used, operated, and closed to achieve long-term stability of the disposal site and to eliminate, to the extent practicable, the need for ongoing active maintenance of the disposal site following closure so that only surveillance, monitoring, or minor custodial care are required.

Based on the results of analyses as described in Section 4.3.3 of this SER, the Division concludes that reasonable assurance exists that this performance objective will be satisfied. Refer to Section 4.3.3 for additional details.

## 4.9 URCR SECTION R313-25-24. DISPOSAL SITE DESIGN FOR NEAR-SURFACE LAND DISPOSAL

### 4.9.1 Long-Term Isolation without Active Maintenance

**Requirement 2524-1:** Site design features shall be directed toward long-term isolation and avoidance of the need for continuing active maintenance after site closure [URCR R313-25-24(1)].

**Basis:** The information contained in the CAW Embankment LAR and the 2005 LRA and other relevant documents (engineering reports, supplemental data submissions and interrogatory

responses) the Licensee submitted indicate that the requirements of URCR R313-25-24(1) have been met.

- The disposal site is located in an area with a precipitation rate smaller than an average of about 9 inches per year (Energy*Solutions* 2011c; Meteorological Solutions, Inc. 2010).
- The disposal site is located in an area where the concentration of dissolved solids in groundwater is greater than 20,000 mg/L, making it undesirable for use without prior processing, thereby minimizing exposure that might otherwise result from groundwater ingestion.
- Waste is placed and covered with no less than 7 ft of earthen cover materials.
- Both vertical and horizontal groundwater velocities are slow.
- The final cover will not be constructed until the embankment settlement is demonstrated to be within acceptable limits through construction of an interim cover prior to construction of the final cover.
- Waste is disposed of no less than 13 ft above the historic high water table at the site.
- The cover system is designed to limit the potential for water erosion, wind erosion, plant intrusion, and animal intrusion (Section 4.3.3).
- The cover system is designed and constructed to limit radiation exposure rate at its top surface to less than 100 mrem/yr, as required by regulation (Section 4.3.1).
- The boundaries of the closed CAW Embankment LAR will be marked with permanent monuments or markers that will warn against intrusion.

The Licensee provided information that provides confidence that the need for continuing active maintenance after site closure is avoided. This conclusion is established by the following facts:

- The cover system is designed to limit the potential for water erosion, wind erosion, plant intrusion, and animal intrusion (Section 4.3.3).
- Settlement and differential settlement within the disposal embankment will be demonstrated to be sufficiently small that damage to the cover system layers primarily responsible for limiting infiltration and encouraging run-off will not occur (Section 4.3.3).
- The clay (radon barrier) layers in the cover system are located deep enough in the cover system (no less than 4 ft) that they would not be damaged by either desiccation or freezing (see, for example, Energy*Solutions* 2006).
- The layer of riprap and the type A filter layer in the cover system would act to discourage root penetration and animal intrusion (Energy*Solutions* 2006).
- Internal erosion between layers of the cover system is prevented by design and construction (Section 4.3.3).
- Cover system slopes are stable under static and dynamic conditions (Section 4.3.3).
- The permeability of the cover system is designed and constructed to be lower than that of the liner system to minimize the potential that infiltrating water will accumulate in the closed disposal embankment after final embankment closure (Section 4.2.1.1.3).
- No features are incorporated into the design of the disposal embankment that rely upon external energy sources or require human support or intervention

Bases for this affirmative finding are presented under requirements 2508-01 through 2508-4 provided in Sections 5.5.1 through 5.5.4 of this SER. Reference to Requirements 2507-2 through 2507-5 of this SER also demonstrate that the Principal Design Features have been designed to perform as intended for many years following the Institutional Control period without reliance on active ongoing maintenance.

The Licensee's clay mining activities in areas adjacent to Section 32 where LLRW is disposed of previously raised concerns regarding their potential long-term effects on stability of and releases from waste disposed of within the CAW embankment and other embankments at the site. These concerns will be addressed in the Division's consideration of the Licensee's 2012 LRA, due to be submitted on or before December 25, 2012.

***References:***

See also Sections of this document referencing requirements 2507-2 through 2507-5 and 2508-1 through 2508-4.

Energy*Solutions*, 2006; 2011c

Meteorological Solutions Inc., 2010

### 4.9.2 Design Compatible with Closure and Stabilization

**Requirement 2524-2:** The disposal site design and operation shall be compatible with the disposal site closure and stabilization plan and lead to disposal site closure that provides reasonable assurance that the performance objectives will be met [URCR R313-25-24(2)].

**Basis:** As described in the "Basis" section above under Requirement 2507-7, waste would be covered soon after each embankment section is filled. Waste containers placed in the embankment would be placed concurrently with backfill placement and compaction efforts. The waste placement and backfill plan, including the specific waste/backfill and geometry of waste areas, as well as the amounts of compaction required for each type of backfill, were developed based on results of well-defined and controlled testing performed under the observation of the Division.

The process of stabilizing a completed disposal embankment is summarized as follows:

1. An interim cover system is constructed over a portion of the embankment only after disposal operations in that portion have been completed.
2. Settlement and differential settlement magnitudes will be monitored (e.g., see Energy*Solutions* 2012c) to ascertain whether the design Cover distortion criteria developed and used for evaluating long-term stability of the embankment with respect to settlement has been achieved.
3. The final cover system will be constructed only after settlement has been shown, after placement of the interim cover system, to be within prescribed acceptable limits (to be verified through analysis of future settlement monitoring, site-specific compacted soils geotechnical testing, and/or additional modeling if required).
4. Placement of the interim and final cover systems are major activities in the stabilization of the disposal units.

5. Because no disposal operations will occur in any area where interim or final cover systems have been constructed, continued active operations within the CAW embankment would not affect stabilized areas of the disposal embankment.

For the reasons stated above, the disposal site design and operation are compatible with the disposal site closure and stabilization plan and are expected to lead to disposal site closure that provides reasonable assurance that the performance objectives will be met. Based on the information summarized above, the Division concludes that the Licensee's proposed design and operation is compatible with the disposal site closure and stabilization plan and would lead to disposal site closure that provides reasonable assurance that this performance objective will be met for the CAW embankment.

***References:***

Energy*Solutions*, 2012c.

### 4.9.3 Complement and Improve the Disposal Site's Natural Characteristics

**Requirement 2524-3:** The disposal site shall be designed to complement and improve, where appropriate, the ability of the disposal site's natural characteristics to assure that the performance objectives will be met [URCR R313-25-24(3)].

**Basis:** Site characteristics that influence the extent to which radioactive material may be released to the general environment and potentially cause radiation exposure to members of the general public include:

- Precipitation rate
- Depth to groundwater
- Dissolved solids content of groundwater
- Probable maximum magnitude of flood events

Proposed CAW embankment design, operating, and closure features provided that complement and improve the ability of the site to limit the release of radioactive material from the site and potentially cause radiation exposure to members of the general public include the following:

- Multi-layer engineered cover system;
- Waste emplacement procedures and configurations that produce a stable disposal embankment;
- Clay liner under disposed waste with permeability greater than that of the cover system;
- Inventories of radionuclides disposed in the embankment will meet limitation requirements determined through the CAW embankment infiltration and contaminant transport modeling analyses (Whetstone Associates 2011b); and
- Final cover will not be constructed until settlement shown to be within acceptable limits.

The site characteristics that influence the extent to which individuals may be exposed to radiation during facility operations include:

- Sparse population density in vicinity of the disposal embankment; and

- Unstable or neutral stability conditions prevail in winds at the site for more than 70% of the time.

Design, operating, and closure features provided that complement and improve the ability of the site to limit the extent to which individuals may be exposed to radiation during facility operations include:

- Waste with highest radioactive concentrations and hazards are contained in shipping containers that are disposed of without opening them; and
- Waste handling and placement operations are conducted so as to limit the release of radioactive materials during operations.

The site characteristics that influence the extent to which long-term stability of the disposal site is achieved and to which the need for ongoing active maintenance of the disposal site following closure is eliminated include:

- Average annual precipitation rate is less than 9 inches per year; and
- Concentration of dissolved solids in groundwater is greater than 20,000 mg/L.

Design, operating, and closure features provided that complement and improve the ability of the site to limit the extent to which long-term stability of the disposal site is achieved and to which the need for ongoing active maintenance of the disposal site following closure is eliminated include:

- The final cover will not be constructed until the embankment settlement has been demonstrated to be within acceptable limits
- The cover system is designed to limit the potential for water erosion, wind erosion, plant intrusion, and animal intrusion
- Internal erosion between layers of the cover system will be minimized or prevented by adhering to specified design (e.g., filter) criteria during construction
- The proposed cover system slopes have been demonstrated to be stable under static and dynamic conditions; and
- The permeability of the cover system is designed and would be constructed to be lower than that of the liner system.

Additional license conditions will require:

- A modification to the currently proposed embankment cover system and demonstration of equivalent or better performance for that modified cover compared to the currently proposed cover, to allow resolution of a remaining concern regarding the EZD value used in infiltration modeling for the current cover design; and
- Submittal and approval by the Division of a study plan to determine geotechnical properties, including maximum tensile strain of both average axial and localized lengthening/bending effects and associated angular distortion for the point of crack initiation, of samples of Licensee's clay materials proposed for use in constructing the CAW embankment compacted-clay radon barrier cover layers, and submittal of findings from such testing demonstrating that expected radon barrier layer distortions are within acceptable limits as prescribed by the specified distortion design criteria.

Based on the information summarized above, the Division concludes, subject to the stated conditions being placed into effect and the associated issues successfully resolved, that the proposed CAW embankment is designed to complement and improve, where appropriate, the ability of the disposal site's natural characteristics to assure that the performance objectives will be met.

***References:***

Whetstone Associates Inc., 2011b

### 4.9.4 Minimize Water Infiltration

**Requirement 2524-4:** Covers shall be designed to minimize, to the extent practicable, water infiltration, to direct percolating or surface water away from the disposed waste, and to resist degradation by surface geologic processes and biotic activity [URCR R313-25-24(4)].

**Basis:** The information contained in the CAW Embankment LAR and the 2005 LRA and other relevant documents (engineering reports, supplemental data submissions and interrogatory responses) the Licensee submitted indicate that the requirements of URCR R313-25-24(4) have been met. The infiltration and transport modeling simulations provided in the CAW Embankment LAR (Whetstone Associates 2011b) support the finding that the groundwater protection criteria for Class A wastes will be met provided that inventories of radionuclides do not exceed limitations determined through the modeling. In order to meet this objective the infiltration must be minimized to limit release and transport of radionuclides from the waste through the unsaturated zone and the shallow water table.

The cover design currently proposed for the CAW embankment is the same as that proposed for the previously contemplated CAC embankment and that previously approved for the CAN embankment and the 2005 LRA, except that the riprap cover layer has been increased to 24 inches in thickness and the proposed Type B filter zone layer thickness on the CAW embankment will be 18 inches on the sideslopes and 6 inches on the topslope and the filter design criteria for the Type B filter zone layers has been updated to reflect additional (permeability) filter criteria. Modeling provided by the Licensee demonstrates that the infiltration through the cover system is expected to be 0.090 cm/yr for the topslope area and 0.168 cm/yr or less for the sideslope areas. The Type B filter zone layer has been designed to drain most water away laterally from the disposed waste. The clay layer in the cover is designed to limit water infiltration. The riprap at the upper surface of the cover is designed to resist degradation by surface geologic processes and biotic activity.

Based on the information summarized above, the Division concludes that the projected performance of the currently proposed CAW embankment cover design (with an EZD value of 20 inches assumed for infiltration modeling) would be adequate to minimize water infiltration and resist degradation. As discussed previously, a new license condition (Section 5.0) will require the Licensee to provide a cover design modification and a submit a performance assessment demonstrating that this modified cover design will provide equal or better performance than that currently predicted.

***References:***

Whetstone Associates, Inc., 2011b

### 4.9.5 Direct Surface Water Drainage Away from Disposal Units

**Requirement 2524-5:** Surface features shall direct surface water drainage away from disposal units at velocities and gradients which will not result in erosion that will require ongoing active maintenance in the future [URCR R313-25-24(5)].

**Basis:** Drainage systems for installation in conjunction with construction and operation of the CAW Embankment are designed to prevent run-on of surface water onto the facility from adjacent areas under flooding conditions and facilitate run-off of storm water resulting from precipitation at velocities that would not cause excessive erosion to the drainage system components. Drainage system components include run-on protection berms and run-off berms, which would be constructed and used during operations, and a permanent drainage ditch system, to be constructed and retained for long-term use. More information about how these drainage system features satisfy regulatory requirements has been presented in Section 4.3.3 and other sections of this SER.

During operations, the embankment would be protected against off-site floodwaters by run-on berms. The off-site environment would also be protected from potentially contaminated water running off the open embankment by run-off berms constructed near the disposal area.

Run-on berms would surround the perimeter of the disposal embankment at all times during operations. These berms would be constructed to a minimum height of 3 ft above the design grade at that location (as determined by original engineering drawings showing site topographic contours) and have a minimum width of 10 ft at the top. The berms would be compacted to 90% of the Standard Proctor density (ASTM D-698). In addition, inspection/travel roads constructed 1 foot above natural grade with a 12-foot width will also be provided.

Run-off berms would be constructed immediately following approval of clay liner construction for a zone of the embankment to be opened for waste placement. Run-off berms would be constructed directly on the clay liner to a height of 3 ft above the finished grade. Run-off berms have a minimum width of 3 ft at the top and are compacted to 90% Standard Proctor density for the soils used to construct them. Once the run-off berms are constructed, waste materials would be placed on the clay liner. However, a minimum separation of 10 ft would be maintained between the toe of the run-off berm and the toe of waste. This 10-foot separation is designed to allow for collection of run-off water from the active embankment and minimize potential contact of waste with standing water.

In order to facilitate the flow of precipitation away from the embankment, the Licensee (Sections 3.1.4, 3.2.4 and 3.3.4 of the 2005 LRA) designed the drainage ditch system so that during operations, storm water would remain within the drainage ditch system (including the ditch east of the CAW embankment and the ditches surrounding the 11e.(2) embankment) with a freeboard of greater than 0.5 foot under the normal precipitation event and no overflow occur (i.e., that the depth of water would be less than the depth of the ditches) under the abnormal precipitation event. Calculations performed by the Licensee indicate that the proposed drainage ditch systems

surrounding the CAW embankment (Section 4.3.3 of this SER), as well as downstream drainage ditch systems on the eastern side of the CAW embankment and surrounding the 11e.(2) embankment, have a sufficient slope to allow drainage of surface water run-off away from the disposal embankment. The 25-year storm event was identified as representing the probable worst-case precipitation event that might be encountered during active site operations. Based on these results, and under the assumed conditions, the drainage ditch system should promote the collection of precipitation as well as promote flow away from the embankment, thus minimizing standing water adjacent to the embankment; thereby minimizing potential infiltration into the waste.

Results of an accident condition involving downstream blockage of the drainage ditch system on Section 3.3.4.1 of the 2005 LRA indicate that, although downstream blockage in the drainage ditch would lead to a localized flood situation in that section of the ditch, once the water level reached the outside berm height, water would disperse away from the embankment as overland flow.

Results of HEC-1 and HEC-2 Modeling analyses conducted by Bingham Environmental, Inc. (1996) and the 1998 LRA Appendix KK) provide data pertaining to the depth of water expected from the Probable Maximum Flood (PMF) for the watershed encompassing the Clive site, indicate that, based on the geometry of water accumulation in the ditch, with respect to the CAW, the abnormal flood event would not cause water to accumulate above the toe of the waste in the embankment, and that the drainage system is therefore adequately designed to minimize infiltration of water through the waste under both normal and abnormal conditions.

The Licensee specified as a design criteria for the CAW embankment perimeter drainage ditch system that the size of the rock used in the ditches be adequate to handle stresses related to flow without disruption in order to prevent internal erosion of the soils beneath the rock erosion barrier of the ditches. Calculations performed by the Licensee (Section 4.3.3 of this SER) indicate that the selected characteristics of the proposed riprap materials (summarized in Table 3.3 of the CAW Embankment LAR) that would be placed in and used to line the CAW Embankment perimeter ditches would be adequate to resist movement (internal erosion) of the riprap materials under flows projected to occur during normal and abnormal precipitation events at the site. Therefore, significant erosion of the ditch clay substrate surface is not expected to occur.

Based on the information summarized above, the Licensee has discussed how the facility's surface features have been designed to direct surface water away from the disposal units at velocities and gradients which would not be expected to result in erosion that would require ongoing active maintenance in the future.

The Licensee's clay mining activities in areas adjacent to Section 32 where LLRW is disposed of previously raised concerns regarding their potential long-term effects on stability of and releases from waste disposed of within the CAW and other embankments at the site. These concerns will be addressed in the Division's consideration of the Licensee's 2012 LRA, due to be submitted on or before December 25, 2012.

**Reference Notes:**

See also Section 4.3.3 of this document.

Bingham Environmental, 1996

### 4.9.6 Minimize the Contact of Water with Waste

**Requirement 2524-6:** The disposal site shall be designed to minimize to the extent practicable the contact of water with waste during storage, the contact of standing water with waste during disposal, and the contact of percolating or standing water with wastes after disposal [URCR R313-25-24(6)].

**Basis:** As earlier approved for the CA and CAN disposal embankments, the Licensee proposes a number of measures to minimize the potential for water contacting waste during and following operations. The Licensee designed the clay liner to be more permeable than the final cover in order to minimize the possibility of infiltrating water accumulating on the liner after closure, thereby limiting the possibility of standing water coming into contact with waste following final closure of the disposal cell (Section 3.3.1.1.2 and Table 3-4 of the 2005 LRA). This design minimizes the potential for any "bathtub effect" of water to occur within the embankment following closure.

The liner is comprised of a 2-ft-thick layer of compacted clay having an in-place, as-built design saturated hydraulic conductivity (permeability) of 1 x $10^{-6}$ cm/sec. The liner materials will be compacted to at least 95% Standard Proctor density for the soils used in constructing the liner, at a moisture content between optimum and plus 5% of the optimum moisture content. The liner will be constructed of soil having 85% fines less than 0.075 mm in diameter; plasticity index range 10 to 25; and liquid limit values ranging between 30 and 50. The completed liner will be flat and level. The liner has been specified to have sufficiently low permeability to encourage precipitation to accumulate on liner surface during the embankment's operational phase, where it is removed as it accumulates as part of ongoing facility operations. During disposal operations, a vacuum truck removes water that accumulates on the working surface.

The cover system has been designed to limit the amount of infiltration of water through the cover system and emplaced waste after waste disposal. A series of simulations using the HELP Model (Version 3.06) (Schroder *et al*, 1994 and Whetstone Associates, Inc., 2011a; 2011b) showed that the amount of water infiltrating through the cover and waste is sufficiently low to meet required groundwater protection criteria provided that inventories of radionuclides do not exceed limitations determined through the modeling analyses. The model used precipitation data taken from 17 years of measurements at Clive, Utah and longer-term measurements from Dugway, Utah. Both the top slope and side slopes of the embankment were evaluated. The net water infiltration through the cover was calculated as 0.090 cm/yr for the topslope and 0.168 cm/yr or less for the sideslopes. This is sufficiently low to meet the groundwater protection criteria for Class A waste.

Several infiltration sensitivity analyses have been conducted to evaluate the effects of possible future establishment and growth of vegetation on cover systems at the Clive Facility that are very similar to the proposed CAW embankment Cover. Plant roots had two primary effects on the cover system: increasing the hydraulic conductivity of the cover material and clogging of the lateral drainage layers. Both of these effects were evaluated with the HELP model to determine if

they adversely affected the net water infiltration rate through the cover system. Nine sensitivity cases with plant roots were conducted. The analyses showed that the presence of roots in the cover system did not adversely affect the net amount of water infiltrating to the waste. In fact, in all nine cases the transpiration of water by the roots more than compensated for the increased soil hydraulic conductivity that the roots cause. When plant roots were present in the cover system, the net water infiltration rate through the waste was lower because the plant roots transpired water from the soil back to the atmosphere. These sensitivity analyses provided increased confidence that the cover system would perform as designed over long periods of time and would be resistant to the effects of natural ecological processes at the site.

Based on the information summarized above, the Division concludes that the Licensee's proposed CAW embankment design with respect to minimizing the contact of water with waste is acceptable.

***References:***

Whetstone Associates Inc., 2011a; 2011b

## 4.10 URCR SECTION R313-25-25. NEAR SURFACE LAND DISPOSAL FACILITY OPERATION AND DISPOSAL SITE CLOSURE

The CAW Embankment LAR involves limited aspects of URCR Section R313-25-25. The applicability of URCR Section R313-25-25 provisions to the review of the CAW Embankment LAR are summarized in Table 4-16. Those sections that do apply to the CAW Embankment LAR are addressed in the sections following the table.

**Table 4-16 – Applicability of URCR Section R313-25-25 Provisions to CAW Embankment LAR.**

| URCR R313-25-25 Section | | CAW Embankment LAR Requires Review? | Justification |
|---|---|---|---|
| **Number** | **Topic** | | |
| 25(1) | Segregated Class A from Class B and Class C LLRW | No | CAW Embankment LAR does not involve disposal of Class B or Class C LLRW |
| 25(2) | 5m Cover on Class C LLRW | No | CAW Embankment LAR does not involve disposal of Class C LLRW |
| 25(3) | Only Class A, Class B, and Class C LLRW | No | CAW Embankment LAR involves only disposal of Class A LLRW |
| 25(4) | Package Integrity | No | Division has reviewed and accepted operating procedures that are not changed or affected by CAW Embankment LAR |
| 255) | Void Spaces | No | Division has reviewed and accepted operating procedures that are not changed or affected by CAW Embankment LAR |
| 25(6) | Radiation Dose at Cover System Surface | Yes | The CAW Embankment LAR involves changes to the cover system that could affect |

**Table 4-16 – Applicability of URCR Section R313-25-25 Provisions to CAW Embankment LAR.**

| URCR R313-25-25 Section | | CAW Embankment LAR Requires Review? | Justification |
|---|---|---|---|
| **Number** | **Topic** | | |
| | | | the projected dose rate following closure |
| 25(7) | Disposal Unit Boundaries and Locations | Yes | The CAW Embankment LAR involves slight adjustments to the footprint of the disposal embankment |
| 25(8) | Buffer Zones | Yes | The CAW Embankment LAR involves slight adjustments to the footprint of the disposal embankment |
| 25(9) | Closure as Disposal Units Are Filled | No | Division has reviewed and accepted operating procedures that are not changed or affected by CAW Embankment LAR |
| 25(10) | Active Disposal Operations Not Affect Stabilized Disposal Units | No | Division has reviewed and accepted operating procedures that are not changed or affected by CAW Embankment LAR |
| 25(11) | Only Radioactive Materials | No | CAW Embankment LAR involves only disposal of Class A LLRW |
| 25(12) | Waste for Near-Surface Disposal | No | CAW Embankment LAR involves only disposal of Class A LLRW |

### 4.10.1 Limits the Radiation Dose at the Surface of the Cover

**Requirement 2525-06:** Waste shall be placed and covered in a manner that limits the radiation dose rate at the surface of the cover to levels that at a minimum will permit the licensee to comply with all provisions of URCR Section R313-15-105 at the time the license is transferred pursuant to URCR Section R313-25-16 [URCR R313-25-25(6)].

**Basis:** The cover proposed for the CAW Embankment (Energy*Solutions*, LLC. 2012a; 2012b; 2012c) is thicker than that previously reviewed and approved by the Division for the CAN and CA embankments (URS Corporation 2005a; 2005b). Values of all factors that affect the projected dose rate at the surface of the final cover system for the proposed CAW embankment are either the same as or greater than (in the sense that projected dose for the revised cover design will be smaller) those of the Class A and CAN embankments. Since these factors were acceptable for the Class A and CAN embankments, they are also acceptable for the proposed CAW embankment.

***References:***

URS Corporation, 2005a

URS Corporation, 2005b

Energy*Solutions*, 2012a; 2012b; 2012c

### 4.10.2 Boundaries and Locations of Disposal Units

**Requirement 2525-07:** The boundaries and locations of disposal units shall be accurately located and mapped by means of a land survey. Near-surface disposal units shall be marked in such a way that the boundaries of the units can be easily defined. Three permanent survey marker control points, referenced to USGS or National Geodetic Survey (NGS) control stations, shall be established on the site to facilitate surveys. The USGS or NGS control stations shall provide horizontal and vertical controls as checked against USGS or NGS record files [URCR Subsection R313-25-25(7)].

**Basis:** The information contained in the CAW Embankment LAR and 2005 LRA the Licensee has submitted indicate that the requirements of URCR R313-25-25(7) will be met. As is presented in Sections 3 and 5 of the CAW Embankment LRA, closed embankments will be marked in the same way as a closed uranium mill tailings cell. Permanent granite markers, similar to those placed at the Vitro embankment, will be placed at the closed embankment. Markers will consist of unpolished granite of specified minimum dimensions, inscribed with lettering of specified characteristics. The markers will be set in a bed of reinforced concrete and slightly raised from the ground/cover surface.

Markers will be placed at the entrance to the site and near the center of the crest of the completed embankment. They will identify the site; the general location of the disposed materials; dates of construction and closure; volume, mass, or tonnage of disposed material; kilograms of source material; grams of special nuclear material; and total activity of radioactive material disposed of in the embankment.

The proposed marking for the CAW embankment is identical to that approved for the CAN embankment and the 2005 LRA (URS Corporation 2005a; 2005b). Based on the information summarized above, the Division concludes that the Licensee's proposed marking for the proposed CAW embankment is acceptable.

**References:**

URS Corporation 2005a; 2005b

### 4.10.3 Buffer Zone

**Requirement 2525-08:** A buffer zone of land shall be maintained between any buried waste and the disposal site boundary and beneath the disposed waste. The buffer zone shall be of adequate dimensions to carry out environmental monitoring activities specified in URCR Subsection R313-25-26(4) and take mitigative measures if needed [URCR R313-25-25(8)].

**Basis:** The information contained in the CAW Embankment LAR, 2005 LRA, and other relevant documents the Licensee has submitted indicate that the requirements of URCR R313-25-25(8) will be met. As indicated in Section 3 of the 2005 LRA, the horizontal buffer zone will be no less than 97.7 ft between the toe of the disposed waste and perimeter fence. During construction and waste emplacement operations, a 300-ft buffer zone exists between the closest edge of any embankment and the site boundary.

A vertical buffer zone is provided between the bottom of the embankment and the underlying unconfined aquifer water table. This buffer zone consists of the 2-foot-thick clay liner and at least 10 ft of undisturbed soils. Although the water surface elevation may rise slightly over time, it is not anticipated that this elevation will exceed the 10 ft of buffer zone in addition to the 2-foot clay liner. In the event that remedial actions are required, they will be performed as a corrective action for a specific nonconforming event. As such, an event-specific plan will be developed at that time under the direction and approval of the Utah Division of Radiation Control and the Utah Division of Water Quality.

Based on its review of the information provided, the Division has concluded that the plans to maintain a buffer zone satisfy applicable regulatory requirements. The dimensions and characteristics of the buffer zone are such that monitoring and mitigative measures can be undertaken as needed.

## 4.11 URCR SECTION R313-25-26; ENVIRONMENTAL MONITORING

The CAW Embankment LAR involves limited aspects of URCR R313-25-26. The applicability of URCR R313-25-26 provisions to the review of the CAW Embankment LAR are summarized in Table 4-17. Those sections that do apply to the CAW Embankment LAR are addressed in the sections following the table

**Table 4-17 – Applicability of URCR Section R313-25-26 Provisions to CAW Embankment LAR.**

| URCR R313-25-26 Section | | CAW Embankment LAR Requires Review? | Justification |
|---|---|---|---|
| Number | Topic | | |
| 26(1) | Pre-Operational Monitoring Program | No | The Division has previously reviewed and accepted the Pre-Operational Monitoring Program |
| 26(2) | Operational Monitoring Program | Yes | The CAW Embankment LAR requires minor alterations in monitoring locations |
| 26(3) | Post-Closure Monitoring Program | No | The Division has previously reviewed and accepted plans for the post-closure monitoring program that is not changed or affected by the CAW Embankment LAR |
| 26(4) | Corrective Measures | No | The Division has previously reviewed and accepted plans for taking corrective measures if required; these are not changed or affected by the CAW Embankment LAR |

### 4.11.1 Operational Environmental Monitoring Program

**Requirement 2526-2:** During the land disposal facility site construction and operation, the licensee shall maintain an environmental monitoring program. Measurements and observations shall be made and recorded to provide data to evaluate the potential health and environmental impacts during both the construction and the operation of the facility and to enable the evaluation

of long-term effects and need for mitigative measures. The monitoring system shall be capable of providing early warning of releases of waste from the disposal site before they leave the site boundary (URCR R313-25-26(2)).

**Basis:** The information contained in the CAW Embankment LAR and other relevant documents (engineering reports, supplemental data submissions and interrogatory responses) the Licensee has submitted indicate that the requirements of URCR R313-25-26(2) will be met. Since the Licensee has ongoing waste disposal operations at the site, the operational environmental monitoring program for those activities will be sufficient to constitute the future operational environmental monitoring program for the subject facility. As described in Section 4.2.4 of this SER, for the CAW embankment, certain revisions to the current air, vadose zone, and groundwater monitoring components of the environmental monitoring plan are proposed based on the proposed footprint and configuration of the embankment. Additional details regarding the proposed environmental monitoring program for the CAW embankment, including a summary of proposed abandoned and relocated monitoring locations, is provided in Section 4.2.4 of this SER. Quarterly environmental monitoring reports have been developed by the Licensee following this Plan and submitted to the Division since 1999 to document and evaluate potential long-term trends in environmental monitoring parameters and assess potential environmental effects and the need for mitigative measures. The Division finds that the current Plan is capable of providing early warning of releases of waste from the disposal site before they leave the site boundary.

Based on the information summarized above, the Division concludes that the Licensee's proposed CAW Embankment operational monitoring plan is acceptable.

## 4.12 URCR SECTION R313-25-31: FUNDING FOR DISPOSAL SITE CLOSURE AND STABILIZATION

The CAW Embankment LAR involves limited aspects of URCR R313-25-31. The applicability of URCR R313-25-31 provisions to the review of the CAW Embankment LAR are summarized in Table 4-18 below. Those sections that do apply to the CAW Embankment LAR are addressed in the sections following the table.

**Table 4-18 – Applicability of URCR Section R313-25-31 Provisions to CAW Embankment LAR.**

| URCR R313-25-31 Section | | CAW Embankment LAR Requires Review? | Justification |
|---|---|---|---|
| **Number** | **Topic** | | |
| a31(1) | Provide Assurances before Operations Begin | Yes | The CAW Embankment LAR involves changes that could affect costs of closing and stabilizing the disposal embankment |
| 31(2) through 31(8) | Details of Acceptable Surety Arrangements | No | The Division has previously reviewed and accepted arrangements for assuring funding; the Division reviews and approved adequate financial assurance annually. |

**Requirement 2531-1:** The applicant shall provide assurances prior to the commencement of operations that sufficient funds will be available to carry out disposal site closure and stabilization, including:

(a) decontamination or dismantlement of land disposal facility structures, and

(b) closure and stabilization of the disposal site so that following transfer of the disposal site to the site owner, the need for ongoing active maintenance is eliminated to the extent practicable and only minor custodial care, surveillance, and monitoring are required. These assurances shall be based on Director approved cost estimates reflecting the Director approved plan for disposal site closure and stabilization. The Applicant's cost estimates shall take into account total costs that would be incurred if an independent contractor were hired to perform the closure and stabilization work [URCR R313-25-31(1)].

**Basis:** The information contained in the CAW LAR, and other relevant documents (engineering reports, supplemental data submissions and interrogatory responses) the Licensee has submitted, indicate that the requirements of URCR R313-25-31, 25-32(1), and 25-32(2) have been or will be met. The Licensee will supplement the financial assurances, prior to initiating any waste placement in portions of the Class A West embankment that exceed horizontally or vertically beyond the current approved CA and CAN embankment designs.

The Licensee has provided a binding arrangement between the Licensee, the Division, and the Licensee's fiduciary agents, Wells Fargo Bank, that ensures that sufficient funds will be available to cover the costs of closing and stabilizing the proposed disposal facility, and monitoring and maintaining it during the institutional control period. The binding arrangement is an Irrevocable Letter of Credit with a Standby Trust Agreement.

The binding arrangement has been and continues to be periodically reviewed by the Division Director to ensure that changes in inflation, technology, and disposal facility operations are reflected in the arrangements. The Licensee is required by regulation to support similar reviews on an annual basis. Any changes to the binding arrangement will be submitted to the Division Director for review and approval before becoming effective.

Based on the information summarized above, the Division concludes that the financial assurance arrangements the Licensee has proposed and will provide for the proposed CAW are acceptable.

# 5.0 SUMMARY OF LICENSE CONDITIONS AND REVISIONS REQUIRED

The Licensee's request to amend the radioactive materials license (RML) to allow construction and operation of the proposed CAW embankment will require that certain revisions be made to the current facility license to properly reflect the proposed new activities and the proposed embankment configuration. In addition, two new license conditions (LCs) will need to be added to the RML to address two currently unresolved technical issues that require resolution prior to cover construction. These required revisions and new LCs are discussed below, and are categorized in terms of whether they constitute a major or minor change to the RML.

## 5.1 MAJOR CHANGES

***New License Conditions***

Allowable Distortion in Final Cover Radon Barrier Layer Components

The Licensee has committed to provide additional information to confirm the existing or support selection of a new maximum allowable distortion value for use in evaluating long-term performance (potential for cracking) of the radon barrier components of the cover in response to differential settlement. A new LC will be added to the RML to address this requirement. The new LC will require that, on or before August 1, 2012, the Licensee submit a detailed study plan for Director review and approval to determine the geotechnical properties, including the maximum tensile strain of both average axial and localized lengthening/bending (angular) effects and associated angular distortion for the point of crack initiation, of samples of the Licensee's clay materials to be used in the construction of the embankment compacted-clay radon barrier cover layers. The LC will also require that within nine months of the Director's approval the Licensee will report the results of the detailed study plan to the Director.

The new LC will also require that final cover placement not occur until the Licensee demonstrates that actual distortion values, based on settlement measurements made on the interim cover soil layer, placed over filled waste areas within the proposed CAW embankment footprint, do not exceed the maximum allowable distortion value determined from results of the study described above, or the current value approved by the Director (e,g, EnergySolutions 2012c).

The proposed LC 41 is as follows:

> *On or before August 1, 2012, the Licensee shall submit, for Director's review and approval, a detailed plan for a study of the clayey soils to be used in the radon barrier of the CAW embankment cover. The objective of this study is to determine the amount of strain that the soils can withstand without cracking when subjected to both axial lengthening and bending as would be experienced when the clay settles differentially as part of the cover system. Within nine months of Director's approval of the study plan, the Licensee shall execute the study and submit a report with results of the study. Based on*

*results of the study and the Director's review, the Director may require the Licensee to modify the embankment and cover design.*

Revised Cover Design and Associated Modeling Activities

The Licensee has committed to provide a revised cover design to the DRC by December 25, 2012. The cover design will include detailed design information including descriptions, design calculations, drawings and specifications. Also, the Licensee has committed to using a different infiltration model to support the revised design of the cover as well as a transport model to assess migration in the saturated zone. The Evaporative Zone Depth (EZD), previously used in infiltration modeling of the CAW embankment, is no longer relevant. The licensee has committed to use a different infiltration model that does not require an EZD input parameter value. In addition to a revised cover design and new infiltration and transport models to support the revised cover, the Licensee will provide an assessment addressing performance of the revised cover design and potential releases from the proposed disposal unit.

The proposed LC 42 is as follows:

*On or before December 25, 2012, the Licensee shall submit a revised cover design (including at least descriptions, design calculations, drawings, and specifications) and an assessment addressing performance of the revised Class A West cover design and transport of releases from the proposed Class A West disposal unit.*

***Revisions to Existing License Conditions***

Limitation on Disposed LLRW Volume

License Condition 9.E is revised to reflect the limitation on the volume of LLRW allowed to be disposed of under the agreement between the Licensee and Governor Jon M. Huntsman, Jr. dated March 15, 2007.

The proposed revised language for License Condition 9.E is as follows:

*E. The Licensee may dispose of a volume of Class A Low-Level Radioactive Waste (LLRW) and Naturally Occurring and Accelerator Produced Radioactive Materials (NARM) in both the Class A West ~~and Class A North~~ disposal cell described in License Condition 40, and in the Mixed Waste Landfill Cell not exceeding a total of 10.1 million cubic yards. Class A waste is defined in Utah Radiation Control Rule R313-15-1008 and NARM at R313-12-3.*

Revised and Additional Limiting Radionuclide Concentrations

Performance assessment modeling results for the proposed CAW embankment indicate that concentrations of selected radionuclides in Class A wastes placed under top slope and under side slope areas within the proposed CAW embankment must not exceed certain revised

concentration limitations in order for the CAW embankment to achieve required performance objectives.

The radionuclides identified in Sections 4.3.1 and 4.3.2 of this SER will be incorporated into the amended License at *LC 29, Reporting*. The proposed revised LC 29 follows:

*E. For the ~~Class A and Class A North~~ Class A West disposal cell~~s~~, 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 Director ~~Executive Secretary~~, at the earliest knowledge, that the following nuclides are scheduled for disposal: ~~aluminum-26,~~ berkelium-247, calcium-41, ~~californium-250,~~ chlorine-36, iodine-129, rhenium-187, ~~terbium-157, and terbium-158~~, and technetium-99.*

The revised radionuclide concentration limitations (maximum acceptable activities) described in Sections 4.3.1 and 4.3.2 of this SER will be incorporated into the amended License at *LC 55, Specific Operating Procedures.* The proposed revised LC 55 follows:

~~*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:*~~

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

*A. For the Class A West disposal cell, the Licensee shall ensure that the average concentrations of selected radionuclides do not exceed the limits stated in Table 55A.*

***Table 55A. Limiting Radionuclide Concentrations in Waste Disposed of in Class A West Disposal Cell.***

| ***Radionuclide*** | ***Maximum Average Radionuclide Concentration[1] in Waste Disposed of Under Top Slope (pCi/g)*** | ***Maximum Average Radionuclide Concentration[1] in Waste Disposed of Under Side Slope (pCi/g)*** |
|---|---|---|
| *berkelium-247* | *6.50E-03* | *3.88E-03* |
| *calcium-41* | *3.53E+04* | *3.41E+01* |
| *chlorine-36* | *1.59E+01* | *9.72E+00* |
| *iodine-129* | *---* | *2.19E+01* |
| *rhenium-187* | *---* | *1.91E+04* |
| *technetium-99* | *---* | *1.72E+03* |

*1. Maximum average radionuclide concentration for a radionuclide is determined as the quotient of the Total Activity (in picocuries) of that radionuclide disposed of under the respective slope and the Total Mass disposed of under the respective slope for the Active Cell (in grams) + Completed Cell (in grams).*

~~*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:*~~

~~*Total Activity of berkelium-247 Received (picocuries) < 0.0001 picocuries per gram*~~
~~*Total Mass of Active Cell (grams) + Completed Cell (grams)*~~

~~*C.*~~*B.* *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:*

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

~~*D.*~~*C.* *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)*

## 5.2 MINOR CHANGES

***Required General Revisions***

The RML will be revised throughout as needed to reflect and reference the CAW Embankment, to remove references to the existing Class A and CAN Embankments where appropriate, and to reference the approved CAW Embankment Drawings ("Series 10014"). These required changes include:

- Update the RML at *LCs 6, 9, 11, 14, 16, 29, 36, 38, 39, 40, 43, 50,* and *53* to reflect the change in the designation and the location of the CAW Embankment and the change in the Class A waste disposal area footprint and height;
- Update the RML at *LCs 38, 43, 48, 89*, and/or other LC's as applicable and appropriate to reference the approved CAW Embankment Drawings ("Series 10014"); and
- Update the last section of LC 89 (Closeout Conditions) to add the following statement at the end of the section:

*The following documents refer to documents the Licensee submitted in support of proposed Amendment #10:*

1) *AMEC Earth & Environmental, Inc. 2011. Report: Geotechnical Update Report – EnergySolutions Clive Facility Class A West Embankment, February 15, 2011*
2) *AMEC Earth & Environmental, Inc. 2011. Cover Letter – Response to Interrogatory CAW R313-25-8(4)-16/1: Seismic Hazard Evaluation, EnergySolutions Clive Facility, Class A West Embankment, Clive, Tooele County, Utah. eport: Geotechnical Update Report – EnergySolutions Clive Facility Class A West Embankment, Clive, Tooele County, Utah. October 25, 2011.*
3) *AMEC Earth & Environmental, Inc. 2011. Response to Interrogatory CAW R313-25-8(4)-16/1: Seismic Hazard Evaluation, EnergySolutions Clive Facility, Class A West Embankment, Clive, Tooele County, Utah. October 25, 2011*
4) *AMEC Earth & Environmental, Inc. 2011. Response to Interrogatory CAW R313-25-8(4)-16/2: Seismic Hazard Evaluation, EnergySolutions Clive Facility, Class A West Embankment, Clive, Tooele County, Utah. December 23. 2011.*
5) *AMEC Earth & Environmental, Inc. 2012. Report: Response to Interrogatory CAW R313-25-8(4)-16/3: Seismic Hazard Evaluation/Seismic Stability Analysis Update, EnergySolutions Clive Facility, Class A West Embankment, Clive, Tooele County, Utah. April 6, 2012.*
6) *AMEC Earth & Environmental, Inc. 2012. Addendum: Additional Cyclic Softening Analysis, EnergySolutions Clive Facility, Class A West Embankment, Clive, Tooele County, Utah. May 3, 2012.*
7) *EnergySolutions, LLC. 2011. License Amendment Request: Class A West Embankment, with Attachments 1 Through 7 and cover letter to Mr. Rusty Lundberg at Utah Division of Radiation Control dated May 2, 2011.*
8) *EnergySolutions, LLC. 2011. Responses to Round 1 Interrogatories: License Amendment Request (UT2300249) for the Class A West Embankment and cover letter to Mr. Rusty Lundberg at Utah Division of Radiation Control, October 28, 2011.*
9) *EnergySolutions, LLC. 2011. Supplemental Responses to Round 1 Interrogatories: License Amendment Request (UT2300249) for the Class A West Embankment, November 28, 2011 and cover letter to Mr. Rusty Lundberg at Utah Division of Radiation Control, November 29, 2011.*
10) *EnergySolutions 2012. Radioactive Material License #UT2300249 and Ground Water Quality Discharge Permit No. UGW450005, Amendment and Modification Request - Class A West Embankment: Response to Round 3 Interrogatory URCR R313-25-7(3)-04, with attachments. Letter from Tim Orton, EnergySolutions, to Mr. Rusty Lundberg, Utah Division of Radiation Control, dated March 20, 2012.*
11) *Whetstone Associates, Inc. 2011. EnergySolutions Class A West Disposal Cell Infiltration and Transport Modeling Report, April 19, 2011.*
12) *Whetstone Associates, Inc. 2011. EnergySolutions Class A West Disposal Cell Infiltration and Transport Modeling Report, November 28, 2011.*
13) *Whetstone Associates, Inc. 2012. EnergySolutions Class A West Disposal Cell Infiltration and Transport Modeling Report, February 23, 2012.*

***Changes to Environmental Monitoring System Network***

Changes to the air, vadose zone, and groundwater monitoring networks that will be required as a result of the construction and operation of the proposed CAW embankment are discussed in Section 4.2.4, "Environmental Monitoring Program," of this SER. These changes will require certain revisions to the RML and the Groundwater Quality Discharge Permit. Required revisions to the RML to reflect some of these changes are summarized below.

Revision to Air Monitoring Network

A new air monitoring station will be added to the environmental monitoring network to provide an additional level of monitoring for assessing potential airborne movement of contamination from the CAW embankment operations to the Vitro Facility to the east. This additional monitoring station (A-6) will be installed on the east side of the proposed CAW embankment (Attachment 1 to EnergySolutions 2012e). The Licensee has revised the Environmental Monitoring Program (EnergySolutions 2012e) to reflect the addition of one new air monitoring station at the location shown on Drawing 07007 J01, January 5, 2012 (Attachment 1 to EnergySolutions 2012f).

The license will be revised at LC 26 to reference the updated Environmental Monitoring Program.

Revisions to Vadose Zone and Groundwater Monitoring Networks

One or more revisions to the existing Groundwater Quality Discharge Permit will be required to reflect the changes to the vadose zone and groundwater monitoring systems that will result from constructing and implementing the proposed CAW embankment.

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# Attachment #3

# PUBLIC PARTICIPATION SUMMARY

for the

Energy*Solutions*' Class A West Embankment

License Amendment Request

Tooele County, Utah

**Table of Contents**

## Abbreviations and Acronyms

| | |
|---|---|
| 11e.(2) | Section 11e.(2) of the Atomic Energy Act of 1954, as amended |
| AASHTO | American Association of State Highway & Transportation Officials |
| ALARA | As Low As Reasonably Achievable |
| ANSI | American National Standards Institute |
| ARML | AASHTO Materials Reference Laboratory |
| ASME | ASME International, formerly American Society of Mechanical Engineers |
| bgs | Below ground surface |
| BLM | U.S. Department of the Interior, Bureau of Land Management |
| BWF | Bulk Waste Facility |
| CAC | Class A Combined Facility |
| CAES | Computer Aided Earthmoving System |
| CAN | Class A North Facility |
| CFR | Code of Federal Regulations |
| cm/sec | centimeters per second |
| cm/yr | centimeters per year |
| CQA/QC | Construction Quality Assurance/Quality Control |
| CRSO | Corporate Radiation Safety Officer |
| CSLM | Controlled Low Strength Material |
| CWF | Containerized Waste Facility |
| cy | Cubic yards |
| D&D | Decontamination and Decommissioning |
| DOE | U.S. Department of Energy |
| Division | Utah Division of Radiation Control |
| DU | Depleted Uranium |
| EZD | Evaporative Zone Depth |
| ft/ft | feet per foot |
| GSA | Generator Site Access |
| GWQDP | Groundwater Quality Discharge Permit |
| HEAL Utah | Healthy Environment Alliance of Utah |
| HIC | High integrity container |
| LARW | Low-activity Radioactive Waste |
| LEU | Low-enriched Uranium |

| | |
|---|---|
| LRA | License Renewal Application |
| LLRW | Low-Level Radioactive Waste |
| NQA-1 | Quality Assurance Requirements for Nuclear Facility Applications published jointly by ASME and ANSI |
| NRC | U.S. Nuclear Regulatory Commission |
| NW | Northwest |
| OSHA | U.S. Occupational Safety and Health Administration |
| PE | Professional Engineer |
| PMP | Probable Maximum Precipitation |
| QA | Quality Assurance |
| QAP | Quality Assurance Program |
| QC | Quality Control |
| RML | Radioactive Materials License |
| RWP | Radiation Work Permit |
| SEC | U.S. Securities and Exchange Commission |
| SER | Safety Evaluation Report |
| sf | square feet |
| SME | Subject Matter Expert |
| $UO_2$ | Uranium dioxide |
| $U_3O_8$ | Triuranium octoxide; yellowcake |
| URCB | Utah Radiation Control Board |
| URCR | Utah Radiation Control Rule |
| URS | URS Corporation |

***Introduction***

The purpose of this document is to summarize public comments received by the Utah Division of Radiation Control (the Division) regarding Energy*Solutions*' request to amend its Radioactive Material License governing disposal of low-level radioactive waste (LLRW) at its facility located at Clive, Utah, and to provide responses to those comments.

Three sets of written comments were received from the public during the comment period that ended on July 26, 2012. One of the sets of comments duplicated another set (both submitted by HEAL Utah). No oral comments were received at the Public Hearing held July 26, 2012 in Tooele, Utah. These comments were considered in revising the requirements of the facility's Radioactive Material License, No. UT 2300249.

Each comment topic received is restated below in italics. The Division's response and disposition follow each comment; denoted with the words "Division Response" in bold text. Images of the complete comment documents are included as Appendices A, B, and C.

Revisions made to Energy*Solutions*' Radioactive Material License (RML), No. UT 2300249, which was issued for public comment on June 12, 2012, are shown in Appendix D and discussed in the conclusion to this document.

***Background***

The following general information provides context for some of the specific comment responses.

***(1) Financial Assurance***

The amount of financial assurances required is approved annually by the UDRC after review of updated cost estimates submitted by the Licensee. The financial assurances are intended to cover the costs of closure and post-closure care of the facilities. The Division reviews the Licensee's surety report annually to assess the adequacy of the surety provided and to determine what surety adjustments should be provided for protecting against financial insolvency. The annual review considers whether adjustments are needed to reflect inflation, increases in the amount of disturbed land, changes in engineering plans, addition of new facilities, closure and stabilization that have already been accomplished, and other conditions that might affect closure costs. For example, A new item was added to the 2011 Surety in the amount of $578,285 to construct a drainage swale, 6700 feet in length, to prevent water collecting in the clay borrow areas of Section 5, immediately south of the disposal facilities.

The 2011 Annual surety has been reviewed and approved by the DRC. The 2012 surety report will be submitted December, 2012.

The following points are pertinent to comments received during the public comment period:

- Development of the Class A West cell will require changes to the closure plan and therefore increases in the surety. License Condition 73 requires EnergySolutions to address those changes and any resulting changes in the surety in its annual Surety Report due in December 2012. It is anticipated that the Division will complete its review of the report by approximately June, 2013. Any increase in surety required by the Division must be provided within 60 days of that approval.
- To address the interim period before the Surety for Class A West is reviewed and increased, EnergySolutions has provided interim Surety sufficient to relocate any waste disposed of that is

not within areas that could be closed in the currently-approved configuration for the Class A or Class A North cells. See Appendix G. If premature closure is required, this waste would be moved to the Class A or Class A North cell, using this portion of the surety. The cells would then close as provided in the currently-approved and fully-funded closure plan.

- This interim Surety funding is also sufficient to meet concerns about timing of the study required under new License Condition 41 which requires a new evaluation of the clays that will be used to build the cap. The characteristics of the clays take on increased importance given the length of the runs in the new larger cell. However, if the study demonstrates that additional processing will be required to process the clays, the existing and interim Surety would cover moving the new waste and implementing the currently-approved Class A and Class A North cells if Surety for that additional processing was not provided and the Licensee became financially insolvent.

- In its May 15, 2011 Class A West application, section 10.2 Funding Assurances EnergySolutions states: "Upon DRC approval of the Class A West embankment and associated financial surety calculations, and prior to placing waste in portions of the class west embankment that exceed horizontally or vertically beyond the current approved Class A and Class A North designs, EnergySolutions will amend the letters of credit necessary to ensure funding for closure and post-closure monitoring of the class A west Embankment." Feb, 23, 2012 (Rev.04). This commitment is incorporated into the permit under License Condition 73.

- License Condition 73 requires EnergySolutions to maintain in the surety an allowance for the cost of re-engineering the facility, including recontouring of embankment slopes if premature closure is necessary. Recontouring may be necessary if there is not enough waste in the cell to close as provided in the Class A West closure plan.

Perpetual Care is another aspect of financial assurance. The annual amount EnergySolutions is required to pay into the Perpetual Care Fund is set by state law (UCA 19-3-106.2) and that amount does not change unless the statute is amended. However, there is also additional financial assurance for perpetual care associated with the five-year reviews the Radiation Control Board undertakes under Utah Code Ann. § 19-1-307(2). By statute, this amount is reviewed and reported to the Legislative Management Committee every five years, not in association with license amendment(s). Perpetual care is now fully funded based on the amount approved by the Radiation Control Board when it approved the September 2011 report, "Evaluation of Closure, Post-closure, and Perpetual Care and Maintenance for Commercial Hazardous Waste and Commercial Radioactive Waste Treatment, Storage, and Disposal Facilities."

The final License includes a new condition related to surety that is pertinent to comments received during the public comment period:

> 76. The Licensee shall at all times maintain a Surety for perpetual care, using an instrument that satisfies the requirements of UAC R313-22 and R313-25. The Surety shall be in the amount last approved by the Radiation Control Board, as provided in Utah Code Ann. 19-1-307(2), as adequate to fund perpetual care, less the amount contributed to the Radioactive Waste Perpetual Care and Maintenance Account created under Utah Code Ann. 19-3-106.2 (but not including any part of that Account resulting from returns on investment).

### ***(2) License Amendment and the Huntsman Agreement***

On March 15, 2007, Governor John Huntsman for the State of Utah and CEO Steve Creamer for EnergySolutions entered into an agreement (Appendix E) that committed EnergySolutions to limit its disposal to "the currently-licensed low-level radioactive waste cell volumes," including the volume of waste that the agreement anticipated as a result of converting EnergySolutions' 11e.(2) cell into a Class A

waste cell. The Division and EnergySolutions have agreed that this total approved volume is 10,357,412 million cubic yards (Class A = 3,778,896 million $yd^3$; Class A North = 1,722,509 million $yd^3$; Class A South = 3,501,915 million $yd^3$; Mixed Waste = 1,354,092 million $yd^3$ for a total of 10,357,412 million $yd^3$). EnergySolutions had originally anticipated that this disposal would occur in three already-licensed low-level radioactive waste cells (Class A, Class A North and Mixed Waste cells) and in the 11e.(2) cell that it expected to convert to a Class A cell. The Licensee has now chosen instead to develop this allowable capacity in two cells, the existing Mixed Waste Cell, and a new combined Class A and Class A North cell (now proposed as the Class A West cell). The Mixed Waste and Class A West cells will have a combined capacity of 10,078,189 cubic yards. This leaves a capacity of 279,223 cubic yards that EnergySolutions can still develop under the Huntsman Agreement.

Additional amendments to EnergySolutions' License to conform to the Huntsman agreement are not necessary because this License covers all areas where Class A waste can be disposed. The only other area that is licensed to take radioactive waste is the 11e.(2) cell. Class A waste cannot be disposed of in that cell, and only Class A waste is subject to the Huntsman Agreement. Because there is no other area that may accept Class A waste, there is no possibility that the Agreement will be violated under currently-applicable licenses. Additional requirements would be redundant and unnecessary.

A modification to License Condition 9.E of the revised RML UT 2300249 will be made to address a correction in the calculations:

> "The Licensee may dispose of a volume of Class A Low-Level Radioactive Waste (LLRW) and Naturally Occurring and Accelerator Produced Radioactive Materials (NARM) in the Class A West disposal cell described in License Condition 40 not exceeding ~~8,742,097~~ 8,724,097 cubic yards, and in the Mixed Waste Landfill Cell not exceeding ~~1,353,004~~ 1,354,092 cubic yards. Together, the total aggregate volume of waste disposed of in the Class A West disposal cell and the Mixed Waste Landfill Cell shall not exceed 10.08 million cubic yards. Class A waste LLRW is defined in Utah Radiation Control Rule R313-15-1009 and NARM at R313-12-3."

### *(3) Waste Settlement*

The design criteria, their basis, conditions evaluated, and projected performance for the Class A West embankment is the same as the currently approved Class A and Class A North embankments. These factors are applicable to the Class A West embankment because liner, waste placement, and cover specifications are the same for each embankment. Site preparation and construction requirements for the Class A West embankment are provided in the LLRW and 11e.(2) CQA/QC Manual (Rev. 26d). Basically, the specifications regarding the Class A West embankment are identical to those of the currently approved Class A and Class A North embankments, with only a minor technical revision regarding settlement monitoring requirement in the LLRW and 11e.(2) CQA/QC Manual. Specifically, the criteria for observed settlement was revised from the current distortion criteria of 0.02 ft/ft, to a more restrictive settlement monitoring observed distortions between any two adjacent points of 0.007 ft/ft or less. This is further discussed in DRC's response HEAL -08 below. Construction methods involving the liner, waste placement, and cover construction for the Class A West embankment will be unchanged from current approved practices as provided in the LLRW and 11e.(2) CQA/QC Manual.

***1. Comments from HEAL Utah, Matt Pacenza, Policy Director***

***Note:*** Comments submitted by Mr. Matt Pacenza are provided verbatim in Appendix A and are duplicated below in italics, with the Division's responses (normal text) following line headers in bold and underscored.

## *Comment HEAL-01:*

*Introductory and Background Information*

> *The below comments are regarding an initial decision by the Director of the Utah Division of Radiation Control to amend the EnergySolutions (Licensee) Low--Level Radioactive Waste Disposal License (RML UT 2300249) and Ground Water Quality Discharge Permit (No. UGW450005).*
>
> *Before we get to the substance of our comments, we think it essential to frame this decision and our response to it in a longer history of EnergySolutions' efforts to expand and shift capacity at the Clive site. It is critical that the Division of Radiation Control, along with DEQ officials and the Herbert Administration, make this particular decision within that broader policy context.*
>
> *Let us start in 2006, when EnergySolutions sought permission from the DRC to create a "Supercell," merging the Class A and Class North embankments and increasing its LLRW capacity at Clive from 8.8 million cubic yards to 13.1 million cubic yards.*
>
> *At the time, HEAL and others argued that such an expansion should trigger the provision of a 1990 law requiring that significant license changes be approved by the Legislature and the Governor. EnergySolutions disagreed with that interpretation, but, just in case, in February 2007, it successfully lobbied the State Legislature to pass a law removing the governor, Legislature and Tooele County Commission from the chain of required approvals for a significant capacity increase.*
>
> *That led Gov. Jon Huntsman to threaten to exercise his veto power via the Northwest Interstate Compact on Low-Level Radioactive Waste Management to prevent the company from creating the Supercell. The Huntsman Administration and the company then entered into negotiations that then led, of course, to what has become known as the "Huntsman Agreement," a negotiated accord between the state of Utah and EnergySolutions*[1].
>
> *Obviously, as state regulators you are familiar with the agreement, so we do not intend to repeat all of its provisions here. The critical piece, however, was a trade:*
>
> *EnergySolutions agreed to give up its Supercell proposal in exchange for being allowed to convert approximately 3.6 million cubic yards of its already-permitted 11e.(2) disposal cell into capacity for low-level radioactive waste.*
>
> *The agreement was signed in March 2007. Over the subsequent four years, the company and state regulators sought pathways to implement the conversion of 11e.(2) into low-level radioactive waste disposal and apparently encountered various legal and technical challenges.*

[1] http://www.utah.gov/governor/news_media/article.html?article=225

*In the meantime, however, the company made clear it was willing to jettison the Huntsman Agreement – as soon as it had grounds to do so.*

*Please see "EnergySolutions flips on deal not to expand waste site," a story from February 2010.*[2] *After the company won an initial court decision that determined that its Clive site wasn't under the jurisdiction of the Northwest Compact, it immediately announced that the Huntsman Agreement was "obsolete."*

> *"When the district court ruled that the Northwest Compact lacked jurisdiction over the Clive [Tooele County] facility," company president Val Christensen said in an e---mail to The Tribune this week, "the standstill agreement with Gov. Huntsman became unnecessary."*

*Company officials were clearly eager several years ago to abandon the Huntsman Agreement. We would thus conclude – and will make this case below – that the state should adopt an extremely cautious approach to drafting license language that leaves as little "wiggle room" as possible, in the effort to avoid opening up potential future loopholes that could lead to greater site expansion.*

*We also point out that same Tribune article from Feb. 2010 makes clear that Gov. Gary Herbert supports the Huntsman Agreement and its volume caps.*

*We now move to May 2011, when EnergySolutions applied to the state for permission to create a new Class A West cell. Like the Supercell, it merges the existing Class A and Class North embankments, although this version is somewhat smaller. The company returned to the merged cell proposal, it said, because it and the state could not satisfactorily resolve outstanding legal and engineering hurdles that stood in the way of the Class A South/11e(2) conversion.*

*Effectively, the proposal before the state and the public now is a reversal of the trade at the heart of the Huntsman Agreement: Instead of giving up the Supercell proposal in exchange for the Class A South conversion, the company now proposes to give up the Class A South conversion in exchange for creating a slightly smaller Supercell.*

**Division Response HEAL-01:** See Background, part 2, License Amendment and the Huntsman Agreement. There has been no reversal of the trade at the heart of the Huntsman Agreement. The heart of that Agreement was a limit on type and total volume of low level radioactive waste. All limits are supported by this amendment as described in the Background, Part 2.

**REFERENCES**

Huntsman, J.M., and Creamer, R. S., 2007. Agreement between the Governor of the State of Utah and Energy*Solutions*, LLC, dated March 15, 2007.

URS 2012, Utah Division of Radiation Control, Safety Evaluation Report. Energy*Solutions* LLRW Disposal Facility Class A West Amendment Request. June 2012.

[2] http://www.sltrib.com/News/ci_14329478

***Comment HEAL-02:***

*Please keep the above history in mind as we move to our substantive comments on the current Class A West Amendment.*

1. *We applaud the Division for the following amendment to RML UT 2300249:*

   *The Licensee may dispose of a volume of Class A Low-Level Radioactive Waste (LLRW) and Naturally Occurring and Accelerator Produced Radioactive Materials (NARM) in both the Class A West and Class A North disposal cell described in License Condition 40, and in the Mixed Waste Landfill Cell not exceeding a total of 10.1 million cubic yards. Class A waste is defined in Utah Radiation Control Rule R313-15-1008 and NARM at R313-12-3.*

   *The* ***not exceeding a total of 10.1 million cubic yards*** *language is welcome, because it codifies in the license for the first time (we believe) a volume cap for that portion of the Clive site. We do not yet know if the licensee has agreed to this language, but if they have, and it stands, it is a step in the right direction of limiting efforts to continually expand the Clive site.*

   - **Division Response HEAL-02:** The Division acknowledges the comment. The actual total is slightly less at 10.08 million cubic yards. This is below the 2007 Agreement by 279,223 cubic yards, as described in background, part 2.

***Comment HEAL-03:***

2. *However, we urge the DRC to further amend the license to include the following: a total cap on LLRW volume for the entire Clive site, including the unused portion of the Class A South/11e.(2) cell.*

   *This additional language is essential if the DRC intends to preserve the total volume caps in the Huntsman Agreement, as Gov. Herbert and regulators have previously indicated they wish to. We believe that EnergySolutions, without violating this license, could come back to the Division in a few years and say they've now figured out a way to safely engineer Class A South and so would like to propose to re-open that 3.5 million cubic yard proposal. That would grant the company a significant expansion in total capacity - which obviously the Huntsman Agreement was seeking to prevent.*

   **Division Response HEAL-03:** See Background, Part 2 and Division Response to HEAL-01.

***Comment HEAL-04:***

*We believe EnergySolutions will be able to argue that the newly RML UT 2300249 supersedes the Huntsman Agreement. It explicitly and directly contradicts the Agreement. It, for example, grants the licensee permission to merge the Class A and Class North embankments – which the Agreement was designed to prevent.*

**Division Response HEAL-04:** The Division does not agree that EnergySolutions will be able to argue that the new License supersedes the Huntsman Agreement. The Agreement prohibited disposal of a total waste volume greater than an agreed-upon amount: the volume within the "waste cell volumes" licensed as of May 1, 2006, plus the volume of the anticipated "Converted Class A Cell." Although the Huntsman Agreement did not

anticipate shifting that volume to different cells, it did not prohibit such a shift if the total volume remains under the ceiling specified in the Agreement. The total volume for Class A Waste under this License Amendment remains under the ceiling specified in the Agreement.

See also Background, Part 2.

***Comment HEAL-05:***

*Is it unrealistic or perhaps paranoid to think that EnergySolutions will seek to further expand its LLRW capacity Clive beyond the 10.1 million cubic yards it is permitted in the Class A West and Mixed Waste disposal cells? To identify additional space elsewhere at Clive – such as Class A South – where it will be able to dispose of additional waste, and continue to bring material to Utah for decades to come?*

**Division Response HEAL-05:** This is not an issue that can be addressed in this License; EnergySolutions will not be able to develop additional capacity as the facility is currently licensed, and there is no License Conditions that DRC can put in place that will prevent EnergySolutions, if it so chooses, from contemplating and even requesting changes to the Huntsman Agreement with the current Administration.

See also Background, Part 2 and Division Responses HEAL -01, HEAL -03 and HEAL-04**.**

***Comment HEAL-06:***

*As mentioned above, the licensee as recently as 2010 sought to jettison the volume caps in the Huntsman Agreement as soon as it had a pretext for doing so. Clearly, EnergySolutions has seen the agreement as a document it would seek to abandon as soon as it could, rather than one that it was bound to in good faith. To our knowledge, EnergySolutions has not publicly indicated they believe they are currently bound to the terms of the original agreement.*

*The company faces tremendous financial pressure to demonstrate to investors that its long-term revenue prospects are solid. Undoubtedly, regulators have noted the recent wave of bad news for EnergySolutions: It dismissed its CEO and CFO. Its stock plummeted, losing more than half its value Standard & Poor's and other key rating agencies down-graded the company's debt to BB- and BB+, aka "speculative grade" or junk bond levels. The company announced it was looking to sell its U.K. and European business, which, according to a recent Associated Press story ("Company charged with dismantling Zion nuclear plant struggling financially") represents at least 60 percent of its total revenue. At the same time, the company has previously made clear that disposal at Clive is among its most profitable work, as it long ago paid the upfront costs for building and engineering the facility. Its newer proposed revenue streams – such as decommissioning shuttered nuclear reactors – have turned out to lose money.*

*Given those economic realities, it would be a surprise if the company were to not seek to expand the potential disposal volume at Clive – to reassure investors that its most profitable revenue stream will continue for many years.*

**Division Response HEAL-06:** The Division acknowledges the comment. See Division Response to HEAL-05.

**REFERENCES**

Energy*Solutions*, LLC. 2011. Annual Surety Submittal, Radioactive Materials License UT2300249: Response to Request for Information.

UDRC 2012. Energy*Solutions* 2011 Annual LLRW Surety Submittal, 2011 Engineering Module 13, Radioactive Materials License Number UT2300249: Conditional Approval.

***Comment HEAL-07:***

*In addition, those financial difficulties – and what experts have suggested is at least a possibility that EnergySolutions may face bankruptcy or liquidation – must be fully factored into this license amendment. It would be prudent for the Division to consider what impact the new Class A West proposal has upon the line of credit and perpetual care fund designed to ensure that the State of Utah will have sufficient resources to safely maintain the Clive facility in case the company no longer can. In other words, will anything about the super cell proposal either a) increase near-term closure costs if the company goes bankrupt, or b) increase costs associated with perpetual care of the site? For instance: Will tying two cells together into a super cell increase costs for fill material if EnergySolutions goes bankrupt before filling the new supercell? Will differential settlement be more likely in a supercell, and create additional financial risks in the long-term? In order to protect Utah's health and environment, and the Utah taxpayer, we believe it is necessary to estimate the impact of the proposed super cell on short-term closure and long term perpetual care costs prior to making a final licensing decision on the proposed super cell.*

**Division Response HEAL-07:** *See* Background, Part 1, regarding the adequacy of the surety, and Part 3, regarding waste settlement. Perpetual care is, by statute, addressed every five years. *See* 19-1-307(2).

The Division evaluated the Licensee's 2011 approved surety report with respect to each of the issues raised in Comments HEAL-06 and HEAL-07 and has determined that they have been appropriately addressed in that document.

In addition, refer to Division Response to HEAL-08.

***Comment HEAL-08:***

*We do believe that merging two different cells into a larger "supercell" presents some unique technical challenges, including: How can the clay liners for the existing cells be adequately "stitched" together, given that the clay liners underlying the existing cells are of different vintages and have been subject to different weights and pressures as the cells have settled? And, importantly, when the supercell is filled, will differential settlement across the various portions of the supercell cause the cover to crack or eventually create ponding or accelerated erosion?*

**Division Response HEAL-08 follows:**

**Liner Connections and Liner Differential Settlement**: The Division has considered potential issues created by allowing construction of the Class A West liner system in the area between the Class A and Class A North embankments (Energy*Solutions*, LLC. 2012). These issues include the possibility that the different placement times and different extents of previous settlement in these three areas might compromise the integrity of the existing and proposed modified liner and cover systems.

The design of the liner system between the Class A and Class A North embankments requires that new portions of the liner be keyed into existing portions. This will result in a "joint" similar to those used in the construction of the original liner system which has a permeability similar to that of a continuously placed section of liner (*see* Appendix F). Once new portions are keyed into existing portions, waste placement will occur. As waste accumulates above the liner, both existing portions (that have only slightly settled) and new portions (that have not settled at all) of the foundation soils will settle together without any distinctively adverse pattern of differential settlement. Hence the Division's conclusion is that the integrity of the Class A West liner system will not be jeopardized or compromised.

Moreover, the method proposed by ES for connecting newly-constructed sections of clay liner to existing clay liners in the CAN and CA embankments includes using an overlapping, "stair-stepped" connection approach. *See* Appendix F. The procedures for constructing such connections between new clay liner sections and existing clay liners are included under the 'Specification', and the 'Quality Control' and 'Quality Assurance' columns of *Work Element – Clay Liner Placement* in the LLRW and 11e.(2) CQA/QC Manual (Energy*Solutions* 2011). The "keying-in" specification requires that sections of clay liner constructed at times more than 30 days apart from each other be keyed-in to each other at vertical steps no greater than nine inches and at least twice as wide as they are high. For the 2-ft-thick clay liner thickness, the width of clay liner connection overlap will be a minimum of 4 feet. Any deficiencies noted in the keying-in to the existing liners must be noted on an "Embankment Construction Lift Approval Form". These procedures are consistent with current recommended practices in the waste disposal industry (e.g., see Sharma and Lewis 1994, Section 8.3.4.2), which include making such a stair-stepped connection and achieving a 4- to 5-foot overlap for such clay liner connections. This procedure requires some reworking of the edge of the existing clay liners and is designed to lead to a continuous bond between the clay liner segments. Phased construction and lateral tie-ins of clay liner sections in this manner is a typical practice at other waste disposal facilities.

A series of analyses were performed to evaluate differential settlement magnitudes across different portions of the proposed CAW embankment (Energy*Solutions*, LLC 2012). Specifics regarding the differential settlement analyses completed for the CAW embankment are discussed in Section 4.4.1 of Attachment 5 to the CAW Embankment License Amendment Request (LAR) (AMEC 2011). Based on the results of the analyses described above, AMEC concluded that: (1) settlement of the foundations soils will be 12 to 16 inches; (2) the foundations settlements are expected to be complete well before final cover is placed (within a 1-year period after final waste placement); (3) monitoring data obtained from the interim cover layer over emplaced wastes is expected to primarily reflect embankment (i.e., waste) settlements and not foundation settlements; and (4) the maximum settlement in the foundation soil will be 24 inches**.** Based on the analysis, AMEC concluded that with primary and secondary foundation settlement incorporated into the

cover design criteria, the magnitude and timing of foundation settlements, will not adversely impact drainage of the final CAW embankment cover. The Division concurs with the analyses and the associated technical conclusions.

**Cover Differential Settlement:** As discussed above, AMEC conducted a series of analyses to evaluate differential settlement magnitudes across different portions of an embankment. Critical cross sections considered in the analyses included sections across and spanning different waste forms, including: (1) bulk compressible wastes placed adjacent to CLSM pyramids; (2) compressible debris and incompressible debris placed in adjacent soil lifts; and (3) Containerized Waste Facility pyramids placed adjacent to other waste forms/types (AMEC 2005; 2011). Details regarding the differential settlement analyses are discussed in Section 4.4.1 of Attachment 5 to the CAW Embankment License Amendment Request (LAR) (AMEC 2011). The Division finds use of these cross sections for assessing potential magnitudes of differential settlement of the proposed CAW embankment to be acceptable**.** Results of analyses of differential settlement for the proposed CAW Embankment (see Section 3.0 and Table 3.4 of the CAW Embankment LAR) indicate that the projected maximum distortion amounts in the Liner of the proposed CAW Embankment are 0.001 ft/ft and 0.007 ft/ft, under normal and abnormal conditions, respectively; and projected maximum distortion amount in the Radon Barrier layer in the cover of the proposed CAW embankment under abnormal conditions is less than 0.01, which occurs for the case of bulk waste**.** The 2011 AMEC study concluded that most of the settlement would occur during operations in the waste placement phase, prior to the final cover placement.

Settlement monument monitoring data obtained by Energy*Solutions* to date for existing embankments, combined with evaluation of settlement vs. embankment height trend data indicate (AMEC 2011) that the magnitude of distortion expected to occur in CAW embankment is less than 0.007 ft/ft . This value is lower than the currently-prescribed allowable clay layer distortion criterion of 0.02 ft/ft, a value that was selected based on published literature data prior to 2005.

Energy*Solutions* is currently conducting additional laboratory testing to confirm the cracking characteristics of the specific soils that will be used for constructing the clay layer in the cover. (See License Condition 41.) The testing will determine minimum (threshold) distortion values required for initiation of cracking of the compacted clay layer. Pending results of this additional laboratory testing, a Specification in *Work Element – Temporary Cover Placement and Monitoring* in the LLRW and 11e.(2) CQA/QC Manual requires that the temporary soil cover placed over waste be monitored for a minimum of 1 year after placement until data from all monitoring locations indicate observed distortions between any two adjacent points of 0.007 ft/ft or less.

The LLRW and 11e.(2) CQA/QC Manual also requires that Energy*Solutions* submit a written report to the Division at least 7 days prior to removing pre-final cover settlement monuments in preparation for final cover construction. Final cover construction cannot begin until an acceptable level of consolidation and settlement has occurred. The results of the additional laboratory testing of clay layer distortion and cracking will be reviewed in relation to these current requirements to determine whether the currently specified maximum allowable distortion threshold (0.007 ft/ft) remains appropriate for the specific soils to be used for clay layer construction. Settlement and differential settlement magnitudes will be monitored (Energy*Solutions* 2012) to ascertain whether the design cover distortion criteria developed and used for evaluating long-term stability of the

embankment with respect to settlement has been achieved. The final cover system will be constructed only after settlement has been shown, after placement of the interim cover system, to be within prescribed acceptable limits.

The testing of clay properties is advisable because the Class A West cell has longer runs that may stress the clays in ways different than previously analyzed. The tests will be completed prior to approval of the Surety, as that process is described in Background, Part 1 of this Response, and the approved Surety will address any necessary changes. In the interim period, the Surety will be sufficient for the reasons specified in Background, Part 1 of this Response.

**REFERENCES**

AMEC Earth & Environmental, Inc. 2005. Geotechnical Study:" Increase in Height and Footprint," May 27, 2005.

AMEC Earth & Environmental, Inc. 2011. Report: "Geotechnical Update Report – Energy*Solutions* Clive Facility Class A West Embankment," February 15, 2011.

Energy*Solutions*, LLC. 2012. Radioactive Material License #UT2300249 and Ground Water Quality Discharge Permit No. UGW450005, Amendment and Modification Request – Class A West Embankment: Response to Round 3 Interrogatory URCR R313-25-7(3)-04, with attachments. Letter from Tim Orton, Energy*Solutions*, to Mr. Rusty Lundberg, Utah Division of Radiation Control, dated March 20, 2012.

EnergySolutions, LLC 2012. LLRW and 11e.(2) Construction Quality Assurance/Quality Control (CQA/QC) Manual" Revision 26d), May 7, 2012.

Sharma and Lewis, 1994. Waste Containment Systems, Waste Stabilization, and Landfills: Design and Evaluation, John Wiley & Sons, Sep 8, 1994.

***Comment HEAL-09:***

*The report indicates that two important documents have not yet been submitted for final state approval: a report explaining the cover design as well as a report examining clay performance. We believe these reports must be submitted and reviewed as part of the overall licensing procedure and that it would be inappropriate for the state to approve the current license amendment in the absence of those two reports.*

**Division Response HEAL-09:** The DRC has accepted the cover design submitted with the License Amendment Application for the Class A West embankment. Unless another cover design is approved, this cover will be implemented. It will also be fully funded under the Surety, as described in Background, Part 1.

However, the licensee is interested in looking at another cover design option, which will be submitted by the end of the year. The DRC is allowing the licensee to investigate these other design options since cover construction of Class A West is a year or so into the future. This also applies to the Clay distortion study; therefore, the DRC and the licensee have time to obtain better information regarding the properties of site specific clays.

When the information is submitted, on or before December 21, 2012, the Division will review Energy*Solutions*' proposed cover design, together with associated analyses and

calculations, to include infiltration model simulations that will be submitted in support of that design. In addition, the clay study will better define the allowable distortion based on properties of site specific clays used in cover construction. Currently, there is a settlement value for which the Licensee will determine the maximum allowable distortion value on site specific clays. Depending on the outcome, this value may be different than the current value approved by the Director.

**REFERENCES**

EnergySolutions, LLC 2011. Radioactive Material License #UT2300249 and Ground Water Quality Discharge Permit No. UGW450005. Amendment and Modification Request – Class A West Embankment; Retraction of the Class A South/1 le.(2) Embankment Design Change Request, dated May 2, 2011.

EnergySolutions, LLC 2012. LLRW and 11e.(2) Construction Quality Assurance/Quality Control (CQA/QC) Manual" Revision 26d), May 7, 2012.

NUREG/CR-4620. Nelson, J.D., S.R. Abt, R.L. Volpe, D. van Zyl, N.E. Hinkle, and W.P. Staub. 1986. *Methodologies for Evaluating Long-Term Stabilization Designs of Uranium Mill Tailings Impoundments*, ORNL/TM-1006, prepared for U.S. Nuclear Regulatory Commission, June 1986.

Temple, D.M., Robinson, K.M., Ahring, R.M., and Davis, A.G. 1987. *Stability Design of Grass-Lined Channels*. U.S. Department of Agriculture, Agricultural Handbook No. 667, U.S. Government Printing Office, Washington, D.C., 167 pp.

URS 2012. Safety Evaluation Report. Energy*Solutions* LlRW Disposal Facility Class A West Amendment Request. June 2012.

US Nuclear Regulatory Commission (NRC), Office of Nuclear Material Safety and Safeguards. 2002. NUREG-1623, *Design of Erosion Protection for Long-term Stabilization*, Final Report. September 2002.

***Comment HEAL-10:***

*We appreciate the Division taking the time to carefully consider these comments. We would like to repeat our most important point for emphasis: the Huntsman Agreement was incredibly important for codifying a trade: the company gave up the Supercell and got back the Class A South conversion. And, now, EnergySolutions proposes to flip that trade: It will give up Class A South in exchange for Class A West. Here's the fundamental problem: Only half that deal is in writing. The company gets Class A West – but there is as yet no language that ensures that the former Class A South Cell will never be developed.*

*The division must require the licensee to commit to an overall volume cap and to agree to not seek to convert Class A South or any other possible cell at Clive in the future. If the State does not take this critically important step, we fear this current license could have the unfortunate impact of nullifying the most important component of the landmark Huntsman Agreement—namely, a cap on total waste at the site of 10.1 million cubic yards.*

**Division Response HEAL-10:** Refer to Division Responses HEAL-01through HEAL-04.

***Note:*** An additional comment submitted by Mr. Christopher Thomas is provided verbatim in Appendix B and is duplicated below in italics.

***Comment HEAL-11 (From Christopher Thomas, Executive Director):***

*a. Incorrect reference*

*There is a proposed amendment that reads:*

*The Licensee may dispose of a volume of Class A Low-Level Radioactive Waste (LLRW) and Naturally Occurring and Accelerator Produced Radioactive Materials (NARM) in both the Class A West and Class A North disposal cell described in License Condition 40, and in the Mixed Waste Landfill Cell not exceeding a total of 10.1 million cubic yards. Class A waste is defined in Utah Radiation Control Rule R313-15-1008 and NARM at R313-12-3.*

*We believe the reference to Utah Radiation Control Rule R313-15-1008 is incorrect; we believe it should be Utah Radiation Control Rule R313-15-1009, "Classification and Characteristics of Low-Level Radioactive Waste," which include waste classification tables.*

**Division Response HEAL-11:** The Division agrees with the comment and regrets the typographical error. The typographical error was corrected.

2. Comments from Charles Judd, Cedar Mountain Environmental, Inc. (July 26, 2012)

***NOTE:*** The paragraphs quoted from Mr. Judd's comments are provided verbatim in Appendix C and duplicated below in italics. Each comment is numbered according to the numbering systems used in his comments. Judd's comments are provided below in italics, with the Division's responses following line headers in bold and underscored.

***Comment Judd-01:***

***Judd Detailed Comments, Page 1***

1. *THE FINANCIAL STABILITY OF THE COMPANY IS DETERIORATING QUICKLY. IT IS POSSIBLE THAT THE STATE OF UTAH WILL SOON BE RESPONSIBLE TO CLOSE THE CELLS. THERE ARE NOT ENOUGH RESOURCES TO CLOSE THE NEW CELL SO THE STATE WILL BE RESPONSIBLE TO PAY THE EXTRA COSTS OF THIS NEW "SUPERCELL".*

   *The financial stability of the company is of great concern. Stock prices have dropped over 90 percent and the debt of the company is huge. To top it off, there was no review done of the financial surety of the site if the new supercell were approved. The DRC must do a financial review of the amendment before it is approved. The surety is the main way the State of Utah is protected from the failure of the company. The State of Utah is at huge risk at this time. There are many issues surrounding the surety that are unknowns. First, the design of the facility is not even known. No one has shown how the new facility would be closed if the company goes bankrupt. It would be a huge cost to fill the cell up to the limits needed to provide proper drainage. There is not enough cover materials identified to complete the cells at the site. Their amount of money set aside to pay for rock is way low. The settlement issues create a time concern for closure that has*

*not been addressed. It is clear that the protection of the State of Utah has not been considered in the proposal. This financial review needs to be done before this proposal is sent out to public comment.*

*The SER was based on a management team that has now drastically changed. The company has gone through several major changes in the past 5 years. These changes are probably based on the financial situation at the company since the stock price has dropped from over 27 dollars to under 2 dollars. The new management needs to be evaluated to determine if they are willing to maintain proper controls at the company even though the financial situation at the company is very concerning. The citizens of Utah should not be expected to pay tens of millions of dollars to close a new supercell after executives of the company have been paid millions in benefits. A complete surety review is needed and a review of the company's financial stability and management should be required before a new supercell is considered. It is clear that a second public comment period is needed when the financial surety review is completed.*

**Division Response Judd-01:**

Financial stability of any company holding a radioactive materials license from the State of Utah concerns the UDRC. Existing regulations require the establishment of surety accounts wherein the licensee places funds, or other appropriate financial instruments, for use in the event of financial insolvency. The UDRC reviews and updates the surety annually, incorporating learning and guidance from the industry, including such widely accepted cost estimation sources such as RS Means. The UDRC has confidence that the current surety contains sufficient funding for closure and remediation of the currently approved facilities and activities. Changes to those facilities and activities as a result of the current action will trigger a revision of surety as described in Background, Part 1 of this Response.

With respect to the specific comment that the design of the proposed CAW embankment is not known, that is not true. There is a design for these embankments that DRC has reviewed and the Director has approved. As described in Division Response HEAL-09 above, Energy*Solutions* is proposing a modification to that design. That proposed modification is not relevant to this licensing; it has not been submitted to DRC for DRC's review and the Director's approval. If it is submitted and if DRC's review indicates that the revised design appears to meet relevant design criteria, a draft license amendment for the revised design will be provided for public notice and comment. Until that time, it is not appropriate to speculate about the proposal.

The Division reviews the Licensee's surety report annually to assess its adequacy and to determine the amount of the sureties. Annual surety adjustments include a cost item for re-engineering of the facility, including possible regrading/recontouring of embankment slopes should that become necessary. Under the hypothetical scenario wherein the Licensee is assumed to become financially incapable of continuing operations at the CAW embankment, a revised grading plan would be re-engineered to provide a final embankment surface that would promote and maintain long-term positive drainage over the performance life of the embankment, accounting for potential differential and total settlement, and a revised final cover would be designed. Further, the surety amount is adjusted annually to reflect inflation, increases in the amount of disturbed land, changes in engineering plans, addition of new facilities, closure and stabilization that have already been accomplished, and other conditions affecting closure costs.

Should ES become unable to fulfill its financial responsibilities before CAW surety monies are in place, the Division would fall back from the CAW cell design, revert to the Class A and Class A North designs, and close both cells (A and A north) accordingly.

If an alternative CAW cover design receives approval, the UDRC will review the impact of those plans on the surety, and require an appropriate adjustment to the surety account prior to allowing Energy*Solutions* to execute those plans,. This review also will determine an appropriate amount of surety to cover the costs of possible re-engineering and closure of the facility prematurely in the event of loss of financial resources on the part of the Licensee to continue operations at the facility. Consistent with findings of this review, the Division will require that the necessary sureties be provided.

During its most recent surety review, completed and approved for 2011, the Division specifically examined the Licensee's estimated costs for processing rock needed for the final cover. The Division required documentation supporting the Licensee's estimate. A detailed review of the work and the supporting documentation support a finding that the existing funding is adequate to fund the anticipated processing costs.

The Division will review the surety cost for all design changes during its next surety review (scheduled to begin in December 2012). Therefore, the Division has added a license condition (condition 43) that requires design cost estimates be provided in the upcoming 2012 surety submission. First placement of final cover over a portion of the proposed CAW embankment footprint is not expected to occur for at least another two years. The Division is aware that the Licensee is considering a design change, and included this License Condition to ensure that this matter will be resolved before that time. If the Director does not approve a change to the cover, the currently-approved cover will be implemented.

See also Background, Part 1 of this Response.

**REFERENCES**

EnergySolutions, LLC. 2011. Annual Surety Submittal, Radioactive Materials License UT2300249: Response to Request for Information.

UDRC 2012. EnergySolutions 2011 Annual LLRW Surety Submittal, 2011 Engineering Module 13, Radioactive Materials License Number UT2300249: Conditional Approval.

***Comment Judd-02:***

2. *APPROVAL SHOULD NOT BE GIVEN WHEN MAJOR DESIGN ISSUES ARE UNKNOWN. UTAH MAY END UP WITH MILLIONS OF CUBIC YARDS OF WASTE TO COVER AND NO WAY TO COVER THE WASTE.*

   *There are two major issues that have not been resolved to the State's satisfaction, one concerning the clay to be used for cell construction and one concerning the rock for cell construction. Instead of solving these issues before public comment, the SER was sent out and DRC is moving forward without knowing if the new design will work. This is not acceptable. The commenters do not have access to significant issues such as what is the cover design. The cover design is one of the major issues in waste facility control since it is the major item to contain the waste for thousands of years. Without proper clay and proper rock there is no way the waste can be*

*contained. A conditional approval is not an acceptable procedure in this situation. ES could go out of business and leave the State of Utah and its citizens with millions of cubic yards of waste that are uncovered and no proper design to cover the waste. ES should wait until they have completed major design items on the cell before they seek approval. It is clear that a second public comment is needed when the design is completed.*

**Division Response Judd-02:** Refer to Division Responses HEAL-08, HEAL-09 and Judd-01. The commenter has not provided any information about alleged deficiencies, so it is not possible for the Division to further respond.

***Comment Judd-03:***

***Judd Detailed Comments, Page 2***

3. *THE NEW "SUPERCELL" ALSO GIVES ES APPROVAL TO LEAVE WASTE UNCOVERED FOR UP TO 30 YEARS. ES CONTINUES TO GET PAID TO ACCEPT WASTE BUT IS NOT PROPERLY COVERING IT, WHICH IS THE MOST IMPORTANT PART OF CELL CONSTRUCTION. IF ES GOES OUT OF BUSINESS THEN THERE IS MILLIONS OF CUBIC YARDS OF WASTE THAT UTAH WILL BE RESPONSIBLE TO COVER.*

   *ES continues to delay the covering of waste material. This request only lengthens the time the waste is uncovered. Originally, ES was to cover waste with a final cover within 5 years. They then committed to cover it in 10 years. Now this amendment will change it so that ES can leave waste open for up to 30 years. This is not acceptable for several reasons. First of all, it leaves the State of Utah at greater risk because there is more waste open that will need to be handled if ES goes out of business (which is more likely every year). Second the waste is open to many elements for too long; open to wind, rain, freeze thaw and other elements. This too brings more risk to the people in Utah. It is convenient for ES to leave waste open for decades, but just creates more risk for everyone else. It is possible that ES does not have the money to pay for the closure now so they are just trying to leave it open for decades and then have someone else be responsible to cover the waste.*

**Division Response Judd-03:** The Division disagrees with this comment. The proposed License Amendment does not change the time for final cover; it remains at 17 years following first waste placement. The timeline for cover construction is dictated by the approved LLRW and 11e.(2) CQA/QC Manual.

The commenter is also incorrect in stating that the time a cell can be open has changed with this License Amendment. The open cell time limitation mandated in Part I.E.6 of the Ground Water Quality Discharge Permit (No. UGW450005). That portion of the Permit is not being modified at this time. It is also important to understand that all deposited waste is required to be covered with a temporary cover (1 foot minimum thickness) within 90 days of any survey that determines that specified waste fill grades (design top of waste elevations) are reached and no later than 15 years after waste placement on each lift area.

A separate interim temporary cover is also required to comply with the "uncovered radioactive waste" limit described in License Condition 11. See the LLRW and 11e.(2) CQA/QC Manual. In addition, License Condition 53 B, requires 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 Class A West cell on a biweekly basis (once every two weeks) between the first day of May and the last day of September.

The Division reviews the Licensee's surety report annually to assess its adequacy and to determine the amount of the sureties. The surety includes a cost item for re-engineering of the facility, including possible regrading/recontouring of embankment slopes, should that become necessary. Further, the surety amount is adjusted annually to reflect inflation, increases in the amount of disturbed land, changes in engineering plans, addition of new facilities, closure and stabilization that have already been accomplished, and other conditions affecting closure costs. The Division oversees Permittee compliance with the LLRW and 11e.(2) CQA/QC Manual and Permit by the implementation of its inspection programs. The Division inspectors conduct their inspections and oversight activities regularly to examine the extent to which the regulatory requirements are satisfied. If a violation is observed, a determination is made regarding an appropriate enforcement action to correct the violation.

As described in Background, Part 2 of this Response, the UDRC will review the impact of this License Amendment on the surety requirements during the review of the 2012 Surety Report, and will require any appropriate adjustment to the surety account. The currently approved 2011 surety report required an appropriate amount of surety to cover the costs of closing the facility prematurely in the event of loss of financial resources to continue operations at the facility, as will the 2012 Surety. Consistent with findings of this review, the Division will require that necessary sureties be provided

Please refer to the approved 2011 Surety Report for discussion of individual financial surety-related items.

***Comment Judd-04:***

4. *NO REVIEW HAS BEEN DONE OF EARLY CELL CLOSURE FOR THIS NEW "SUPERCELL". IF THE AMENDMENT WERE APPROVED, THEN UTAH COULD BE RESPONSIBLE FOR EARLY CELL CLOSURE WHICH WOULD COST OVER $35 MILLION EXTRA.*

   *Once construction of the new supercell starts, there is no approved way to close the cell early if the company goes out of business. The only approved option would be to close the entire cell. This means that the State of Utah may need to bring in over 3,000,000 cubic yards of fill material to complete the cell. Fill material is costing over $12 per cubic yard. This means that the State of Utah is accepting an additional $35 million in cost. This money is not covered under the surety. ES does not have access to this amount of material right now and neither does the State of Utah. So costs would be much higher than $35 million. ES could not just dig material close to the cell for the fill material because it would change the groundwater flow and the surface water flow around the cell and affect the long term performance of the cell. No approval should be given until the early closure costs are accepted by ES and included in their surety.*

   - **Division Response Judd-04:** The Division disagrees with the additional cost amount as estimated by the Commenter for implementing early closure of the CAW embankment, if that becomes necessary. That estimate is apparently based on the assumption that it would be necessary to import clean soil sufficient to allow the cover system to be constructed at the designed elevation.

If the site were to close prematurely, it would be necessary to import some soils to produce a surface contour upon which the cover system could be constructed in order to meet all applicable design requirements. As described in Division Response HEAL-07, the Division's reviews of the Licensee's annual surety cost report includes an allowance for the cost to prepare a design for recontouring the disposal unit should closure occur in the coming year.

Thus, the Division ensures annually that all costs associated with closure, should it occur during the following 12 months, are covered by the surety provided by the Licensee. This will continue to be the case upon amendment of the license to allow construction of the Class A West embankment. Importing of soils and recontouring would be done so as to allow for shedding of runoff and to minimize impacts to groundwater and surface water. Investigations related to issues of potential impacts to groundwater and surface waters from use of clay materials from nearby soils are currently being undertaken by ES and reviewed by the DRC.

See also Background, Part 1 of this Response.

***Comment Judd-05:***

5. *PROPER STUDIES COULD NOT HAVE BEEN DONE ON THE NEW "SUPERCELL" BECAUSE THE PHASING OF WASTE PLACEMENT HAS NOT BEEN ESTABLISHED.*

*The phasing of waste placement has not been addressed in this amendment. This is not a normal requirement of the NUREGs, but needs to be addressed because of the unique approach that is being proposed. The idea of bridging two cells with waste over a 25 year period has not been done before. The cell will perform differently depending on how the waste is placed. If ES begins to put waste in the new section, then the old sections will be left open for too many years. If ES puts waste in the old sections, then the differential settlement becomes a much bigger issue because time between the different waste columns is even longer. ES should be required to establish their plans for phasing waste placement in advance so it can be included in the analysis of the embankment. The proper analysis cannot have been done at his time because we do not know the phasing of the embankment. This problem is exaggerated by the fact that ES does not have an idea of how much waste is coming in each year. If they do know, they should provide some idea so that the proper phasing can be done in the embankment. After proper information is provided then proper analysis can be done. After that the public should be allowed to comment on the proposal.*

**Division Response Judd-05:** Those areas in the gap that do not have a prepared liner and foundation will be constructed as per the Construction Quality Assurance Quality Control Manual (CQA/QC Manual). The foundation plus liner are inspected prior to waste placement to ensure that there are no significant cracks or other deformations that would indicate that the foundation plus liner are not stable. If determined to be unstable, then it will be surcharged (weight will be placed on it for a period of time) to make it stable, (to complete any primary consolidation that might be occurring). There will be additional settlement of the liner and foundation unit during waste placement due to primary and secondary consolidation due to the load of the placed waste. The load on the foundation of the completed CAW cell will be about 10,000 lbs. per square feet. Settlement due to consolidation will be monitored with the cell settlement monitoring program that measures/monitors waste + foundation + liner settlement. Moreover, prior to construction

of the final cover, the Licensee must have demonstrated through settlement monitoring that settlement has stabilized to acceptable levels.

The Division agrees that attention must be paid to placement of the waste and to settlement within the waste and the interim cover to ensure that the final cover system is constructed on a stable foundation. There is reasonable assurance that settlement will have stabilized so that the final cover can be constructed within the 17-year open cell limit (EnergySolutions, LLC. 2012). The Licensee has options available to accelerate consolidation as described in the CQA/QC Manual.

Existing license and permit conditions provide adequate assurance that conditions necessary for long-term stability and proper performance will be achieved. The commenter has not provided any support for his assertion that reviewing and giving approval to the schedule of waste shipments and locations for waste placements at this time is justified.

**REFERENCES**

EnergySolutions, LLC. 2012. Radioactive Material License #UT2300249 and Ground Water Quality Discharge Permit No. UGW450005, Amendment and Modification Request – Class A West Embankment: Response to Round 3 Interrogatory URCR R313-25-7(3)-04, with attachments. Letter from Tim Orton, EnergySolutions, to Mr. Rusty Lundberg, Utah Division of Radiation Control, dated March 20, 2012.

EnergySolutions, LLC 2012. LLRW and 11e.(2) Construction Quality Assurance/Quality Control (CQA/QC) Manual" Revision 26d), May 7, 2012.

## ***Comment Judd-06:***

***Judd Detailed Comments, Page 3***

6. *THERE IS NOT ENOUGH ROCK MATERIAL TO SUPPORT THE NEW DESIGN. UTAH MAY HAVE TO PAY TO HAUL ROCK FROM LONG DISTANCES TO COVER THE NEW EMBANKMENT.*

   *The new design calls for more rock rip rap. In the past year, ES has tried to obtain rock from their new rock source. This rock source did not provide the type and amount of rock rip rap that they have suggested. Instead, the new rock source produces a large amount of sand and less than 1 inch material. The new design calls for more of larger rock which is limited in the ES rock source. ES has only reserved less than 200,000 cubic yards of bank run material for their rock materials. This would produce less than 100,000 cubic yards of material that is beneficial for rock cover. There is less than 1.5 million cubic yards of bank run material in the entire pit. This material is also being used by other companies. ES has not reserved close to enough material to finish the new cell, let alone the other cells that will need to be covered. ES does not have access to enough material to construct rock rip rap with the new design. If ES were to go out of business the State of Utah would [be] required to build cover without having access to rock for its construction. That would mean tens of millions of extra costs that would have to be borne by the State of Utah and its citizens.*

**Division Response Judd-06:** As previously described, the new cover design EnergySolutions is considering is not before the Division at this time. See Division

Response to Judd-01. The Division has evaluated the question of whether there are adequate sources of materials for construction of the currently-approved Class A West cover system during its review of the Licensee's amendment request (LAR). The Licensee has provided suitable documentation to demonstrate that adequate supplies of materials are indeed available and the commenter has provided no information to the contrary. The clay and rock resource calculations are in Attachment 9 of the LAR. The Division is satisfied that sufficient suitable materials are available to construct the Class A West cover system.

Refer also to Background, Part 1, and Division Response Judd-01 above.

***Comment Judd-07:***

7. *ENERGYSOLUTIONS HAS UNDERESTIMATED THE COSTS TO PRODUCE AND PLACE ROCK COVER FOR THE NEW "SUPERCELL". THESE EXTRA COSTS WILL BE PAID BY THE STATE OF UTAH UNLESS A FINANCIAL REVIEW IS DONE BEFORE THE AMENDMENT IS APPROVED.*

   *The cost for the rock rip rap material that is shown in the surety is not sufficient for the actual costs that will be incurred. A recent project by ES for rock production showed that the costs for rock production are significantly more expensive than previously shown in the surety. The rock material had to be handled several times before it was placed on the mixed waste cell. ES excavated the rock from the pit and had to use a dozer to loosen the material. ES found that there were large amounts of caliche in the rock source that will become more and more of a problem over time because they used the best material this time. The rock then was put through a screening process which is way more expensive than ES suggests in their surety. The screening revealed that there was a smaller amount of usable material than expected in the bank run material. The rock then had to be sorted again to get it to the right specifications. The rock then was picked up again and loaded into trucks and hauled again. Finally the rock was placed. The total cost per cubic yard for material is much higher than suggested in the surety. The State of Utah and its citizens are in danger of having to pay these extra costs, especially if the new design is approved with thicker rock in the cover design*

   - **Division Response Judd-07:** See Division Response to Judd-06.

***Comment Judd-08:***

8. *CHANNELING IN THE COVER HAS NOT BEEN STUDIED SUFFICIENTLY TO PROTECT THE STATE OF UTAH IF UTAH IS REQUIRED TO COVER THE WASTE.*

   *No studies have been done to examine the new design's effect on channeling in the cover. This is especially of concern because of the longer flow lines in both the top rock and the side slope rock and because ES original LARW cell has shown that there is significant differential settlement when waste is place at different times. A review of the LARW cell shows that when waste is placed at different times there is differential settlement in the cover directly over the areas where waste is placed at different times. This creates channeling in the flow as water is placed on the embankment. The new CAW cell will have greater problems because the waste placed in the two existing cells is already settled. The time between that waste placement and the new waste placement is much longer. In fact, the older cells will have been in place for up to 15 years before new waste is placed next to it. This is sure to cause more channeling in the cover. This channeling will have more water flowing in it because of the longer flow lines. This issue needs to be investigated further.*

- **Division Response Judd-08:** The Commenter is mistaken in his statement that no studies have been done to examine the effects on channeling resulting from the new cover design. The Division reviewed and approved Attachment 10 to the revised license amendment request, which addressed the impacts on site drainage projected to result from the design changes associated with the Class A West license amendment request. The driving event was the updated Probable Maximum Precipitation (PMP) event. The characteristics of the proposed Class A West embankment cover system, including substantially longer flow lines, were incorporated into the design and analysis of the cover system's performance. [Cite]. The commenter has not provided information to suggest any problem with this analysis.

  All waste, newly and previously placed, will have to meet the same settlement requirements across the top of the embankment. Settlement must be reached before cover construction regardless of how long ago the waste material was placed. If consolidation of the waste unit is occurring at unacceptable rates then surcharging can occur. Acceptable rates are determined by drawing a consolidation or settling curve and determining where on the curve the current consolidation is. The consolidation is acceptable when it is on a flat part of the curve indicating that minimum to no settling due to consolidation is occurring. Quality assurances for all of these requirements are in the "transition to final cover" section of the CQA/QC Manual.

  The design approach employed conforms to the latest design guidance issued by the U.S. Nuclear Regulatory Commission (NUREG-1623 and NUREG/CR-4620). The results show an interstitial velocity within the Type A Filter Layer of 0.17 ft/sec on the top slope and 0.40 ft/sec on the side slope. These values are very comparable and slightly less than those calculated using the NUREG/CR-4620 methodology and show that erosion will be within acceptable levels. The projected water runoff velocity on the radon barrier over the top slope is calculated at 0.055 feet per second and over the side slope is calculated at 0.12 feet per second, both values well below any threshold where erosion might become possible.

  As to the potential for differential settlement that might disrupt the integrity of the Class A West cover system, Work Element-Temporary Cover Placement and Monitoring, Pre-Final Cover Settlement Monuments of the Construction Quality Assurance/QualityControl Manual specifies that final cover construction will not commence until results from the settlement monitoring system indicate that settlement of the interim cover has stabilized to acceptable levels. Stabilization to acceptable levels of the interim cover settlement has been generally observed to occur within in a few years of waste placement in the Class A and Class A North embankments. The Division considers the LARW cover system to be functioning correctly, and has confidence that the cover system will perform as intended.

  The commenter has not provided any information to suggest that these requirements will not be sufficient to address any concerns about differential settlement.

**REFERENCES**

NUREG-1623. NRC (U.S. Nuclear Regulatory Commission). "Design of Erosion protection for Long Term Stability". September 2002.

NUREG/CR-4620. Nelson, J.D., Abt, SK, Volpe, R.L., van Zyl, D., Hinkle, N.E., and Staub, W.P. "Methodologies for Evaluating Long-Term Stabilization Designs of Uranium Mill Tailings Impoundments". June 1986.

***Comment Judd-09:***

***Judd Detailed Comments, Page 4***

9. *THE FILTER ZONE WILL NOT PERFORM PROPERLY IN THE NEW SUPERCELL BECAUSE OF EXTREME SETTLEMENT IN THE AREA BETWEEN THE TWO EXISTING CELLS.*

   *The attempt to build a higher cell will create a situation where the filter zones will not perform properly. The areas with waste placed later will settle more than the existing cells because the waste column is deeper and because the waste is being placed later This will create a situation where the filter zone will have areas where the flow line in the filter may go up hill and at least will not have the proper slope that is required on the top of the embankment. This will create channeling and possible ponding on the top of the embankment. The LARW cell is an example of how this differential settlement will affect flow on the top of the embankment. This is not acceptable for proper long term cover construction.*

   **Division Response Judd-09:** As noted in Division Response Judd-08, the record in this matter demonstrates that the potential for differential settlement in the Class A West embankment cover system has been appropriately addressed. The Licensee is required to ensure that settlement with the interim cover has stabilized before construction of the final cover system commences. In addition, the Division is imposing additional license conditions that will provide assurance that the clay used in constructing the Class A West cover system will perform as required to accommodate any additional minor settlement that may occur following embankment closure. As described above in Division Response HEAL-09, the clay study will better define the allowable distortion value based on properties of site specific clays used in cover construction. The commenter has provided no information to support the statements made in this comment.

***Comment Judd-10:***

10. *ES HAS NOT ESTABLISHED THAT THE MAJOR CONSTRUCTION MATERIAL FOR THE CELL (CLAY) CAN HANDLE THE NEW "SUPERCELL". IF THE CLAY FAILS THE ENTIRE CELL FAILS. THE SETTLEMENT BETWEEN THE NEW CELL AREA AND THE TWO CURRENT CELLS WILL CAUSE THE CLAY LINER AND THE CLAY COVER TO FAIL*

    *The clay used for construction is still an unknown. ES does not know if the clay that will be used can withstand the new type of construction. This is a great concern. The clay is the most important part of cell construction; it is used to contain the waste both on the bottom of the cell and the top of the cell. If it does not perform properly then the embankment will fail. With the new design it is very likely that the clay liner under the waste will fail. If the two licensed cells have been constructed for about 10 years before the clay liner between the two cells is constructed then the settlement will certainly create a failure between the new clay liner and the old clay liner. The settlement under the current cells is approximately 90% complete, probably settling over two feet. The new clay liner will now be constructed and then the new waste placed in this area. The waste column in the new area will be over 70 feet and should create settlement of the*

*clay liner of about three feet. It seems unlikely to think that the new clay liner will settle just the right amount to tie in exactly with the old clay liner. There will be a break between the new and old clay liners. This is not a good situation and should not be allowed. There is no reason that this risk should be taken.*

**Division Response Judd-10:** For response to the challenge that the liner will suffer damage because of the different times at which the different portions of the liner were/will have been constructed; refer to Division Response HEAL-08 and Judd-08.

The Division has previously accepted the clay material that is readily available for constructing the cover systems at the Clive facility. The Division's previous acceptance was based on the characteristics of similar clays whose properties had been demonstrated by others; this was determined to be sufficient for the previous designs. Because of different stresses that the new design would place on the clays, the Division is now pursuing information expected to provide additional confidence that the:

Clay actually planned for construction of the Class A West cover system will indeed accommodate what little additional differential settlement is expected following confirmation that settlement in the interim cover has stabilized (i.e., prior to constructing the final cover).

Cover system will perform as projected and as required. CAW's approval is conditional on settlement of the embankment prior to construction of the cover system. Differential settlement has to meet a criterion of 0.007 ft/ft prior to any construction of cover system. This assures the cover system is built on a stable embankment/foundation.

See also Background, Part 1, regarding Surety for the period before the clay study required by License Condition 41 is reviewed and approved, and any required changes are fully funded under a new Surety.

***Comment Judd-11:***

11. *THE TWO FOOT CLAY COVER IS NOT SUFFICIENT IF THE NEW "SUPERCELL" IS APPROVED. THERE IS LITTLE ROOM FOR ERROR WHEN THERE IS ONLY A TWO FOOT COVER.*

*In an attempt to save money, ES has decided to only put 2 feet of clay cover over the waste. This is an extremely risky proposal. Even though studies show that the 2 foot cover may be sufficient to hold in the radioactive material that only works if the 2 foot cover stays intact. There are many ways the clay cover could be compromised including through frost, erosion, cracking, stress, tension and penetration by animals and roots. It is much better to have extra amounts of clay cover to overprotect the waste in case any of these natural processes happen to the embankment. ES is proposing a new way to construct the clay cover where differential settlement is sure to increase. The expected settlement in some areas will be over 3 feet, which is more than the depth of the cover. Just as with the clay liner it is hard to get any settlement to happen at the same rate in an old embankment and a new embankment that are tied together. Therefore, it is very likely that the clay cover will fail due to cracks and differential settlement.*

**Division Response Judd-11:** The differential settlement cannot exceed the criteria set in the CQA/QC Manual. Prior to cover construction settlement must be reached as described

in Division Response Judd-10 above. The Licensee and Division have carefully evaluated the stability of the 2-foot-thick clay Radon Barrier and its performance as an infiltration and radon barrier. Information provided by Energy*Solutions* with the Class A West license amendment request demonstrates the adequacy of the radon barrier design relative to limiting radon emissions from the final surface of the cover system (URS 2012). A key design criterion is the limitation of allowable distortion of the upper radon barrier to less than or equal to the specified maximum allowable distortion criterion due to any settlement occurring within the CAW embankment. That is, settlement occurring within the CAW embankment due to settlement of waste and backfill must not result in a magnitude of differential settlement that would contribute to a distortion exceeding the specified maximum allowable distortion criterion. If required based on the laboratory testing results from the clay study, a revised maximum allowable distortion criterion for the cover will be identified and invoked as a final design criterion for the cover and imposed prior to final cover construction. The license amendment request demonstrates that earthen cover materials are provided in sufficient thickness above the Radon Barrier to preclude damage to the Radon Barrier (URS 2012). The Division has responded to the challenge that the clay cover will not remain stable (able to yield without cracking) in Division Responses HEAL-08 and Judd-09. The license amendment request demonstrates that root and animal penetration are unlikely to compromise the integrity of the cover system clay layer (URS 2012). Division Response HEAL-08 addresses the challenge that the liner system will not maintain its integrity following delayed placement of waste in the Class A West embankment.

The commenter did not provide any technical support for these comments, so no additional evaluation is possible.

**REFERENCES**

URS 2012. Safety Evaluation Report. Energy*Solutions* LLRW Disposal Facility Class A West Amendment Request. June 2012.

***Comment Judd-12:***

***Judd Page 5***

12. THE PROPOSED AMENDMENT IS IN CONTRADICTION TO THE "HUNTSMAN AND ES AGREEMENT".

*EnergySolutions signed an agreement with Governor Huntsman several years ago. This proposal is not in accordance with that agreement. The agreement was based on certain types of waste coming into the state. Instead this proposal allows for much hotter waste to come into the state by changing the waste accepted from 11 e2 waste to low level wastes. The governor's agreement was also based on a specific configuration of the waste and not expanding the height of the waste to such extreme elevations.*

*One of the main reasons that the Governor of Utah signed an agreement in 2007 was to get EnergySolutions to withdraw its amendment to build a "supercell". The Governor agreed on several concessions based on ES promise not to build the larger cell. Now 5 years later ES is asking for a new "supercell" that is almost identical to the one they promised not to build. ES has*

*committed to not build a combined Class A Cell. Now they want to build a combined Class A cell and just change the name. This is in direct violation of the current agreement.*

*The current request is not in accordance with the 2007 agreement. The 2007 agreement allows ES to build the existing low level cells that were licensed as of March of 2006. That would be the Class A cell and the Class A north cell. The agreement also allowed ES to convert a portion of the 11 e.(2) cell into low level waste volume. It does not allow the Class A cell and the Class A north cell to be combined and the height increased. In fact, this is the main reason the Governor made the agreement was to stop the combination of the two cells. ES should not be given this amendment because it is not in accordance with the 2007 agreement with Governor Huntsman. The State of Utah and its citizens should not be the ones that take all the risk so that ES can bring in more waste and leave it uncovered for decades.*

**Division Response Judd-12:** See Background, Part 2 and Division responses to HEAL-01, HEAL-02, HEAL-04, HEAL-05 and HEAL-06. The statement that "The governor's agreement was based on a specific configuration of the waste and not expanding the height of the waste to such extreme elevations" is also not supported by the language of the agreement itself (See Appendix E).

The comment that waste will be left ". . . uncovered for decades" is incorrect, as described in Division Response to Judd-03.

***Conclusion***

Comment addressed in this document led to modification of the Radioactive Material License, No. UT 2300249. The modifications and the associated justification is shown in the table below. The entire license, with changes marked in red-line format, is included in Appendix D.

| **License Condition Modifications** | **Reason** |
|---|---|
| 9.E. The Licensee may dispose of a volume of Class A Low-Level Radioactive Waste (LLRW) and Naturally Occurring and Accelerator Produced Radioactive Materials (NARM) in the Class A West disposal cell described in License Condition 40 not exceeding 8,724,097 cubic yards, and in the Mixed Waste Landfill Cell not exceeding 1,354,092 cubic yards. Together, the total aggregate volume of waste disposed of in the Class A West disposal cell and the Mixed Waste Landfill Cell shall not exceed 10.08 million cubic yards. Class A waste LLRW is defined in Utah Radiation Control Rule R313-15-1009 and NARM at R313-12-3. | The maximum waste volumes were added to the permit to avoid any confusion as to the maximum capacity of each cell. |
| 43. The Licensee shall, in the 2012 Surety submittal, provide cost estimates based on the Class A West design submitted on Drawings 10014 C01 through C06 listed in Table 2C of the GWQDP. The Licensee shall provide surety funding as approved by the Executive Director prior to commencing construction of the clay liner in the area between the previously approved Class and Class A North embankments. | The requirement was added to ensure that adequate surety funds will be provided well before waste is received for disposal in the newly approved Class A West embankment. |
| 76. The Licensee shall at all times maintain a Surety for perpetual care, using an instrument that satisfies the requirements of UAC R313-22 and R313-25. The Surety shall be in the amount last approved by the Radiation Control Board, as provided in Utah Code Ann. 19-1-307(2), as adequate to fund perpetual care, less the amount contributed to the Radioactive Waste Perpetual Care and Maintenance Account created under Utah Code Ann. 19-3-106.2 (but not including any part of that Account resulting from returns on investment). | EnergySolutions has provided this Surety for several years, but the Division determined that this arrangement should be formalized with a License Condition. |

## ***Reference Summary***

References that are particularly pertinent to a comment response have been listed with that response but this comment response document relies generally on the following records.

AMEC Earth & Environmental, Inc. 2011. Report: "Geotechnical Update Report – Energy*Solutions* Clive Facility Class A West Embankment," February 15, 2011.

EnergySolutions, LLC. License No: UT2300249; Revised Annual Surety Review, November 7, 2007.

Energy*Solutions*, LLC. 2011. Annual Surety Submittal, Radioactive Materials License UT2300249: Response to Request for Information.

Energy*Solutions*, LLC. 2012. Radioactive Material License #UT2300249 and Ground Water Quality Discharge Permit No. UGW450005, Amendment and Modification Request – Class A West Embankment: Response to Round 3 Interrogatory URCR R313-25-7(3)-04, with attachments. Letter from Tim Orton, Energy*Solutions*, to Mr. Rusty Lundberg, Utah Division of Radiation Control, dated March 20, 2012.

EnergySolutions, LLC 2012. LLRW and 11e.(2) Construction Quality Assurance/Quality Control (CQA/QC) Manual" Revision 26d), May 7, 2012.

Huntsman, J.M., and Creamer, R. S. 2007. Agreement between the Governor of the State of Utah and Energy*Solutions*, LLC, dated March 15, 2007.

NUREG-1623, NRC (U.S. Nuclear Regulatory Commission). "Design of Erosion protection for Long Term Stability". September 2002.

NUREG/CR-4620. Nelson, J.D., Abt, SK, Volpe, R.L., van Zyl, D., Hinkle, N.E., and Staub, W.P. "Methodologies for Evaluating Long-Term Stabilization Designs of Uranium Mill Tailings Impoundments". ORNL/TM-1006, prepared for U.S. Nuclear Regulatory Commission, June 1986.

Temple, D.M., Robinson, K.M., Ahring, R.M., and Davis, A.G. 1987. *Stability Design of Grass-Lined Channels*. U.S. Department of Agriculture, Agricultural Handbook No. 667, U.S. Government Printing Office, Washington, D.C., 167 pp.

UDRC 2012. Energy*Solutions* 2011. Annual LLRW Surety Submittal, 2011 Engineering Module 13, Radioactive Materials License Number UT2300249: Conditional Approval. AMEC Earth & Environmental, Inc. 2005. Geotechnical Study: "Increase in Height and Footprint," May 27, 2005.

UDRC 2012. EnergySolutions 2011 Annual LLRW Surety Submittal, 2011 Engineering Module 13, Radioactive Materials License Number UT2300249: Conditional Approval.

URS 2012. Safety Evaluation Report. Energy*Solutions* LLRW Disposal Facility Class A West Amendment Request. June 2012.

US Nuclear Regulatory Commission (NRC), 2002. Office of Nuclear Material Safety and Safeguards. 2002. NUREG-1623, "Design of Erosion Protection for Long-term Stabilization", Final Report. September 2002.

Utah Division of Radiation Control 2012. Safety Evaluation Report. Energy*Solutions* LLRW Disposal Facility Class A West Amendment Request. June 2012.

# APPENDIX A
# COMMENTS RECEIVED FROM
# MATT PACENZA, POLICY DIRECTOR
# HEAL UTAH

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HEAL UTAH POWERING ACTION TO PROTECT UTAH

To: Division of Radiation Control
From: HEAL Utah
Re: Public Comment on Class A West Amendment.
Date: 26 July 2012

The below comments are regarding an initial decision by the Director of the Utah Division of Radiation Control to amend the EnergySolutions (Licensee) Low-Level Radioactive Waste Disposal License (RML UT 2300249) and Ground Water Quality Discharge Permit (No. UGW450005).

Before we get to the substance of our comments, we think it essential to frame this decision and our response to it in a longer history of EnergySolutions' efforts to expand and shift capacity at the Clive site. It is critical that the Division of Radiation Control, along with DEQ officials and the Herbert Administration, make this particular decision within that broader policy context.

Let us start in 2006, when EnergySolutions sought permission from the DRC to create a "Supercell," merging the Class A and Class North embankments and increasing its LLRW capacity at Clive from 8.8 million cubic yards to 13.1 million cubic yards.

At the time, HEAL and others argued that such an expansion should trigger the provision of a 1990 law requiring that significant license changes be approved by the Legislature and the Governor. EnergySolutions disagreed with that interpretation, but, just in case, in February 2007, it successfully lobbied the State Legislature to pass a law removing the governor, Legislature and Tooele County Commission from the chain of required approvals for a significant capacity increase.

That led Gov. Jon Huntsman to threaten to exercise his veto power via the Northwest Interstate Compact on Low-Level Radioactive Waste Management to prevent the company from creating the Supercell. The Huntsman Administration and the company then entered into negotiations that then led, of course, to what has become known as the "Huntsman Agreement," a negotiated accord between the state of Utah and EnergySolutions.[1]

Obviously, as state regulators you are familiar with the agreement, so we do not intend to repeat all of its provisions here. The critical piece, however, was a trade:

[1] http://www.utah.gov/governor/news_media/article.html?article=225

EnergySolutions agreed to give up its Supercell proposal in exchange for being allowed to convert approximately 3.6 million cubic yards of its already-permitted 11e.(2) disposal cell into capacity for low-level radioactive waste.

The agreement was signed in March 2007. Over the subsequent four years, the company and state regulators sought pathways to implement the conversion of 11e.(2) into low-level radioactive waste disposal and apparently encountered various legal and technical challenges..

In the meantime, however, the company made clear it was willing to jettison the Huntsman Agreement – as soon as it had grounds to do so.

Please see "EnergySolutions flips on deal not to expand waste site," a story from February 2010.[2] After the company won an initial court decision that determined that its Clive site wasn't under the jurisdiction of the Northwest Compact, it immediately announced that the Huntsman Agreement was "obsolete."

> "When the district court ruled that the Northwest Compact lacked jurisdiction over the Clive [Tooele County] facility," company president Val Christensen said in an e-mail to *The Tribune* this week, "the standstill agreement with Gov. Huntsman became unnecessary."

Company officials were clearly eager several years ago to abandon the Huntsman Agreement. We would thus conclude – and will make this case below – that the state should adopt an extremely cautious approach to drafting license language that leaves as little "wiggle room" as possible, in the effort to avoid opening up potential future loopholes that could lead to greater site expansion.

We also point out that same Tribune article from Feb. 2010 makes clear that Gov. Gary Herbert supports the Huntsman Agreement and its volume caps.

We now move to May 2011, when EnergySolutions applied to the state for permission to create a new Class A West cell. Like the Supercell, it merges the existing Class A and Class North embankments, although this version is somewhat smaller. The company returned to the merged cell proposal, it said, because it and the state could not satisfactorily resolve outstanding legal and engineering hurdles that stood in the way of the Class A South/11e(2) conversion.

Effectively, the proposal before the state and the public now is a reversal of the trade at the heart of the Huntsman Agreement: Instead of giving up the Supercell proposal in exchange for the Class A South conversion, the company now proposes to give up the Class A South conversion in exchange for creating a slightly smaller Supercell.

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[2] http://www.sltrib.com/News/ci_14329478

Please keep the above history in mind as we move to our substantive comments on the current Class A West Amendment.

1. We applaud the Division for the following amendment to RML UT 2300249:

   *The Licensee may dispose of a volume of Class A Low-Level Radioactive Waste (LLRW) and Naturally Occurring and Accelerator Produced Radioactive Materials (NARM) in both the Class A West and Class A North disposal cell described in License Condition 40, and in the Mixed Waste Landfill Cell not exceeding a total of 10.1 million cubic yards. Class A waste is defined in Utah Radiation Control Rule R313-15-1008 and NARM at R313-12-3.*

   The ***not exceeding a total of 10.1 million cubic yards*** language is welcome, because it codifies in the license for the first time (we believe) a volume cap for that portion of the Clive site. We do not yet know if the licensee has agreed to this language, but if they have, and it stands, it is a step in the right direction of limiting efforts to continually expand the Clive site.

2. However, we urge the DRC to further amend the license to include the following: a total cap on LLRW volume for the entire Clive site, including the unused portion of the Class A South/11e(2) cell.

   This additional language is essential if the DRC intends to preserve the total volume caps in the Huntsman Agreement, as Gov. Herbert and regulators have previously indicated they wish to. We believe that EnergySolutions, without violating this license, could come back to the Division in a few years and say they've now figured out a way to safely engineer Class A South and so would like to propose to re-open that 3.5 million cubic yard proposal. That would grant the company a significant expansion in total capacity -- which obviously the Huntsman Agreement was seeking to prevent.

   We believe EnergySolutions will be able to argue that the newly RML UT 2300249 supersedes the Huntsman Agreement. It explicitly and directly contradicts the Agreement. It, for example, grants the licensee permission to merge the Class A and Class North embankments – which the Agreement was designed to prevent.

   Is it unrealistic or perhaps paranoid to think that EnergySolutions will seek to further expand its LLRW capacity Clive beyond the 10.1 million cubic yards it is permitted in the Class A West and Mixed Waste disposal cells? To identify additional space elsewhere at Clive – such as Class A South – where it will be able to dispose of additional waste, and continue to bring material to Utah for decades to come? We would argue, that it is, rather, very likely that the licensee will seek to do just that, for the following reasons:

- As mentioned above, the licensee as recently as 2010 sought to jettison the volume caps in the Huntsman Agreement as soon as it had a pretext for doing so. Clearly, EnergySolutions has seen the agreement as a document it would seek to abandon as soon as it could, rather than one that it was bound to in good faith. To our knowledge, EnergySolutions has not publicly indicated they believe they are currently bound to the terms of the original agreement.
- The company faces tremendous financial pressure to demonstrate to investors that its long-term revenue prospects are solid. Undoubtedly, regulators have noted the recent wave of bad news for EnergySolutions: It dismissed its CEO and CFO[3]. Its stock plummeted, losing more than half its value.[4] Standard & Poor's and other key rating agencies down-graded the company's debt to BB- and BB+, aka "speculative grade" or junk bond levels. [5] The company announced it was looking to sell its U.K. and European business[6], which, according to a recent Associated Press story ("Company charged with dismantling Zion nuclear plant struggling financially") represents at least 60 percent of its total revenue.[7]
  At the same time, the company has previously made clear that disposal at Clive is among its most profitable work, as it long ago paid the upfront costs for building and engineering the facility. Its newer proposed revenue streams – such as decommissioning shuttered nuclear reactors – have turned out to lose money.
  Given those economic realities, it would be a surprise if the company were to not seek to expand the potential disposal volume at Clive – to reassure investors that its most profitable revenue stream will continue for many years.
- In addition, those financial difficulties – and what experts have suggested is at least a possibility that EnergySolutions may face bankruptcy or liquidation – must be fully factored into this license amendment. It would be prudent for the Division to consider what impact the new Class A West proposal has upon the line of credit and perpetual care fund designed to

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[3] http://www.sltrib.com/sltrib/money/54281263-79/company-energysolutions-executive-changes.html.csp

[4] http://finance.yahoo.com/echarts?s=ES+Interactive#symbol=es;range=3m;compare=;indicator=volume;charttype=area;crosshair=on;ohlcvalues=0;logscale=off;source=undefined;

[5] http://www.sltrib.com/sltrib/money/54292551-79/company-energysolutions-lockwood-credit.html.csp

[6] http://finance.yahoo.com/news/energysolutions-announces-consideration-sale-uk-130000885.html

[7] http://www.chicagotribune.com/business/ct-biz-0701-zion-20120630,0,6686911,full.story

ensure that the State of Utah will have sufficient resources to safely maintain the Clive facility in case the company no longer can. In other words, will anything about the super cell proposal either a) increase near-term closure costs if the company goes bankrupt, or b) increase costs associated with perpetual care of the site? For instance: Will tying two cells together into a super cell increase costs for fill material if EnergySolutions goes bankrupt before filling the new supercell? Will differential settlement be more likely in a supercell, and create additional financial risks in the long-term? In order to protect Utah's health and environment, and the Utah taxpayer, we believe it is necessary to estimate the impact of the proposed super cell on short-term closure and long term perpetual care costs prior to making a final licensing decision on the proposed super cell.

3. We do believe that merging two different cells into a larger "supercell" presents some unique technical challenges, including: How can the clay liners for the existing cells be adequately "stitched" together, given that the clay liners underlying the existing cells are of different vintages and have been subject to different weights and pressures as the cells have settled? And, importantly, when the supercell is filled, will differential settlement across the various portions of the supercell cause the cover to crack or eventually create ponding or accelerated erosion?

   The report indicates that two important documents have not yet been submitted for final state approval: a report explaining the cover design as well as a report examining clay performance. We believe these reports must be submitted and reviewed as part of the overall licensing procedure and that it would be inappropriate for the state to approve the current license amendment in the absence of those two reports.

We appreciate the Division taking the time to carefully consider these comments. We would like to repeat our most important point for emphasis: the Huntsman Agreement was incredibly important for codifying a trade: the company gave up the Supercell and got back the Class A South conversion. And, now, EnergySolutions proposes to flip that trade: It will give up Class A South in exchange for Class A West. Here's the fundamental problem: *Only half that deal is in writing.* The company gets Class A West – but there is as yet no language that ensures that the former Class A South Cell will never be developed.

The division must require the licensee to commit to an overall volume cap and to agree to not seek to convert Class A South or any other possible cell at Clive in the future. If the State does not take this critically important step, we fear this current license could have the unfortunate impact of nullifying the most important

component of the landmark Huntsman Agreement—namely, a cap on total waste at the site of 10.1 million cubic yards.

Sincerely,

Matt Pacenza
Policy Director
HEAL Utah

***
824 South 400 West
Suite B111
Salt Lake City, 84101
matt@healutah.org
801-355-5055

# APPENDIX B
# SUPPLEMENTAL COMMENTS RECEIVED FROM CHRISTOPHER THOMAS, EXECUTIVE DIRECTOR HEAL UTAH

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John Hultquist <jhultquist@utah.gov>

# Fwd: Additional comment related to Public Comment on EnergySolutions' Class A West Amendment

1 message

**rad public** <radpublic@utah.gov> Tue, Nov 20, 2012 at 4:40 PM
To: John Hultquist <jhultquist@utah.gov>

---------- Forwarded message ----------
From: **Christopher Thomas** <christopher@healutah.org>
Date: Thu, Jul 26, 2012 at 4:58 PM
Subject: Additional comment related to Public Comment on EnergySolutions' Class A West Amendment
To: radpublic@utah.gov

Dear Mr. Lundberg:

I am submitting this small comment in addition to our longer comments submitted by HEAL Utah's Policy Director, Matt Pacenza.

There is a proposed license amendment that reads:

The Licensee may dispose of a volume of Class A Low-Level Radioactive Waste (LLRW) and Naturally Occurring and Accelerator Produced Radioactive Materials (NARM) in both the Class A West and Class A North disposal cell described in License Condition 40, and in the Mixed Waste Landfill Cell not exceeding a total of 10.1 million cubic yards. Class A waste is defined in Utah Radiation Control Rule R313-15-1008 and NARM at R313-12-3.

We believe the reference to Utah Radiation Control Rule R313-15-1008 is incorrect; we believe it should be Utah Radiation Control Rule R313-15-1009, "Classification and Characteristics of Low-Level Radioactive Waste," which includes waste classification tables.

Please see the rule online at: http://www.rules.utah.gov/publicat/code/r313/r313-015.htm#T46

Please do not hesitate to contact me if you have any questions.

Sincerely,

--
Christopher Thomas
Executive Director
HEAL Utah
801-355-5055 (main)
801-560-1915 (cell)
www.facebook.com/healutah
www.healutah.org

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Division of Radiation Control
Phone: (801) 536-4250
Fax: (801) 533-4097
www.radiationcontrol.utah.gov

# APPENDIX C
# COMMENTS RECEIVED FROM
# CEDAR MOUNTAIN ENVIRONMENTAL, INC.,
# CHARLES JUDD, PRESIDENT

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CEDAR MOUNTAIN ENVIRONMENTAL INC.

July 26, 2012


DRC-2012-002356

Rusty Lundberg, Director
Utah Division of Radiation Control
195 North 1950 West
P.O. Box 144850
Salt Lake City, Utah 84114-4850

Dear Rusty Lundberg:

Included with his letter are the public comments on EnergySolutions(ES) proposed amendment to create a supercell referred to as the new CAW cell. In general, the amendment is flawed because it is in direct contradiction with the agreement ES has with Governor Huntsman. The agreement specifies what cells could be constructed for LLRW and certainly the Governor did not want a "supercell" as is requested here. Now it seems that because ES cannot fit enough LLRW in the 11e.(2) cell they have asked for a new "supercell" for their own convenience.

The problem is that for ES convenience the State of Utah and its citizens are put at great risk. ES has been getting paid to accept waste for the last 12 years and have yet to cover that waste. While the company executives have been taking out millions of dollars each year the stock price of the company has dropped from over $25 a share to under $2 a share. Meanwhile, the waste that has been accepted and paid for continues to sit in the west desert without a cover. This amendment creates a situation where the waste will continue to sit uncovered for many more years with the increasing possibility that the State of Utah will be responsible to cover the waste. It is not a good idea for the Division of Radiation Control to permit Utah and its citizens to be at great risk when it is in clear contradiction to Governor Huntsman's agreement with ES. It does not seem that this proposed amendment is good for Utah or its citizens. Thank you for your consideration of these public comments.

Sincerely,

Charles A Judd

Charles Judd

2028 EAST FORT UNION BLVD., STE. 102-A; SALT LAKE CITY, UT 84121

1. THE FINANCIAL STABILITY OF THE COMPANY IS DETERIORATING QUICKLY. IT IS POSSIBLE THAT THE STATE OF UTAH WILL SOON BE RESPONSIBLE TO CLOSE THE CELLS. THERE ARE NOT ENOUGH RESOURCES TO CLOSE THE NEW CELL, SO THE STATE WILL BE RESPONSIBLE TO PAY THE EXTRA COSTS OF THIS NEW SUPERCELL.

The financial stability of the company is of great concern. Stock prices have dropped over 90 percent and the debt of the company is huge. To top it off there was no review done of the financial surety of the site if the new supercell were approved. The DRC must do a financial review of the amendment before it is approved. The surety is the main way the State of Utah is protected from the failure of the company. The State of Utah is at huge risk at this time. There are many issues surrounding the surety that are unknowns. First, the design of the facility is not even known. No one has shown how the new facility would be closed if the company goes bankrupt. It would be a huge cost to fill the cell up to the limits needed to provide proper drainage. There is not enough cover materials identified to complete the cells at the site. Their amount of money set aside to pay for rock is way low. The settlement issues create a time concern for closure that has not been addressed. It is clear that the protection of the State of Utah has not been considered in the proposal. This financial review needs to be done before this proposal is sent out to public comment.

The SER was based on a management team that has now drastically changed. The company has gone through several major changes in the past 5 years. These changes are probably based on the financial situation at the company since the stock price has dropped from over 27 dollars to under 2 dollars. The new management needs to be evaluated to determine if they are willing to maintain proper controls at the company even though the financial situation at the company is very concerning. The citizens of Utah should not be expected to pay tens of millions of dollars to close a new supercell after executives of the company have been paid millions in benefits. A complete surety review is needed and a review of the company's financial stability and management should be required before a new supercell is considered. It is clear that a second public comment period is needed when the financial surety review is completed.

2. APPROVAL SHOULD NOT BE GIVEN WHEN MAJOR DESIGN ISSUES ARE UNKNOWN. UTAH MAY END UP WITH MILLIONS OF CUBIC YARDS OF WASTE TO COVER AND NO WAY TO COVER THE WASTE.

There are two major issues that have not been resolved to the State's satisfaction, one concerning the clay to be used for cell construction and one concerning the rock for cell construction. Instead of solving these issues before public comment, the SER was sent out and DRC is moving forward without knowing if the new design will work. This is not acceptable. The commenters do not have access to significant issues such as what is the cover design. The cover design is one of the major issues in waste facility control since it is the major item to contain the waste for thousands of years. Without proper clay and proper rock there is no way the waste can be contained. A conditional approval is not an acceptable procedure in this situation. ES could go out of business and leave the State of Utah and its citizens with millions of cubic yards of waste that are uncovered and no proper design to cover the waste. ES should wait until they have completed major design items on the cell before they seek approval. It is clear that a second public comment is needed when the design is completed.

3. THE NEW SUPERCELL ALSO GIVES ES APPROVAL TO LEAVE WASTE UNCOVERED FOR UP TO 30 YEARS. ES CONTINUES TO GET PAID TO ACCEPT WASTE BUT IS NOT PROPERLY COVERING IT, WHICH IS THE MOST IMPORTANT PART OF CELL CONSTRUCTION. IF ES GOES OUT OF BUSINESS THEN THERE IS MILLIONS OF CUBIC YARDS OF WASTE THAT UTAH WILL BE RESPONSIBLE TO COVER.

ES continues to delay the covering of waste material. This request only lengthens the time the waste is uncovered. Originally, ES was to cover waste with a final cover within 5 years. They then committed to cover it in 10 years. Now this amendment will change it so that ES can leave waste open for up to 30 years. This is not acceptable for several reasons. First of all, it leaves the State of Utah at greater risk because there is more waste open that will need to be handled if ES goes out of business (which is more likely every year). Second the waste is open to many elements for too long; open to wind, rain, freeze thaw and other elements. This too brings more risk to the people in Utah. It is convenient for ES to leave waste open for decades, but just creates more risk for everyone else. It is possible that ES does not have the money to pay for the closure now so they are just trying to leave it open for decades and then have someone else be responsible to cover the waste.

4. NO REVIEW HAS BEEN DONE OF EARLY CELL CLOSURE FOR THIS NEW SUPERCELL. IF THE AMENDMENT WERE APPROVED, THEN UTAH COULD BE RESPONSIBLE FOR EARLY CELL CLOSURE WHICH WOULD COST OVER $35 MILLION EXTRA.

Once construction of the new supercell starts, there is no approved way to close the cell early if the company goes out of business. The only approved option would be to close the entire cell. This means that the State of Utah may need to bring in over 3,000,000 cubic yards of fill material to complete the cell. Fill material is costing over $12 per cubic yard. This means that the State of Utah is accepting an additional $35 million in cost. This money is not covered under the surety. ES does not have access to this amount of material right now and neither does the State of Utah. So costs would be much higher than $35 million. ES could not just dig material close to the cell for the fill material because it would change the groundwater flow and the surface water flow around the cell and affect the long term performance of the cell. No approval should be given until the early closure costs are accepted by ES and included in their surety.

5. PROPER STUDIES COULD NOT HAVE BEEN DONE ON THE NEW SUPERCELL BECAUSE THE PHASING OF WASTE PLACEMENT HAS NOT BEEN ESTABLISHED.

The phasing of waste placement has not been addressed in this amendment. This is not a normal requirement of the NuREGs, but needs to be addressed because of the unique approach that is being proposed. The idea of bridging two cells with waste over a 25 year period has not been done before. The cell will perform differently depending on how the waste is placed. If ES begins to put waste in the new section, then the old sections will be left open for too many years. If ES puts waste in the old sections, then the differential settlement becomes a much bigger issue because the time between the different waste columns is even longer. ES should be required to establish their plans for phasing waste placement in advance so it can be included in the analysis of the embankment. The proper analysis cannot have been done at this time because we do not know the phasing of the embankment. This problem is

exaggerated by the fact that ES does not have an idea of how much waste is coming in each year. If they do know, they should provide some idea so that the proper phasing can be done in the embankment. After proper information is provided then proper analysis can be done. After that the public should be allowed to comment on the proposal.

6. THERE IS NOT ENOUGH ROCK MATERIAL TO SUPPORT THE NEW DESIGN. UTAH MAY HAVE TO PAY TO HAUL ROCK FROM LONG DISTANCES TO COVER THE NEW EMBANKMENT.

The new design calls for more rock rip rap. In the past year, ES has tried to obtain rock from their new rock source. This rock source did not provide the type and amount of rock rip rap that they have suggested. Instead, the new rock source produces a large amount of sand and less than 1 inch material. The new design calls for more of larger rock which is limited in the ES rock source. ES has only reserved less than 200,000 cubic yards of bank run material for their rock materials. This would produce less than 100,000 cubic yards of material that is beneficial for rock cover. There is less than 1.5 million cubic yards of bank run material in the entire pit. This material is also being used by other companies. ES has not reserved close to enough material to finish the new cell, let alone the other cells that will need to be covered. ES does not have access to enough material to construct rock rip rap with the new design. If ES were to go out of business the State of Utah would required to build cover without having access to rock for its construction. That would mean tens of millions of extra costs that would have to be borne by the State of Utah and its citizens.

7. ENERGYSOLUTIONS HAS UNDERESTIMATED THE COSTS TO PRODUCE AND PLACE ROCK COVER FOR THE NEW SUPERCELL. THESE EXTRA COSTS WILL BE PAID BY THE STATE OF UTAH UNLESS A FINANCIAL REVIEW IS DONE BEFORE THE AMENDMENT IS APPROVED.

The cost for the rock rip rap material that is shown in the surety is not sufficient for the actual costs that will be incurred. A recent project by ES for rock production showed that the costs for rock production are significantly more expensive than previously shown in the surety. The rock material had to be handled several times before it was placed on the mixed waste cell. ES excavated the rock from the pit and had to use a dozer to loosen the material. ES found that there were large amounts of caliche in the rock source that will become more and more of a problem over time because they used the best material this time. The rock then was put through a screening process which is way more expensive than ES suggests in their surety. The screening revealed that there was a smaller amount of usable material than expected in the bank run material. The rock then had to be sorted again to get it to the right specifications. The rock then was picked up again and loaded into trucks and hauled again. Finally the rock was placed. The total cost per cubic yard for material is much higher than suggested in the surety. The State of Utah and its citizens are in danger of having to pay these extra costs, especially if the new design is approved with thicker rock in the cover design.

8. CHANNELING IN THE COVER HAS NOT BEEN STUDIED SUFFICIENTLY TO PROTECT THE STATE OF UTAH IF UTAH IS REQUIRED TO COVER THE WASTE

No studies have been done to examine the new designs effect on channeling in the cover. This is especially of concern because of the longer flow lines in both the top rock and the side slope rock and because ES original LARW cell has shown that there is significant differential settlement when waste is place at different times. A review of the LARW cell shows that

when waste is placed at different times there is differential settlement in the cover directly over the areas where waste is placed at different times. This creates channeling in the flow as water is placed on the embankment. The new CAW cell will have greater problems because the waste placed in the two existing cells is already settled. The time between that waste placement and the new waste placement is much longer. In fact, the older cells will have been in place for up to 15 years before new waste is placed next to it. This is sure to cause more channeling in the cover. This channeling will have more water flowing in it because of the longer flow lines. This issue needs to be investigated further.

9. THE FILTER ZONE WILL NOT PERFORM PROPERLY IN THE NEW SUPERCELL BECAUSE OF EXTREME SETTLEMENT IN THE AREA BETWEEN THE TWO EXISTING CELLS.

The attempt to build a higher cell will create a situation where the filter zones will not perform properly. The areas with waste placed later will settle more than the existing cells because the waste column is deeper and because the waste is being placed later. This will create a situation where the filter zone will have areas where the flow line in the filter may go up hill and at least will not have the proper slope that is required on the top of the embankment. This will create channeling and possible ponding on the top of the embankment. The LARW cell is an example of how this differential settlement will affect flow on the top of the embankment. This is not acceptable for proper long term cover construction.

10. ES HAS NOT ESTABLISHED THAT THE MAJOR CONSTRUCTION MATERIAL FOR THE CELL (CLAY) CAN HANDLE THE NEW SUPERCELL. IF THE CLAY FAILS THE ENTIRE CELL FAILS. THE SETTLEMENT BETWEEN THE NEW CELL AREA AND THE TWO CURRENT CELLS WILL CAUSE THE CLAY LINER AND THE CLAY COVER TO FAIL.

Travis

The clay used for construction is still an unknown. ES does not know if the clay that will be used can withstand the new type of construction. This is a great concern. The clay is the most important part of cell construction; it is used to contain the waste both on the bottom of the cell and the top of the cell. If it does not perform properly then the embankment will fail. With the new design it is very likely that the clay liner under the waste will fail. If the two licensed cells have been constructed for about 10 years before the clay liner between the two cells is constructed then the settlement will certainly create a failure between the new clay liner and the old clay liner. The settlement under the current cells is approximately 90% complete, probably settling over two feet. The new clay liner will now be constructed and then the new waste placed in this area. The waste column in the new area will be over 70 feet and should create settlement of the clay liner of about three feet. It seems unlikely to think that the new clay liner will settle just the right amount to tie in exactly with the old clay liner. There will be a break between the new and old clay liners. This is not a good situation and should not be allowed. There is no reason that this risk should be taken.

11. THE TWO FOOT CLAY COVER IS NOT SUFFICIENT IF THE NEW SUPERCELL IS APPROVED. THERE IS LITTLE ROOM FOR ERROR WHEN THERE IS ONLY A TWO FOOT COVER.

In an attempt to save money, ES has decided to only put 2 feet of clay cover over the waste. This is an extremely risky proposal. Even though studies show that the 2 foot cover may be sufficient to hold in the radioactive material that only works if the 2 foot cover stays intact.

There are many ways the clay cover could be compromised including through frost, erosion, cracking, stress, tension and penetration by animals and roots. It is much better to have extra amounts of clay cover to overprotect the waste in case any of these natural processes happen to the embankment. ES is proposing a new way to construct the clay cover where differential settlement is sure to increase. The expected settlement in some areas will be over 3 feet, which is more than the depth of the cover. Just as with the clay liner it is hard to get any settlement to happen at the same rate in an old embankment and a new embankment that are tied together. Therefore, it is very likely that the clay cover will fail due to cracks and differential settlement.

12. THE PROPOSED AMENDMENT IS IN CONTRADICTION TO THE HUNTSMAN AND ES AGREEMENT.

EnergySolutions signed an agreement with Governor Huntsman several years ago. This proposal is not in accordance with that agreement. The agreement was based on certain types of waste coming into the state. Instead this proposal allows for much hotter waste to come into the state by changing the waste accepted from 11 e2 waste to low level wastes. The governor's agreement was also based on a specific configuration of the waste and not expanding the height of the waste to such extreme elevations.

One of the main reasons that the Governor of Utah signed an agreement in 2007 was to get EnergySolutions to withdraw its amendment to build a "supercell". The Governor agreed on several concessions based on ES promise not to build the larger cell. Now 5 years later ES is asking for a new "supercell" that is almost identical to the one they promised not to build. ES has committed to not build a combined Class A Cell. Now they want to build and combined Class A cell and just change the name. This is in direct violation of the current agreement.

The current request is not in accordance with the 2007 agreement. The 2007 agreement allows ES to build the existing low level cells that were licensed as of March of 2006. That would be the Class A cell and the Class A north cell. The agreement also allowed ES to convert a portion of the11 e.(2) cell into low level waste volume. It does not allow the Class A cell and the Class A north cell to be combined and the height increased. In fact, this is the main reason the Governor made the agreement was to stop the combination of the two cells. ES should not be given this amendment because it is not in accordance with the 2007 agreement with Governor Huntsman. The State of Utah and its citizens should not be the ones that take all the risk so that ES can bring in more waste and leave it uncovered for decades.

# APPENDIX D
# AMENDED LICENSE RML NO. UT 23000249
# RESULTING FROM PUBLIC COMMENTS

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DRC-03
October 1989

**LICENSE AMENDMENT**

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

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

**********

LICENSEE

1. Name: EnergySolutions, LLC (EnergySolutions)

2. Address: 423 West 300 South
Suite 200
Salt Lake City, UT 84101

3. License Number UT 2300249
Amendment # ~~13~~14

**********

4. Expiration Date
January 25, 2013

**********

License Category – 4-a

**********

| 6. | Radioactive material (element and mass number) | 7. | Chemical and/or physical form | 8. | Maximum quantity licensee may possess at any one time |
|---|---|---|---|---|---|
| A. | Any Radioactive Material including Special Nuclear Material specified in License Condition 13 A through J. | A. | 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*** |

**UTAH DIVISION OF RADIATION CONTROL**
**RADIOACTIVE MATERIALS LICENSE**
**SUPPLEMENTARY SHEET**

License # UT 2300249
Amendment # ~~13~~14

| 6. | Radioactive material (element and mass number) | 7. | Chemical and/or physical form | 8. | Maximum quantity licensee may possess at any one time |
|---|---|---|---|---|---|
| B. | Special Nuclear Material | B. | See 7.A of this license | B. | As specified in License Condition 13.A through J. (1,000 Ci) total except as specified by Condition 15 |
| C. | Cesium-137 | C. | 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; Not to exceed 6 sources total |
| D. | Americium-241 | D. | 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; Not to exceed 6 sources total. |
| E. | Americium-241<br>Americium-243<br>Neptunium-237<br>Plutonium-236<br>Plutonium-239<br>Plutonium-242<br>Thorium-229<br>Thorium-230<br>Uranium-232<br>Uranium-238<br>Curium-244<br>Hydrogen-3<br>Carbon-14<br>Iron-55<br>Nickel-59<br>Nickel-63<br>Technetium-99 | E. | Liquid | E. | Not to exceed 5 microcuries total activity per isotope; Not to exceed 16 sources total. |
| F. | Strontium-90/Yttrium-90 | F. | Liquid | F. | Not to exceed 5 microcuries total activity |

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| 6. | Radioactive material (element and mass number) | 7. | Chemical and/or physical form | 8. | Maximum quantity licensee may possess at any one time |
|---|---|---|---|---|---|
| G. | Americium-241 | G. | 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 | H. | 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 | I. | 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 |
| J. | Strontium-90/Yttrium-90 and Americium-241 | J. | 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; Not to exceed 6 sources total. |
| K. | Am-241, Cd-109, Co-57, Te-123m, Cr-51, Sn-113, Sr-85, Cs-137, Co-60, Y-88, Th-230, Na-22, Mn-54, Eu-155 and Pb-210 | K. | Calibration or Reference Source(s) | K. | Not to exceed 5 microcuries per isotope; Not to exceed 25 sources total. |
| L. | Uranium-234, Uranium-235, Uranium-238, Americium-241, and Plutonium-239 | L. | Calibration or Reference Source(s) | L. | Not to exceed 20 nanocuries per isotope |
| M. | Cobalt-60 and Cesium-137 | M. | Calibration or Reference Combined Source(s) | M. | Not to exceed 0.4 microcuries per source; Not to exceed 6 sources total. |
| N. | Reserved | N. | Reserved | N. | Reserved |
| O. | Americium-241 and Europium-152 | O. | Calibration or Reference Combined Sources | O. | Not to exceed 2 microcuries per source; Not to exceed 4 sources total. |
| P. | Cesium-137 | P. | Sealed Source(s) registered pursuant to R313-22-210 or an | P. | Not to exceed 12 millicuries per |

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| 6. | Radioactive material (element and mass number) | 7. | Chemical and/or physical form | 8. | Maximum quantity licensee may possess at any one time |
|---|---|---|---|---|---|
| | | | equivalent U.S. Nuclear Regulatory Commission or Agreement State regulation | | source; Not to exceed 3 sources total. |

***Applies to undisposed maximum quantity at the Class A West 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 Secretary~~Director of the Utah Division of Radiation Control (Director) ~~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~~Director of the Utah Division of Radiation Control ~~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

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Transportation or Nuclear Regulatory Commission approved design specifications.

E. The Licensee may dispose of a volume of Class A Low-Level Radioactive Waste (LLRW) and Naturally Occurring and Accelerator Produced Radioactive Materials (NARM) in the Class A West disposal cell described in License Condition 40 not exceeding ~~8,742,097~~ 8,724,097 cubic yards, and in the Mixed Waste Landfill Cell not exceeding ~~1,353,004~~ 1,354,092 cubic yards. Together, the total aggregate volume of waste disposed of in the Class A West disposal cell and the Mixed Waste Landfill Cell shall not exceed 10.08 million cubic yards. Class A waste LLRW is defined in Utah Radiation Control Rule R313-15-1009 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 and treat 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. Treated aqueous liquids may be disposed at the Mixed Waste Facility or the LLRW Facility, in accordance with Exhibit 3 of the Waste Characterization Plan. Treated (amalgamated) liquid mercury shall be disposed at the Mixed Waste Facility only.

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.

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

K. Reserved

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

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points of reference:

| | |
|---|---|
| Southwest Section Corner: | Latitude 40° 40' 51.890" N<br>Longitude 113° 7' 28.580" W |
| Elevation | 4269.76 feet above mean sea level (amsl) |
| Southeast Section Corner | Latitude 40° 40' 51.879" N<br>Longitude 113° 6' 20.011" W |
| Elevation | 4277.27 feet-amsl |
| Northwest Section Corner | Latitude 40° 41' 44.098" N<br>Longitude 113° 7' 28.654" W |
| Elevation | 4273.06 feet-amsl |
| Northeast Section Corner | Latitude 40° 41' 44.086" N<br>Longitude 113° 6' 20.109" 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. Authorized Use of Sealed Sources

i. Licensed material in Items 6.C and 6.D used as authorized in 9.I, and licensed materials in Items 6.E through 6.P used as authorized in 9.J and identified as sealed sources may be used and stored on all property owned by the Licensee at their Clive facility. The property is located in Sections 29, 32 and in parts of Sections 28 and 33 in Township 1 South, Range 11 West and parts of Sections 4, 5 and 6 in Township 2 South, Range 11 West SLBM, Tooele County, Utah.

ii. Licensed material not authorized for use specified in License Conditions 9.I and 9.J or not defined as sealed sources in License Condition 9.J shall be used and stored only at the Licensee's facilities referenced in Condition 10.B.

11. The open cell area within the Class A West ~~and Class A North~~ disposal embankment~~s~~, where waste disposal/placement has occurred 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.

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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, 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<br>Radionuclide | Column 2<br>Maximum Concentration (pCi/g) | Column 3<br>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 |
| 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

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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

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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

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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 40, 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~~Director~~,~~ of the Utah Division of Solid and Hazardous Waste ~~Control Board~~ and "HSWA Permit" issued by the U.S. Environmental Protection Agency.

B. The Licensee may dispose of treated mixed waste in the Class A West ~~North or the Class A~~ disposal cell~~s~~ if it meets the criteria described in Exhibit 3 of the Waste Characterization Plan.

C. All other mixed wastes shall be disposed in the Mixed Waste Landfill Cell only.

**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.

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C. Following treatment at the Mixed Waste facility the Licensee shall classify the resultant processed waste in accordance with UAC R313-15-1009.

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 R313-15-1009(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 R313-15-1009(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 R313-15-1009(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 and minimal quantities as described in Condition 17 and in the Waste Characterization Plan, receipt of non-aqueous liquid waste is prohibited unless specifically approved by the ~~Executive Secretary~~Director.

ii. Treated liquid radioactive waste shall be disposed at the Mixed Waste Facility or the LLRW Facilities in accordance with Exhibit 3 of the Waste Characterization Plan.

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.

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G. In accordance with UAC R313-15-1009(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 ($3.7 \times 10^{12}$ Bequerels).

H. In accordance with UAC R313-15-1009(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 R313-15-1009, "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 West ~~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~~Director.
   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~~Director.
   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

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**MANAGEMENT OF FREE LIQUIDS**

17. A. In accordance with UAC R313-15-1009(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.

B. Solid waste received and containing unexpected aqueous 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.

C. Unexpected non-aqueous free liquids less than 1% of the volume of the waste within the container shall be solidified prior to disposal.

D. Should shipment(s) arrive with greater than 1% unexpected free liquids (total of aqueous and non-aqueous), 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 FOR NEW LICENSEES:**

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)<br>2. Change Area(s) | 1. Weekly<br>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 (dated January 5, 2012, or the most recent approved amendment to that plan ~~September 30, 2010~~).

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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.

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28. The Licensee shall submit the following to the ~~Executive Secretary~~Director for review and approval pending resolution of all issues as judged by the ~~Executive Secretary~~Director:
    A. The Licensee shall submit a corrective action plan for the Cover Test Cell for ~~Executive Secretary~~Director 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~~Director approval. Within 30-days of completion of said construction, the Licensee shall submit an As-Built report for ~~Executive Secretary~~Director approval.

    B. The Licensee shall submit an annual report for ~~Executive Secretary~~Director 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~~Director:

    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 received 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

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Radioactive Waste (LLRW), LLRW with PCBs, Mixed Waste (MW), 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~~Director, at the earliest knowledge, that the following nuclides are scheduled for disposal: berkelium-247 and chlorine-36.

E. For the Class A West ~~and Class A North~~ disposal cell~~s~~, 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~~Director, at the earliest knowledge, that the following nuclides are scheduled for disposal: ~~aluminum-26,~~ berkelium-247, calcium-41, ~~californium-250,~~ chlorine-36, iodine-129, rhenium-187, ~~terbium-157, and terbium-158~~ and Technetium-99.

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.

**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 (November 7, 2011, rev 23).

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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~~Director, 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~~Director 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~~Director 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~~Director. 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. A. In accordance with UAC R313-25-8, effective June 1, 2010 the Licensee shall not dispose of significant quantities of concentrated depleted uranium prior to the approval by the ~~Executive Secretary~~Director of

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the performance assessment required in R313-25-8.

B. Performance assessment: A performance assessment, in general conformance with the approach used by the Nuclear Regulatory Commission (NRC) in SECY-08-0147, shall be submitted for ~~Executive Secretary~~Director review and approval no later than June 1, 2011. The performance assessment shall be revised as needed to reflect ongoing guidance and rulemaking from NRC. For purposes of this performance assessment, the compliance period will be a minimum of 10,000 years. Additional simulations will be performed for a minimum 1,000,000-year time frame for qualitative analysis.

C. Revised disposal embankment design: If the performance assessment specified in paragraph 35.B indicates that changes to disposal operations and cover design are necessary to ensure compliance with the requirements of 10 CFR Part 61 or Utah Administrative Code R313, EnergySolutions will provide a revised design that does meet those requirements, for all wastes that have been and are reasonably anticipated to be disposed of at the facility within 180 days of ~~Executive Secretary~~Director approval of the performance assessment.

D. Remediation: If following the completion of DRC's review of the performance assessment described in paragraph 35.B, the disposal of DU as performed after the date of this license condition would not have met the requirements of the performance assessment, the facility will undertake remediation to ensure that the performance standards are met, or if that is not possible, shall remove the DU and transport it off-site to a licensed facility.

E. Surety: The Licensee shall fund the surety for the remediation, in License Condition 35.D. Within 30-days of the effective date of this license condition, the licensee shall submit for ~~Executive Secretary~~Director review and approval, the surety cost estimates for remediation of existing Savannah River DU waste disposal and planned, similar large quantity DU waste disposal.

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 West 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~~Director and disposed of in the Containerized Waste Facility; or

B. Packaged in High-Integrity Containers (HIC) approved by the ~~Executive Secretary~~Director, carbon-steel liners, unapproved HICs, or poly HICs meeting the void space criteria described in License

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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~~Director, 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 Construction Quality Assurance/Quality Control Manual.

38. The Licensee shall construct the Class A West disposal Cell identified in the Ground Water Quality Discharge Permit No. UGW450005 and in accordance with approved engineering design drawings "Series ~~9821~~10014".

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 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 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 configurations, backfill materials and associated placement activities, shall be those approved by the ~~Executive Secretary~~Director following specifications contained in the Work Element: Containerized Waste Facility-Waste Placement Test Pad and the Work Element Containerized Waste Facility- Waste Placement Sections of the currently approved LLRW Construction Quality Assurance/Quality Control 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.

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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 West~~or Class A North~~ disposal embankment~~s~~, in accordance with debris placement requirements of the currently approved LLRW and 11e.(2) CQA/QC Manual.

40. The LARW and Class A West 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 West 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.~~ On or before August 1, 2012, the Licensee shall submit, for Director's review and approval, a detailed plan for a study of the clayey soils to be used in the radon barrier of the CAW embankment cover. The objective of this study is to determine the amount of strain that the soils can withstand without cracking when subjected to both axial lengthening and bending as would be experienced when the clay settles differentially as part of the cover system. Within nine months of Director's approval of the study plan, the Licensee shall execute the study and submit a report with results of the study. Based on results of the study and the Director's review, the Director may require the Licensee to modify the embankment and cover design.

42. ~~Reserved.~~ On or before December 21~~25~~, 2012, the Licensee shall submit a revised cover design (including at least descriptions, design calculations, drawings, and specifications) and an assessment addressing performance of the revised Class A West cover design and transport of potential releases from the proposed Class A West disposal unit.

43. The Licensee shall, in the 2012 Surety submittal, provide cost estimates based on the Class A West design submitted on Drawings 10014 C01 through C06 listed in Table 2C of the GWQDP. The Licensee shall provide surety funding as approved by the Director prior to commencing construction of the clay liner in the area between the previously approved Class and Class A North embankments.

44. The Licensee shall fulfill all requirements and maintain compliance with all conditions in the LLRW CQA/QC Manual and engineering drawings currently approved by the ~~Executive Secretary~~Director.

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

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(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~~Director. Said certification shall include all engineering test methods required by License Condition 44, or as directed by the ~~Executive Secretary~~Director. Certification is not required for the DRC approved sealed single ring infiltrometer permeability test contained in Appendix B to the LLRW and 11e(2) CQA/QC Manual.

46. Reserved

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

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**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~~Director, a set of "As-Built" drawings shall be submitted for review. The drawings shall indicate as-built 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 West Cell ~~Cell, Class A North Cell~~, 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 West Cell ~~or Class A North Cell~~ within 90 days as debris in accordance with requirements of the LLRW 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:

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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

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 West Cell ~~and Class A North Cell~~ which ~~have~~ has 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 4, October 6, 2011).

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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:~~

~~Total Activity of chlorine-36 Received (picocuries) ≤ 0.2828 picocuries per gram~~
~~Total Mass of Active Cell (grams) + Completed Cell (grams)~~

A. For the Class A West disposal cell, the Licensee shall ensure that the average concentrations of selected radionuclides do not exceed the limits stated in Table 55A.

**Table 55A. Limiting Radionuclide Concentrations in Waste Disposed of in Class A West Disposal Cell.**

| Radionuclide | Maximum Average Radionuclide Concentration[1] in Waste Disposed of Under Top Slope (pCi/g) | Maximum Average Radionuclide Concentration[1] in Waste Disposed of Under Side Slope (pCi/g) |
|---|---|---|
| berkelium-247 | 0.0065 | 0.00388 |
| calcium-41 | 35,300 | 34.1 |
| chlorine-36 | 15.9 | 9.72 |
| iodine-129 | --- | 21.9 |
| rhenium-187 | --- | 19,100 |
| technetium-99 | --- | 1,720 |

1. Maximum average radionuclide concentration for a radionuclide is determined as the quotient of the Total Activity (in picocuries) of that radionuclide disposed of under the respective slope and the Total Mass disposed of under the respective slope for the Active Cell (in grams) + Completed Cell (in grams).

~~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:~~

~~*Total Activity of berkelium-247 Received (picocuries) ≤ 0.0001 picocuries per gram*~~
~~*Total Mass of Active Cell (grams) + Completed Cell (grams)*~~

~~C~~B. 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:

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

~~D~~C. 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*

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*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 returned 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~~Director of the Utah Division of 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~~Director of the Utah Division of 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 October 8, 2009).

59. Reserved.

60. Wind dispersed Dry Active Waste (DAW) located outside of the Contaminated Restricted Area is prohibited.

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

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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~~Director authorizes their disposition.

68. The Licensee shall immediately notify the ~~Executive Secretary~~Director 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;

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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~~Director 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~~Director, 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~~Director 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% |

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

F. Within 60-days of ~~Executive Secretary~~Director 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 December 1 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~~Director 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. The Licensee shall at all times maintain a Surety for perpetual care, using an instrument that satisfies the requirements of UAC R313-22 and R313-25. The Surety shall be in the amount last approved by the Radiation Control Board, as provided in Utah Code Ann. 19-1-307(2), as adequate to fund perpetual care, less the amount contributed to the Radioactive Waste Perpetual Care and Maintenance Account created under Utah Code Ann. 19-3-106.2 (but not including any part of that Account resulting from returns on investment).

**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.

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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~~Director 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~~Director 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.

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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~~Director.

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~~Director 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 March 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~~Director, the U.S. Nuclear Regulatory Commission, or an Agreement State to perform such services.

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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~~Director.

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~~Director, 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.

**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. Reserved.

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~~Director, 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.

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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~~Director, 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~~Director in writing that it has completed the requirements of this License Condition.

88. The licensee shall comply with requirements described in the ~~Executive Secretary~~Director'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

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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~~Director when full compliance with the requirements described in the ~~Executive Secretary~~Director'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" have been achieved. Notification to the ~~Executive Secretary~~Director shall be made within twenty-five (25) days after full compliance has been achieved.

D. The licensee shall notify both the ~~Executive Secretary~~Director 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:

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(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 32.A.
(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 32.A.
(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 32.A. 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.

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(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 21.A 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.

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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

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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.

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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.
(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.

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(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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(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.
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(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.
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(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.
(32) Utah Division of Radiation Control (Dane Finerfrock) to Envirocare of Utah, Inc. (Tye Rogers). 2005b. "Response to March 25, 2005 Envirocare Response to the February 27, 2005 DRC Request for Information - Restoration of Site Drainage." April 22, 2005.
(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.
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(39) Whetstone Associates, Inc. 2000a. Revised Envirocare of Utah Western LARW [Class A] Cell Infiltration and Transport Modeling. July 19, 2000.
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(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.
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(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-

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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.
(70) Letter CD01-0296, "Containerized Waste Facility - Placement of Class A Ion-Exchange Resins in

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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 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

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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.

L. The following documents refer to revisions made in Amendment 5:

(1) Letter dated July 27, 2009, (CD09-0188) from Daniel Shrum to Dane Finerfrock; Radioactive Material License Number UT 2300249 - Request for Amendment.

(2) Letter dated May 6, 2009, (CD09-0116) from Sean McCandless to Dane Finerfrock, Radioactive Material License #UT 2300249 – Request for Amendment and Response to April 15, 2009, Request for Information.

(3) Letter dated May 28, 2009, Dane Finerfrock to Sean McCandless, 2009 Module 14 Engineering Inspection – Soil Lab and Testing Methods with accreditation for License Condition 45, Radioactive Materials License UT 2300249 Closeout Letter.

(4) Letter dated April 7, 2009, (CD09-0091) from Sean McCandless to Dane Finerfrock Radioactive Material License #UT 2300249 and Ground Water Quality Discharge Permit No. UGW450005 - Response to DRC Request for Information

(5) Memorandum from Dave Esser to File, dated May 21, 2009, Proposed correction to the Ground Water Quality Discharge Permit UGW45005 and Radioactive Material License UT2300249 – Amendment Review regarding section, disposal cell, and buffer zone Latitude and Longitude coordinates.

M. The following documents refer to revisions made in Amendment 6:

(1) Letter dated October 22, 2007, (CD07-0340) from Sean McCandless to Dane Finerfrock; Radioactive Material License Number UT 2300249 - Request for Amendment to Conditions 14.B and 16.F.ii.

(2) Letter dated November 20, 2007, from John Hultquist to Sean McCandless, Formerly Characteristic Hazardous Waste meeting, request to Amendment, Radioactive Material License #UT 2300249.

(3) URS Memorandum dated December 10, 2007, Gary Merrell to Dane Finerfrock Review of Whetstone Technical Memorandum, "Formerly Characteristic Waste Modeling of Class A and Class A North Cells," from Susan Wyman to Dan Shrum, September 25, 2007.

(4) Letter dated January 21, 2009, (CD09-0015) from Sean McCandless to Dane Finerfrock Formerly Characteristic Waste – Response to Letter dated November 20, 2007.

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(5) Letter dated January 21, 2009, (CD09-0014) Timothy Orton to Dennis Downs, Div. of Solid and Hazardous Waste, Class 2 Modification – Management of Wastes at the Mixed Waste Facility that will be disposed at the LLRW Facility.
(6) Memorandum dated February 18, 2009, from Boyd Imai to John Hultquist, EnergySolutions Amendment Request (CD07-0340).
(7) Memorandum dated September 21, 2009, from Boyd Imai to John Hultquist, Review; Formerly Characteristic Waste – License Amendment Request.
(8) Letter dated August 31, 2009, Sean McCandless to Dane Finerfrock, Radioactive Material License No. UT2300249 – Revised request for Amendment – Formerly Characteristic (LLRW Destined) Waste.
(9) Email dated October 15, 2009, Sean McCandless to John Hultquist, Formerly Characteristic, Attachments Revised RML 10/8/09 and WCP Revised 10/8/09.
(10) Memorandum dated October 19, 2009, from Boyd Imai to John Hultquist, Formerly Characteristic Wastes – Transfer to LLRW.

N. The following documents refer to revisions made in Amendment 7:
(1) Letter dated September 21, 2009, (CD09-0241) from Val J. Christensen to Amanda Smith; RML No. UT2300249 – Commitments Relating to Depleted Uranium Disposal.
(2) Letter dated October 1, 2009, (CD09-0258) from Val J. Christensen to Dane Finerfrock; RML No. UT2300249 – Commitments Relating to Depleted Uranium Disposal
(3) Notice of Agency Action to Consider Proposed License Condition No. 35 dated October 21, 2009.
(4) Email dated February 22, 2010, from Laura Lockhart to Dane Finerfrock and John Hultquist, License Condition documents –comment response document.

O. The following document refer to revision made in Amendment 8:
(1) Letter dated June 1, 2010, (CD10-0162) from Sean McCandless to Dane Finerfrock; RML No. UT2300249—Request for Amendment.
(2) Letter dated July 15, 2010, (CD10-0200) from Sean McCandless to Rusty Lundberg; RML No. UT2300249—Revision of Appendix I, *Organization.*
(3) Letter dated August 2, 2010, (CD10-0219) from Sean McCandless to Rusty Lundberg; RML No. UT2300249—Revision of Appendix I, *Organization.*
(4) Letter dated November 1, 2010, (CD10-0298) from Rick Chalk to Rusty Lundberg; 1. Radioactive Material License UT 2300249, License Condition 16.1 (sic) Letter dated November 23, 2009 to Dane Finerfrock from Mark Ledoux, CD09-0323, 2. Administrative request from DRC to EnergySolutions to amend License UT 2300249, License Conditions 6, 7, and 8.
(5) Email date November 18, 2010, from Thomas Brown to Boyd Imai, LC 8 E, K, M and O.

P. The following documents refer to revision made in Amendment 9:
(1) Letter dated December 6, 2010, (CD10-0347) from Dan B. Shrum to Rusty Lunberg; RML No. UT2300249—Amendment Request – Condition 35.B, Depleted Uranium.
(2) Memorandum dated December 13, 2010, from John Hultquist to File regarding Amendment

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request.

Q. The following documents refer to revision made in Amendment 10:
(1) Letter dated February 24, 2011, (CD11-0045) from Dan Shrum to Rusty Lundberg; Radioactive Material License No. UT2300249, License Condition 35.B.
(2) Letter dated February 24, 2011, from Rusty Lundberg to Dan Shrum Radioactive Material License No. UT2300249, License Condition 35.B Depleted Uranium Performance Assessment.
(3) Letter dated March 14, 2011 (CD11-0075) from Dan Shrum to Rusty Lundberg Radioactive Material License No. UT2300249, License Condition 35.B Depleted Uranium Performance Assessment.

R The following documents refer to revision made in Amendment 11:
(1) Letter dated September 30, 2010, (CD10-0264) from L. Wayne Johns to Rusty Lundberg; Radioactive Material License No. UT2300249, License Condition 26, and Radioactive Material License No. UT2300478, License Condition 13.1.D Environmental Monitoring Plan.
(2) Letter dated October 21, 2010, (CD10-0290) from L. Wayne Johns to Rusty Lundberg; Radioactive Material License No. UT2300249, License Condition 26, and Radioactive Material License No. UT2300478, License Condition 13.1.D Environmental Monitoring Plan.
(3) Memorandum dated October 21, 2010, from Bill Craig to File; EnergySolutions request to change Appendix R.
(4) Email dated January 25, 2011, from John Hultquist (DRC) to Sean McCandless (ES) regarding draft license and statement of basis.
(5) Email dated January 27, 2011, from John Hultquist (DRC) to Sean McCandless (ES) responding to proposed language change to LC 60.

S The following documents refer to revisions made in Amendment 12:
(1) Letter dated August 2, 2011, (CD11-0183) from Sean McCandless to Rusty Lundberg; Radioactive Material License No. UT2300249, Request to Amend License Conditions 6.E, 9 and 10.
(2) Letter dated August 17, 2011, (CD11-0224) from Sean McCandless to Rusty Lundberg; Radioactive Material License No. UT2300249, Request to Amend License Conditions 6.E, 9 and 10; Revised Request.
(3) Letter dated August 25, 2011, (CD11-0234) Sean McCandless to Rusty Lundberg; Radioactive Material License No. UT2300249, Request to Amend License Conditions 52 and 54.
(4) Email dated October 5, 2011, from Ryan Johnson (DRC) to Sean McCandless (ES); Request to Amend License Condition 52.
(5) Email dated October 5, 2011, from Ryan Johnson (DRC) to Sean McCandless (ES); Request to Amend License Condition 54.
(6) Letter dated October 13, 2011 (CD11-0282) Sean McCandless to Rusty Lundberg; Radioactive Material License No. UT2300249, Request to Amend License Conditions 52 and 54.
(7) Letter dated October 27, 2011, from Rusty Lundberg to Dan Shrum; Radioactive Material License

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No. UT2300249: Division of Radiation Control's (DRC) Response to Amend License Conditions 52 and 54, dated August 25, 2011.

(8) Letter dated October 27, 2011, (CD11-0293) from Sean McCandless to Rusty Lundberg; Radioactive Material License No. UT2300249, Response to Inspection Report dated October 18, 2011. Radiation Safety Inspection, Containerized Waste Facility (CWF) Operations.

(9) Letter dated November 2, 2011, (CD11-0298) from Rick Chalk to Rusty Lundberg; Radioactive Material License No. UT2300249, Request to Amend License Conditions 6.E, 9 and 10; Revised Request.

(10) Letter dated November 7, 2011, from Rusty Lundberg to Sean McCandless; Radioactive Material License No. UT2300249: Division of Radiation Control's (DRC) Response to Amend License Conditions 39.B, dated October 27, 2011.

(11) Email dated November 8, 2011, from Ryan Johnson (DRC) to Sean McCandless (ES); Draft Statement of Basis and Amendment #12 of Radioactive Material License UT2300249.

(12) Letter dated November 8, 2011, (CD11-0307) from Sean McCandless to Rusty Lundberg, Radioactive Material License No. UT2300249; Revision of Appendix I, *Organization*.

(13) Email dated November 15, 2011, from Ryan Johnson (DRC) to Sean McCandless (ES); Amendment request for LC 32.A.

T The following documents refer to revisions made in Amendment 13:

(1) Letter dated August 2, 2011, (CD11-0183) from Sean McCandless to Rusty Lundberg; Radioactive Material License No. UT2300249, Request to Amend License Conditions 6.E, 9 and 10.

(2) Letter dated August 17, 2011, (CD11-0224) from Sean McCandless to Rusty Lundberg; Radioactive Material License No. UT2300249, Request to Amend License Conditions 6.E, 9 and 10; Revised Request.

(3) Letter dated November 2, 2011, (CD11-0298) from Rick Chalk to Rusty Lundberg; Radioactive Material License No. UT2300249, Request to Amend License Conditions 6.E, 9 and 10; Revised Request.

(4) Email dated November 17, 2011, from Ryan Johnson (DRC) to Sean McCandless (ES); Amendment request to store gauges on Section 29.

U. The following documents were submitted in support of proposed Amendment #14:

1) AMEC Earth & Environmental, Inc. 2011. Report: Geotechnical Update Report – EnergySolutions Clive Facility Class A West Embankment, February 15, 2011

2) AMEC Earth & Environmental, Inc. 2011. Cover Letter – Response to Interrogatory CAW R313-25-8(4)-16/1: Seismic Hazard Evaluation, EnergySolutions Clive Facility, Class A West Embankment, Clive, Tooele County, Utah. report: Geotechnical Update Report – EnergySolutions Clive Facility Class A West Embankment, Clive, Tooele County, Utah. October 25, 2011.

3) AMEC Earth & Environmental, Inc. 2011. Response to Interrogatory CAW R313-25-8(4)-16/1: Seismic Hazard Evaluation, EnergySolutions Clive Facility, Class A West Embankment, Clive, Tooele County, Utah. October 25, 2011

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4) AMEC Earth & Environmental, Inc. 2011. Response to Interrogatory CAW R313-25-8(4)-16/2: Seismic Hazard Evaluation, EnergySolutions Clive Facility, Class A West Embankment, Clive, Tooele County, Utah. December 23. 2011.
5) AMEC Earth & Environmental, Inc. 2012. Report: Response to Interrogatory CAW R313-25-8(4)-16/3: Seismic Hazard Evaluation/Seismic Stability Analysis Update, EnergySolutions Clive Facility, Class A West Embankment, Clive, Tooele County, Utah. April 6, 2012.
6) AMEC Earth & Environmental, Inc. 2012. Addendum: Additional Cyclic Softening Analysis, EnergySolutions Clive Facility, Class A West Embankment, Clive, Tooele County, Utah. May 3, 2012.
7) EnergySolutions, LLC. 2011. (CD11-0123) License Amendment Request: Class A West Embankment, with Attachments 1 Through 7 and cover letter from Sean McCandless to Mr. Rusty Lundberg at Utah Division of Radiation Control dated May 2, 2011.
8) EnergySolutions, LLC. 2011. (CD11-0207) Radioactive Material License #UT2300249 and Ground Water Quality Discharge Permit No. UGW450005. Amendment and Modification Request – Class A West Embankment; Correction to Letter dated July 27, 2011, to Mr. Rusty Lundberg at Utah Division of Radiation Control.
9) EnergySolutions, LLC. 2011. (CD11-0295) Responses to Round 1 Interrogatories: License Amendment Request (UT2300249) for the Class A West Embankment and cover letter to Mr. Rusty Lundberg at Utah Division of Radiation Control, October 28, 2011.
10) EnergySolutions, LLC. 2011. (CD11-0327) Supplemental Responses to Round 1 Interrogatories: License Amendment Request (UT2300249) for the Class A West Embankment, November 28, 2011 and cover letter to Mr. Rusty Lundberg at Utah Division of Radiation Control, November 29, 2011.
11) EnergySolutions, LLC. 2012. (CD12-008) Radioactive Material License #UT2300249, Class A West - Round 2 Interrogatory Response, dated January 12, 2012.
12) EnergySolutions, LLC. 2012. (CD12-0049) Radioactive Material License #UT2300249, Class A West - Response to Division Request and Round 3 Interrogatory dated February 23, 2012.
13) EnergySolutions, LLC. 2012. (CD12-0065) Radioactive Material License #UT2300249, Revised CAW Well Spacing Analysis, dated March 3, 2012.
14) EnergySolutions, LLC. 2012. (CD12-0075) Radioactive Material License #UT2300249 and Ground Water Quality Discharge Permit No. UGW450005, Amendment and Modification Request - Class A West Embankment: Response to Round 3 Interrogatory URCR R313-25-7(3)-04, with attachments. Letter from Tim Orton, EnergySolutions, to Mr. Rusty Lundberg, Utah Division of Radiation Control, dated March 20, 2012.
15) EnergySolutions, LLC. 2012. (CD12-0093) Radioactive Material License #UT2300249 - Class A West Embankment: Class A West: Round 3 Seismic Stability Response, dated April 4, 2012.
16) Email dated April 6, 2012, from Sean McCandless to John Hultquist and Robert Baird; Final Report for CAW Round 3 Interrogatory Response.
17) EnergySolutions, LLC. 2012. (CD12-0095) Radioactive Material License #UT 2300249 and Ground Water Quality Discharge Permit No. UGW450005. Amendment and Modification Request – Class A West Embankment: Complete, Electronic Submittal.

**UTAH DIVISION OF RADIATION CONTROL**
**RADIOACTIVE MATERIALS LICENSE**
**SUPPLEMENTARY SHEET**

License # UT 2300249
Amendment # ~~13~~14

18) EnergySolutions, LLC. 2012. (CD12-0114) Radioactive Material License #UT2300249 - Class A West Embankment: Liquefaction Addendum, Response to DRC Comments and Suggestions and Complete Electronic Copy.
19) Whetstone Associates, Inc. 2011. EnergySolutions Class A West Disposal Cell Infiltration and Transport Modeling Report, April 19, 2011.
20) Whetstone Associates, Inc. 2011. EnergySolutions Class A West Disposal Cell Infiltration and Transport Modeling Report, November 28, 2011.
21) Whetstone Associates, Inc. 2012. EnergySolutions Class A West Disposal Cell Infiltration and Transport Modeling Report, February 23, 2012.
22) EnergySolutions, LLC. 2012. (CD12-00185) Radioactive Material License #UT2300249 and Ground Water Quality Discharge Permit No. UGW450005 - Class A West Embankment: Clay Distortion Study Plan.

**UTAH DIVISION OF RADIATION CONTROL ~~BOARD~~**

Rusty Lundberg, ~~Executive Secretary~~Director Date

# APPENDIX E
# COPY OF HUNTSMAN – ENERGY*SOLUTIONS* AGREEMENT – MARCH 15, 2007

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# AGREEMENT

This agreement is entered into by and between the Governor of the State of Utah and EnergySolutions, LLC, and any successor or assignee ("EnergySolutions") as follows:

1. EnergySolutions will promptly withdraw the Combined Class A Cell license amendment currently pending before the Utah Board of Radiation Control and its Executive Secretary. EnergySolutions may complete the required licensing process for conversion of the remaining already licensed unused capacity (the "converted already licensed capacity") of the currently-licensed 11e.(2) Cell to a Class A Cell (the "Converted Class A Cell"), and upon successfully meeting all technical and legal requirements, utilize the converted already licensed capacity for the disposal of low-level radioactive waste in the Converted Class A Cell.

2. EnergySolutions and the State of Utah reiterate their commitment that they do not support Class B or C low-level radioactive waste or radioactive waste having a higher radionuclide concentration than the highest radionuclide concentration allowed under licenses existing on February 25, 2005, being disposed in the State of Utah as outlined in Utah Code Annotated Section 19-3-103.7.

3. For so long as EnergySolutions refrains from applying for a license, license amendment, or license renewal for disposal of low-level radioactive waste beyond the currently-licensed low-level radioactive waste cell volumes, which were licensed as of May 1, 2006, and the Converted Class A Cell, the Governor agrees to refrain from making, and shall not permit his designee to make, any request to the Northwest Interstate Compact on Low-Level Radioactive Waste Management (the "Compact") regarding low-level radioactive waste volumes for receipt by EnergySolutions, except as necessary to facilitate the Converted Class A Cell volume, or to initiate or support action to limit the volume of low-level radioactive waste on Section 32, Township 1S, Range 11W, of EnergySolutions' Clive Facility.

4. Nothing in this agreement shall be construed as an admission by EnergySolutions that the Compact has jurisdiction over its operations or facilities or a waiver of EnergySolutions' rights of recovery, if any, for unlawful taking without due process of law, impairment of third-party contracts, violation of vested property rights, or similar claims, based on future actions of the State of Utah or the Compact. Notwithstanding the foregoing, this agreement shall not be used as the basis for any claims against the State of Utah or the Compact.

5. Except for the commitments made by the Governor pursuant to this agreement, nothing in this agreement shall alter or limit the authority or legal rights of the State of Utah, the Compact, the Utah Board of Radiation Control, or the Board's Executive Secretary.

This Agreement will take effect upon the signatures of the parties.

Jon M. Huntsman, Jr.
Governor
State of Utah

March 15, 2007
Date

R. Steve Creamer
Chief Executive Officer
EnergySolutions, LLC

3/15/07
Date

# APPENDIX F

## COPY OF ENGINEERING DRAWING 10014-C08
## "KEYING IN" CELL LINER
## APRIL 28, 2011

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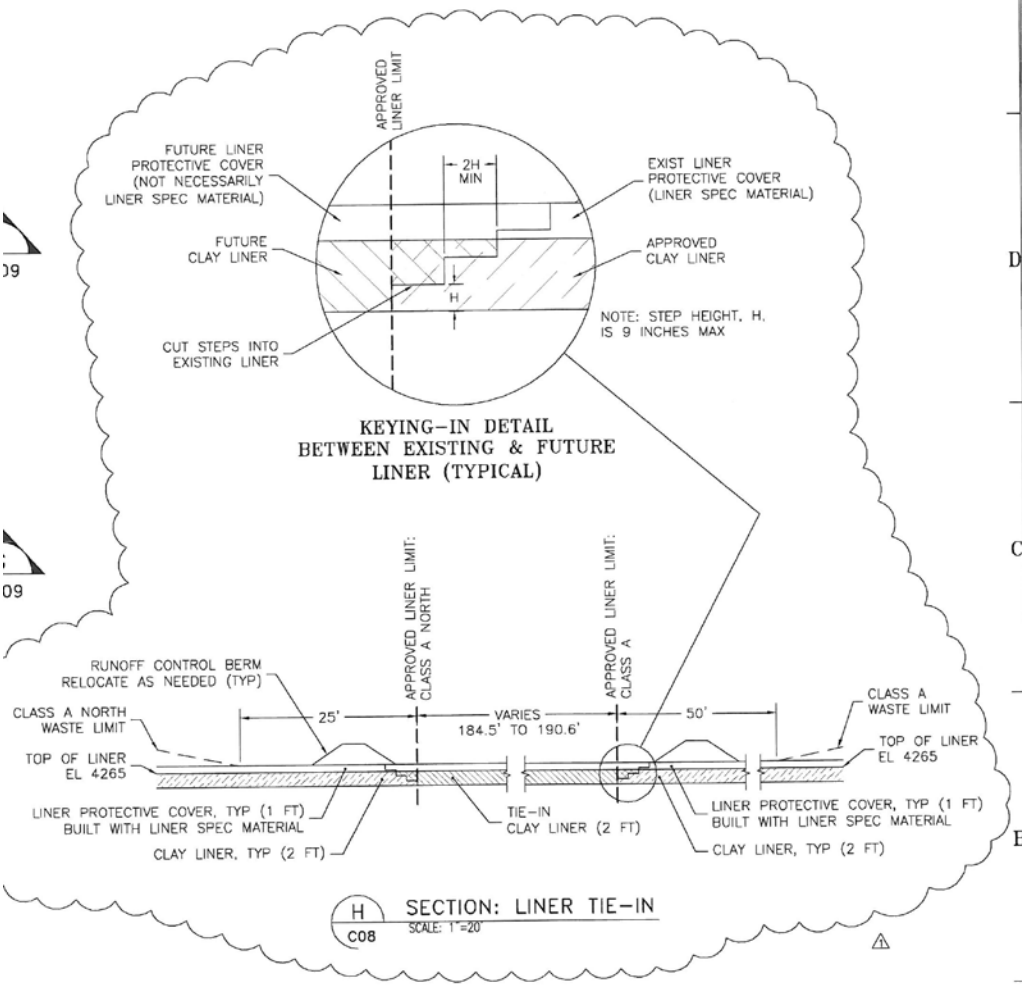


LEGEND:

- CLASS A & CLASS A NORTH EMBANKMENTS
- WASTE LIMITS: CLASS A WEST
- BREAKLINES: CLASS A WEST
- LINER LIMITS: CLASS A WEST
- CWF DISPOSAL AREAS

LICENSED PROFESSIONAL ENGINEER
No. 189500
DAVID F BOOTH
1/5/12
STATE OF UTAH

| NO. | DATE | BY | DESCRIPTION OF CHANGE |
|---|---|---|---|
| 1 | 1/5/12 | DFB | FOR LICENSING/CONSTRUCTION: REVISED WASTE LIMIT (TOE OF WASTE), A |
| 2 | 4/28/11 | DFB | FOR LICENSING/CONSTRUCTION |

ENERGYSOLUTIONS

ENERGYSOLUTIONS "CLIVE" FACILITY
CLASS A WEST EMBANKMENT
CLASS A, CLASS A NORTH & CLASS A WEST MAP
CLIVE, UTAH

FINAL DRAWING

| | |
|---|---|
| DRAFTED BY | D. BOOTH |
| REVIEWED BY | G. DUTSON |
| APPROVED BY | D. BOOTH |
| SCALE | AS NOTED |
| DATE | 04/28/11 |
| REV. | 2 |

10014
C08

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# Appendix G

Radioactive Material License #UT2300249 and Ground Water Quality Discharge Permit No UGW 450005; Request for Variance to Approve Waste Limits for the Class A Cell

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ENERGY*SOLUTIONS*

April 11 2012 DRC-2012-001315 CD12 0085

RECEIVED
APR 12 2012
DEPARTMENT OF
ENVIRONMENTAL QUALITY

Mr Rusty Lundberg
Director
Utah Division of Radiation Control
P O Box 144810
Salt Lake City UT 84114 4810

Re Radioactive Material License #UT2300249 and Ground Water Quality Discharge Permit No UGW 450005 Request for Variance to Approved Waste Limits for the Class A Cell

Dear Mr Lundberg

Energy*Solutions* submitted a request for license amendment and discharge permit modification for the Class A West cell design on May 5, 2011 It is our understanding that technical review of the request is nearly complete with outstanding interrogatories relating to seismic and liquefaction issues awaiting response from Energy*Solutions* Our consultant on these issues reports that the response is expected within the week This response will then require DRC technical review It is hoped that final approval following a public comment period can be achieved sometime this summer

However ongoing waste disposal operations will require additional capacity prior to that time Although the Class A North cell design is fully approved and provides more than adequate capacity for ongoing disposal operations as well as site closure volumes the site is near the open cell limit of 3 65 million square feet provided at License condition 11 One option given this situation is to amend the license to increase this limit and move ongoing disposal operations into the Class A North cell Such an amendment would require supporting surety calculations and funding as well as its own public comment period However given the status of the Class A West design review the need for additional open cell area is likely to be short term and therefore may not be the best use of the Division s licensing resources

As an alternative to increasing the open cell area, Energy*Solutions* requests approval to place a limited volume of waste on top of the Class A cell This waste would be placed above the existing height limits for the Class A cell design (but within the limits proposed for the Class A West cell design) in accordance with all applicable waste placement requirements in the LLRW and 11e (2) CQA/QC Manual In terms of the LLRW surety the material will be considered overbuild volume and funded as such prior to implementation of any approval

Energy*Solutions* requests approval for up to 70 000 cubic yards of material to be placed as overbuild volume in this manner The attached surety calculations show that this volume in addition to the existing overbuild allowance of 33 611 (based on August 2011 as built surveys) requires an additional $380 365 in surety funding This funding will be added to the current approved (2010 annual update) LLRW surety total of $70 030 485 46 prior to any waste placement under the variance

Energy*Solutions* understands that any waste material placed above the current approved Class A cell limits will be done at our own risk If for any reason the Class A West design must be revised such that waste placed under the requested variance must be relocated that activity will be completed entirely at our expense

Please contact me at 801 649 2151 with any questions regarding this issue

Sincerely

Sean McCandless
Director of Compliance and Permitting

encl

cc John Hultquist DRC (w/ encl )

| | A | B | | | E | | G | | | | K | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | k | Item | | | | | Units | Quantity | 2011 Unit Cost | 2010 Unit Cost | Total Cost | Means Reference # | Notes |
| 45 | 203 | HEALTH PHYSICS STAFF AND RAD SURVEY EQUIPMENT | | | | | | | | | | | |
| 45 | | Note Assume HP support is needed for 24 months to account for pre closure preparation | | | | | | | | | | | |
| | | and post closure shutdown | | | | | | | | | | | |
| | | This includes three to four months for survey set up and other miscellaneous HP functions | | | | | | | | | | | |
| 45 | | HEALTH PHYSICS AND SURVEY EQUIPMENT | | | | | | | | | | | |
| | | | PPE & miscellaneous supplies | | | | Each | 1 00 | $ 12 940 65 | $12 686 91 | $12 941 | | |
| | | | In situ gamma spectrometer | | | | Each | 2 00 | $ 68 370 00 | $68 370 00 | $136 740 | | Revised per Third Party Quote 2008 |
| 45 | | | Badging | | | | LS | 1 00 | $ 19 410 95 | $19 030 34 | $19 411 | | |
| 45 | | | Analytical costs | | | | LS | 1 00 | $ 127 247 64 | $124 752 58 | $127 248 | | |
| | | HEALTH PHYSICS PERSONNEL | | | | | | | | | | | |
| 46 | | | Senior Health Physicist | | | | Days | 520 00 | $ 648 72 | $ 636 00 | $337 335 | | Revised per Third Party Quote of $79 50/hr |
| 2 | | | Senior HP Technician | | | | Days | 520 00 | $ 403 92 | $ 396 00 | $210 039 | | Revised per Third Party Quote of $49 50/hr |
| 46 | | | HP Technician (2) | | | | Days | 1 040 00 | $ 336 60 | $ 330 00 | $350 064 | | Revised per Third Party Quote of $41 25/hr |
| | | | CLOSURE REPORT | | | | Each | 1 00 | $ 23 857 80 | $ 23 390 00 | $23 858 | | 520 hours of mid level engineer reporting at $44 98/hr Revised Estimate per Hourly Mean Wage from latest BLS Occupational Employment and Wages May 2007 |
| 46 | | | | | | | | | | | | | |
| 46 | | HEALTH PHYSICS PERSONNEL FOR DECONTAMINATION OF EQUIPMENT IN GENERAL CLEAN UP SECTION | | | | | | | | | | | |
| 46 | | | | | | | Hours | 3500 00 | $ 42 08 | 41 25 | $147 280 | | Revised per Third Party Quote of $41 25/hr |
| 46 | | | | | | | | | | | | | |
| 46 | | | | | | | | | Total | | $1,364,916 | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | 204 | DISPOSAL VOLUMES AND LINER CONSTRUCTION | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | Summary of Volumes from Previous Sections in Cubic Yards (CY) | | | | | | | | | | | |
| | | Debris to be disposed with CLSM | | | | | | 31 052 06 | | | | | |
| | | Debris | | | | | | 115 476 97 | | | | | |
| | | Fill required for Debris | | | | | | 0 00 | | | | | Soil volume is greater than debris volume therefore assuming 1 1 placement with Compactor no additional fill is required |
| | | Contaminated Soil Ballast and Stored Waste | | | | | | 214 839 16 | | | | | |
| | | Total Material Disposed of | | | | | | 361 368 19 | | | | | |
| | | | | | | | | | | | | | |
| | | Overbuild removal and placement | | | | | | | | | | | |
| | | | Excavation | | | | CY | 73 611 00 | $ 1 80 | | $132 500 | 31 23 16 42 0260 | Excavate down to native soils add 15 / for loading costs |
| | | | Haul | | | | CY | 73 611 00 | $ 2 33 | | $171,514 | 31 23 23 20 1014 | Haul material using a 12 CY dump truck @ 0 5 miles RT |
| | | | Placement | | | | CY | 73,611 00 | $ 1 55 | | $114,098 | 31 23 23 17 0020 | Place soil in cell w/dozer |

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| | k | Item | E | Units | Quantity | 2011 Unit Cost | 2010 Unit Cost | K Total Cost | Means Reference # | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 5 | | | Compaction of material in cell | CY | 73 611 00 | $ 0 67 | | $49 320 | 31 23 23 23 5600 | excav/backfill/compact compaction sheepsfoot 6 lift 2 passes |
| | | LINER | | | | | | | | |
| | | Note Need to construct the following to meet design criteria | | | | | | | | |
| | | | Liner | SF | 71 596 00 | | | | | |
| | | | Remove Overburden | CY | 1 745 82 | $ 1 42 | | $2 480 | 31 23 16 42 0260 | Assume remove top 1 of 10 Unit 4 layer (11 / of cover volume is overburden) |
| | | | Excavation of clay | CY | 7 935 56 | $ 2 49 | | $19 760 | 31 23 16 42 0260 | add 75 / to excavation cost to account for heavy soil and loading into trucks |
| | | | Haul volumes | CY | 7,935 56 | $ 2 33 | | $18 490 | 31 23 23 20 1014 | Haul material using a 12 CY dump truck @ 0 5 miles RT |
| | | | Place material in cell | CY | 7 935 56 | $ 1 55 | | $12 301 | 31 23 23 17 0020 | Place soil in cell w/dozer |
| | | | Compaction of material in cell | CY | 7 935 56 | $ 0 67 | | $5 317 | 31 23 23 23 5600 | excav/backfill/compact compaction sheepsfoot 6 lift 2 passes |
| | | | | | | **Total** | | **$525 780** | | |
| | **205** | **SETTLEMENT MONITORING** | | | | | | | | |
| | | Temporary Cover | | | | | | | | |
| | | Temporary Cover (one foot of native soil) | | | | | | | | |
| 0 | | | | | | | | | | |
| | | | Remove Overburden | CY | 14 759 21 | $ 1 42 | | $20 959 | 31 23 16 42 0260 | Assume remove top 1 of 10 Unit 4 layer (11 / of cover volume is overburden) |
| | | | Excavation of clay | CY | 134 174 67 | $ 2 49 | | $334 095 | 31 23 16 42 0260 | add 75 / to excavation cost to account for heavy soil and loading into trucks |
| | | | Haul volumes | CY | 134 174 67 | $ 2 33 | | $312 627 | 31 23 23 20 1014 | Haul material using a 12 CY dump truck @ 0 5 mile RT |
| | | | Placement of material | CY | 134 174 67 | $ 1 55 | | $207 971 | 31 23 23 17 0020 | Place soil in cell w/dozer |
| | | | Compaction of material | CY | 134 174 67 | $ 0 67 | | $89 898 | 31 23 23 23 5600 | excav/backfill/compact compaction sheepsfoot 6 lift 2 passes |
| | | Surveys | | Each | | | | | | |
| | | | Monuments | Each | 384 00 | $ 45 32 | $44 43 | $17 403 | | Based on current purchase costs and increased annually for inflation |
| | | | Labor | Hours | 320 00 | $ 89 74 | $87 98 | $28 717 | | Based on hourly surveyor cost of $80 per hour |
| | | | Bi annual Engineering Review | | 2 00 | $ 2 691 63 | $2 638 85 | $5 384 | | Based on 24 hours of engineer time at $100 per hour for each review |
| | | | | | | **Total** | | **$1 017 054** | | |
| | **206** | **SURCHARGING** | | | | | | | | |

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| | | | C | D | | F | | | | J | | | N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | k | Item | | | | | Units | Quantity | 2011 Unit Cost | 2010 Unit Cost | Total Cost | Means Reference # | Notes |
| | | | | 58 | $ 103 258 | $ 57 981 | 83 | 103 258 05 | $ 45 212 | | | | |
| | | | | 59 | $ 103 258 | $ 57 407 | 84 | 103 258 05 | $ 44 764 | | | | |
| | | | | 60 | $ 103 258 | $ 56 838 | 85 | 103,258 05 | $ 44 321 | | | | |
| | | | | 61 | $ 103 258 | $ 56 276 | 86 | 103 258 05 | $ 43 882 | | | | |
| | | | | 62 | $ 103 258 | $ 55 718 | 87 | 103 258 05 | $ 43 447 | | | | |
| 04 | | | | 63 | $ 103 258 | $ 55 167 | 88 | 103 258 05 | $ 43 017 | | | | |
| | | | | 64 | $ 103 258 | $ 54 621 | 89 | 103 258 05 | $ 42 591 | | | | |
| | | | | 65 | $ 103 258 | $ 54 080 | 90 | 103 258 05 | $ 42 170 | | | | |
| | | | | 66 | $ 103 258 | $ 53 544 | 91 | 103 258 05 | $ 41 752 | | | | |
| | | | | 67 | $ 103 258 | $ 53 014 | 92 | 103 258 05 | $ 41 339 | | | | |
| | | | | 68 | $ 103 258 | $ 52 489 | 93 | 103 258 05 | $ 40 929 | | | | |
| | | | | 69 | $ 103 258 | $ 51 970 | 94 | 103 258 05 | $ 40 524 | | | | |
| | | | | 70 | $ 103 258 | $ 51 455 | 95 | 103 258 05 | $ 40 123 | | | | |
| | | | | 71 | $ 103 258 | $ 50 946 | 96 | 103 258 05 | $ 39 726 | | | | |
| | | | | 72 | $ 103 258 | $ 50 441 | 97 | 103,258 05 | $ 39 332 | | | | |
| 04 | | | | 73 | $ 103 258 | $ 49 942 | 98 | 103 258 05 | $ 38 943 | | | | |
| | | | | 74 | $ 103 258 | $ 49 447 | 99 | 103 258 05 | $ 38 557 | | | | |
| | | | | 75 | $ 103 258 | $ 48 958 | 100 | 103 258 05 | $ 38 176 | | | | |
| | | | | | | | | Second 50 Years | $ 2 460 924 | | | | |
| | 502 | SUBTOTAL SUMMARY | | | | | | | | | | | |
| | | | Closure Costs | | | | | | $ 55 020 234 37 | | | | |
| | | | Post Closure Costs (Year 1 50) | | | | | | $ 4 339 061 63 | | | | |
| | | | Post Closure Costs (Year 51 100) | | | | | | $ 2 460 924 45 | | | | |
| | 503 | TOTAL SUMMARY | | | | | | | | | | | |
| | | TEMPORARY STORAGE TANKS | | | | | | | | | | | |
| | | | Decontamination and release only | | | | 0 00 | 3 096 00 | $ | | | | |
| | | PROPOSED AMOUNT FOR CLOSURE IS | | | | | | | $ 61,820,220 45 | | | | |
| | | | | | | | | Current Value | $ 55 980 707 63 | | | | |
| | | | | | | | | Increase over Current | $ 5 839 512 82 | | | | |
| | | | | | | Perpetual Care Fund Balance as of 11/23/2011 | | | $ 4 409 369 99 | | | | |
| | | | | | | | | Perpetual Care Requirement | $ 13 000 000 00 | | | | |
| | | | | | | | | Perpetual Care LOC Value | $ 8 590 630 01 | | | | |
| | | | | | | | | Combined Total | $ 70 410 850 46 | | | | |
| | | | | | | Current Combined Total | | | $ 65 393 882 18 | | | | |
| | | | | | | LOC Change | | | $ 5 016 968 28 | | | | |

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# Professional Certification

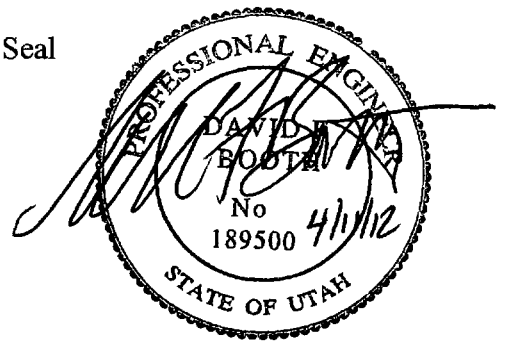
## CERTIFYING ENGINEER CERTIFICATION

I David F Booth P E (Utah No 189500 2202) do hereby certify that I have reviewed this revised annual surety submittal which was prepared in accordance with the approved drawings and specifications

David F Booth P E

4/11/12
Date

Seal



# Attachment #4

State of Utah
GARY R HERBERT
*Governor*

SPENCER J COX
*Lieutenant Governor*

Department of
Environmental Quality

Amanda Smith
*Executive Director*

DIVISION OF RADIATION CONTROL
Rusty Lundberg
*Director*

DRC-2014-007787

# MEMORANDUM

TO: Dan Shrum, Senior Vice President, Regulatory Affairs
EnergySolutions, LLC

FROM: Rusty Lundberg (RL)
Director

DATE: September 10, 2014

SUBJECT: Division of Radiation Control Position Statement Regarding the "Huntsman Agreement"

I have been asked to provide a statement on how the Division of Radiation Control interprets the 2007 "Huntsman Agreement" (Agreement) on two key issues. To clarify, the Division's position remains consistent with how it has interpreted the Agreement in the past as well as consistent with how the State of Utah in general treats agreements entered into by sitting Governors. Therefore, the following points reaffirm our position:

1.) Energy*Solutions'* disposal volume is limited by the Huntsman Agreement to the volume that remains to date in the "Converted Class A Cell." Paragraph 1 of the Agreement allows Energy*Solutions* to "convert" the already licensed unused capacity of the 11e.(2) Cell to a Class A Cell. Energy*Solutions* applied the majority of this converted volume to create the Class A West cell and to expand the Mixed Waste cell. In essence, Paragraph 1 clearly articulates that the allowable capacity remaining for use by Energy*Solutions* for the disposal of Class A waste is the unused volume resulting from the Class A West combined cell and Mixed Waste cell expansion. This point is reiterated in Paragraph 3 where it states that the Governor shall refrain from requesting action from the Compact (Northwest Interstate Compact) regarding disposal volume "so long as Energy*Solutions* refrains from applying for a license, license amendment, or license renewal for disposal of LLRW beyond the currently-licensed . . . cell volumes, which were licensed as of May 1, 2006, and the 'Converted Class A Cell'."

2.) The Huntsman Agreement continues to bind both the State of Utah and Energy*Solutions*. The first paragraph makes this clear. Additionally, Governor's Agreements, Executive Orders, etc. bind future Governor's until such time as they are officially revoked or rendered void by another agreement or document.

# Attachment #5

# Appendix G – INTERPRETING THE HUNTSMAN AGREEMENT

## OFFICE OF THE ATTORNEY GENERAL, STATE OF UTAH MEMORANDUM

**TO:** Helge Gabert, Project Manager
EnergySolutions Depleted Uranium Performance Assessment

**FROM:** Laura Lockhart, Assistant Attorney General
Utah Attorney General's Office

**DATE:** April 6, 2015

**RE:** Interpreting the Huntsman Agreement

This memo is in response to your request for an explanation of how the Huntsman Agreement (attached) would be enforced and what limitations it imposes on the State of Utah. I should note that this memo includes my legal advice to you, but is not a formal Attorney General's Office opinion and does not reflect any determination made by the Attorney General.

### A. Background: History of the Huntsman Agreement

The Huntsman Agreement ("Agreement"), reflected a policy determination by the administration of Governor Jon Huntsman that there should be an upper limit to the amount of waste that Energy*Solutions* would be allowed to dispose of. This policy determination came at a time when one Energy*Solutions* proposal for expansion beyond its borders had just been defeated,[1] and another proposal had been submitted for approval to increase disposal capacity by combining two existing cells into the Combined Class A Cell referred to in paragraph 1 of the Agreement.

As described in paragraph 3 of the Agreement, the Huntsman Administration had been considering turning to the Northwest Interstate Compact on Low-Level Radioactive Waste ("Compact") to enforce its waste limitations. This would likely have resulted in a dispute because, as can be inferred from later litigation described below, Energy*Solutions* believed that the Compact's authority did not extend to waste disposal at Energy*Solutions*. Energy*Solutions* and the Huntsman Administration entered into negotiations to see if they could agree on a waste cap that would allow both sides to avoid litigation.

The negotiations resulted in the March 15, 2007 Huntsman Agreement, under which the parties agreed that Energy*Solutions* could convert all of the remaining capacity in a disposal cell

[1] Energy*Solutions*' proposal to expand its boundaries was stopped by the Utah Legislature with the passage of SB 155 during the 2007 General Session. That bill required approval of the Legislature and the Governor before the boundaries of an existing facility could be expanded. Energy*Solutions* has not sought approval for a boundary expansion.

for 1 le.(2) byproduct waste - a waste that is generally of very low radioactivity, but that does not fit the definition of low-level radioactive waste - to a higher level Class A waste disposal facility. In exchange, Energy*Solutions* agreed to limit total disposal to the combined currently-approved Class A and 11e.(2) converted amounts, and also agreed not to seek authority to dispose of Class B or Class C waste.

The parties were unable to avoid litigation about the Compact's authority for very long, however. In 2008, the Huntsman Administration objected to Energy*Solutions*' plan to dispose of imported Italian radioactive waste. The Huntsman Administration was in the process of bringing that issue to the Compact to request that it prohibit foreign waste disposal when Energy*Solutions* brought a lawsuit against the Compact seeking a declaratory judgment that the Compact had no authority over the Energy*Solutions* disposal site. The State of Utah intervened in the lawsuit. After a loss at the federal District Court level, the Compact and the State of Utah won in the 10th Circuit Court of Appeals. It is now clear that the Compact does have authority to control waste disposal at Energy*Solutions*. See *EnergySolutions v. State of Utah*, 625 F.3d 1261 (10th Cir. 2010).

**B. <u>Background: History of Approved Waste Disposal Volume at Energy*Solutions*</u>**

There were three cells authorized for disposal of low-level radioactive waste at the time of the Huntsman Agreement: the Class A, Class A North and Mixed Waste Cells.[2] As described above, the Huntsman Agreement also authorized conversion of a cell that had been authorized for disposal of 11e.(2) waste to Class A waste disposal.

In 2006, Energy*Solutions* proposed to consolidate the Class A and Class A North cells into a single Class A West cell. At about the same time, it also proposed to expand the Mixed Waste Cell. Both of those changes were approved in one license amendment in 2012. In order to remain consistent with the terms of the Huntsman Agreement, the Division of Radiation Control agreed to move some of the unused capacity allowed under the agreement from the 11e.(2) cell into both the new Class A West cell and the Mixed Waste Cell.

[2] All of the information in Part B may be found in the appropriate license and permit amendment files located in the Divisions of Radiation Control and Solid and Hazardous Waste for these licenses and permit: Radioactive Material License UT 2300249 (DRC); Byproduct Material License, UT 2300478 (DRC); and Part B RCRA Mixed Waste Permit (DSHW).

## C. Enforceability and Scope of the Huntsman Agreement

### 1. Is the Huntsman Agreement enforceable?

The remedy for a violation of the terms of the Huntsman Agreement by Energy*Solutions* is spelled out in paragraph 3 of the Agreement itself: the State can go to the Compact and seek enforceable limitations. It should be noted that this is a more certain remedy now than it was at the time the Agreement was executed since the Compact has since been judicially determined to have authority over the Energy*Solutions* facility. Approval by the Compact would still be required, however.

### 2. Did the Huntsman Agreement bind future administrations to the waste volume limits in the Agreement?

No it did not. The only commitment made by Governor Huntsman in the Agreement, in paragraph 3, is that the Governor would refrain from seeking authority from the Compact to impose new disposal volume restrictions on Energy*Solutions* if the facility met the Agreement's restrictions. The Agreement did not affirmatively require the State of Utah to request a limitation from the Compact if Energy*Solutions* failed to meet the Agreement restrictions.[3] This conclusion is even more clear in light of this provision in the Agreement:

> Except for the commitments made by the Governor pursuant to this agreement, nothing in this agreement shall alter or limit the authority or legal rights of the State of Utah, the Compact, the Utah Board of Radiation Control, or the Board's Executive Secretary.

Huntsman Agreement, ¶ 5. Future administrations are therefore free to agree to different volume limitations or to end any limitations.

There are also no requirements from other sources that would prevent a different administration from effecting a different policy. There is no disposal volume limitation in the Compact policies or regulations[4], and, other than the geographic boundary limitation found in Utah Code Ann. § 19-3-105(3) and (8), there is no disposal volume limitation in state law.

[3] Because the Huntsman Agreement does not seek to tie the hands of later administrations, I have not evaluated an administration's authority to do so.

[4] See Compact policies at http://www.ecy.wa.gov/nwic/policy.htm.

**Attachment to Lockhart April 6, 2015 Memo "Interpreting the Huntsman Agreement"**

**AGREEMENT**

This agreement is entered into by and between the Governor of the State of Utah and EnergySolutions, LLC, and any successor or assignee ("EnergySolutions") as follows:

1. EnergySolutions will promptly withdraw the Combined Class A Cell license amendment currently pending before the Utah Board of Radiation Control and its Executive Secretary. EnergySolutions may complete the required licensing process for conversion of the remaining already licensed unused capacity (the "converted already licensed capacity") of the currently-licensed 11e.(2) Cell to a Class A Cell (the "Converted Class A Cell"), and upon successfully meeting all technical and legal requirements, utilize the converted already licensed capacity for the disposal of low-level radioactive waste in the Converted Class A Cell.

2. EnergySolutions and the State of Utah reiterate their commitment that they do not support Class B or C low-level radioactive waste or radioactive waste having a higher radionuclide concentration than the highest radionuclide concentration allowed under licenses existing on February 25, 2005, being disposed in the State of Utah as outlined in Utah Code Annotated Section 19-3-103.7.

3. For so long as EnergySolutions refrains from applying for a license, license amendment, or license renewal for disposal of low-level radioactive waste beyond the currently-licensed low-level radioactive waste cell volumes, which were licensed as of May 1, 2006, and the Converted Class A Cell, the Governor agrees to refrain from making, and shall not permit his designee to make, any request to the Northwest Interstate Compact on Low-Level Radioactive Waste Management (the "Compact") regarding low-level radioactive waste volumes for receipt by EnergySolutions, except as necessary to facilitate the Converted Class A Cell volume, or to initiate or support action to limit the volume of low-level radioactive waste on Section 32, Township 1S, Range 11W, of EnergySolutions' Clive Facility.

4. Nothing in this agreement shall be construed as an admission by EnergySolutions that the Compact has jurisdiction over its operations or facilities or a waiver of EnergySolutions' rights of recovery, if any, for unlawful taking without due process of law, impairment of third-party contracts, violation of vested property rights, or similar claims, based on future actions of the State of Utah or the Compact. Notwithstanding the foregoing, this agreement shall not be used as the basis for any claims against the State of Utah or the Compact.

5. Except for the commitments made by the Governor pursuant to this agreement, nothing in this agreement shall alter or limit the authority or legal rights of the State of Utah, the Compact, the Utah Board of Radiation Control, or the Board's Executive Secretary.

This Agreement will take effect upon the signatures of the parties.

Jon M. Huntsman, Jr.
Governor
State of Utah

March 15, 2007
Date

By Steve Creamer
Chief Executive Officer
EnergySolutions, LLC

3/15/07
Date