ENERGY*SOLUTIONS*

May 2, 2011 CD11-0123

Mr. Rusty Lundberg
Executive Secretary
Utah Division of Radiation Control
Utah Division of Water Quality
195 North 1950 West
P.O. Box 144850
Salt Lake City, UT 84114-4850

Re: Radioactive Material License #UT 2300249 and Ground Water Quality Discharge Permit No. UGW450005. Amendment and Modification Request – Class A West Embankment; Retraction of the Class A South/11e.(2) Embankment Design Change Request

Dear Mr. Finerfrock:

Energy*Solutions*, LLC (Energy*Solutions*) hereby requests an amendment and modification to Radioactive Material License (RML) #UT 2300249 and Ground Water Quality Discharge Permit No. UGW450005 (GWQDP). The purpose of this amendment and modification is to permit a new Class A West embankment that will encompass the footprints of the existing Class A and Class A North embankments. In order to obtain the correct geometry, the Class A West embankment will need to have a shoulder height of 37.6 feet, compared to current shoulder heights of 32 feet (for the Class A embankment) and 35 feet (for the Class A North embankment).

Attached please find a summary of the technical review matters associated with this request. Included with this summary are location and design drawings, detailed geotechnical analysis of the proposed embankment geometry, groundwater infiltration and transport modeling, an ALARA safety review and updated site drainage calculations. Check number 13273 has been provided to cover the license amendment fee associated with this request.

At this time, Energy*Solutions* also hereby retracts its Class A South/11e.(2) embankment design change request, first submitted for Division review on January 4, 2008.

Table 1 below compares the embankment volumes of the Class A, Class A North, Class A South and Class A West embankments.

Table 1. Embankment Volumes

Embankment	Disposal Volume (cy)
Class A West	8,724,097
Class A North	1,722,509
Class A	3,778,896
Class A South	3,408,704

As illustrated in Table 1, combining the Class A and Class A North embankments into the Class A West embankment adds 3,222,692 cubic yards of waste disposal capacity to Energy*Solutions* Clive facility (the Class A West disposal volume minus the sum of the Class A and Class A North disposal volumes). This represents a 186,012 cubic yard reduction in requested disposal space when compared to the retracted Class A South facility (Class A South disposal volume minus the extra disposal volume provided by Class A West).

If you have any questions regarding this issue, please contact me at 801-649-2000.

Sincerely,

Sean McCandless

Sean McCandless
Director, Compliance and Permitting

enclosures

cc: John Hultquist, DRC (w encl.)

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

ATTACHMENTS

1. Proposed License/Permit Changes
    a. Proposed Redline/Strikeout Changes to Radioactive Material License #UT 2300249
    b. Proposed Redline/Strikeout Changes to Ground Water Quality Discharge Permit No. UGW450005
2. Proposed Embankment Design (Engineering Drawing Series 10014)
3. Whetstone April 19, 2011 Report, "EnergySolutions Class A West Disposal Cell Infiltration and Transport Modeling."
4. Class A West Site Drainage Evaluation and Ditch Flow Calculations.
5. AMEX Earth & Environmental, Inc Report, 2011.
6. Class A West Well Spacing Analysis
7. Clive Radiation Safety Committee ALARA Evaluation

1.0 GENERAL INFORMATION

1.1 INTRODUCTION

EnergySolutions, LLC (EnergySolutions) requests that the Utah Division of Radiation Control (DRC) review and approve a design change to the Class A North and Class A disposal embankments. This design change constitutes an amendment to both Radioactive Material License (RML) # UT 2300249 (EnergySolutions, 2008), the Class A Low Level Radioactive Wwaste license) and Ground Water Quality Discharge Permit No. UGW450005 (EnergySolutions, 2005). Proposed changes to these documents are provided in redline/strikeout format as Attachment 1a and 1b to this Amendment Request.

This amendment would combine the Class A and Class A North disposal cells into one embankment with a moderate increase to the overall height of the proposed embankment. Combining these two embankments into one allows EnergySolutions to more effectively utilize the space on Section 32 for LLRW disposal. Engineering Drawing Series 10014 provided in Attachment 2 illustrates the proposed embankment design. It should be noted that drawings from this series have been used to replace other drawings in the GWQDP (see Attachment 1b). Overall, the Class A North embankment footprint will be extended by approximately 110 feet to the north to make productive use of open ground between the rail facilities and the embankment. The heights at the shoulder and top of the completed embankment are 37.6 feet and 75.3 feet respectively (see Engineering Drawing 10014-C01).

The Class A West embankment is similar in concept to the Class A Combined (CAC) embankment requested in 2005 (EnergySolutions, 2005). Key parameters are summarized in Table 1.1 below. Although the Class A West embankment builds on analyses performed in support of the previous CAC design, all analyses have been updated to the specific Class A West geometry.

Table 1.1: Comparison of Class A West and CAC embankments

	CAW	CAC	CAN	Class A
Disposal Volume (cy)	8,724,097	9,828,087	1,722,509	3,778,896
Embankment Area (ft^2)	5,801,781	5,561,723	1,713,768	3,164,247
Shoulder Height (ft)*	37.6	50	35.7	32
Peak Height (ft)*	75.3	85.2	42.5	53.6
Side Slope Length (ft)**	188	250	178.5	160
Top Slope Length (ft)**	942	880	225.5	540

* Measured from the top of clay liner (EL 4265') to the top of waste.
Class A: Add 6.5' for top of cover height. Subtract ~9' for average height above natural grade.
Class A North: Add 6.5' for top of cover height. Subtract ~10' for average height above natural grade.
Class A West: Add 6.5' for top of cover height. Subtract ~9.5' for average height above natural grade.
** Dimensions are for top of waste.

Upon approval of this amendment request, the Class A and Class A North embankments would be re-designated as the Class A West (CAW) embankment. Engineering and construction practices with respect to waste placement would continue as specified in EnergySolutions' existing Construction Quality Assurance and Quality Control Plan

(CQA/QC Plan) and in accordance with practices currently performed in the Class A and Class A North embankments (EnergySolutions, 2008).

Overall height of the embankment will increase by 26 feet. The increased height allows EnergySolutions to effectively combine both embankments into one while maintaining compliance with top slope and slide slope requirements established in the permit.

As waste placement in the existing Class A embankment nears completion, LLRW waste disposal operations will move north and encompass the unutilized area that currently exists between Class A and Class A North.

In order to evaluate potential groundwater impacts from the Class A West embankment, a study was performed titled, "EnergySolutions Class A West Disposal Cell Infiltration and Transport Modeling," dated April 19, 2011 (Whetstone, 2011). This report, provided in Attachment 3, was prepared by Whetstone Associates consistent with previous groundwater modeling performed for embankments at the Clive facility.

1.1.1 IDENTITY OF APPLICANT

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

EnergySolutions' directors are as follows:

Val J. Christensen
President, Chief Executive Officer
423 West 300 South, Suite 200
Salt Lake City, UT 84101

Board Members/Managers:

Steven R. Rogel
Chairman
423 W 300 S, Suite 200
Salt Lake City, Utah 84101

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

David B. Winder
Director
490 16th Avenue
Salt Lake City, UT 84103

J. Barnie Beasley, Jr.
Director
729 Falling Springs Dr.
P.O. Box 558
Tiger, GA 30576

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

Dr. Pascal Colombani
Director
Senior Advisor
AT Kearney Paris
44 rue de Lisbonne
75008 Paris
France

David J. Lockwood
Director
Partner
ValueAct Capital
435 Pacific Ave., 4th Floor
San Francisco, CA 94133

Claire Spottiswoode, CBE
Director
Chairman
EnergySolutions EU Ltd.
1st Floor, Stella Building
Windmill Hill Bus. Park
Whitehill Way
Swindon
SN5 6NX
UK

1.1.2 QUALIFICATIONS OF APPLICANT

1.1.2.1 TECHNICAL QUALIFICATIONS

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

There will be no change to the waste types received, waste placement procedures, or basic embankment design systems; therefore, Energy*Solutions*' past experience translates directly to the construction of the Class A West embankment.

1.1.2.2 FINANCIAL QUALIFICATIONS

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

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

As detailed in Section 10 below, EnergySolutions will fund existing surety instruments in an amount adequate to close the Class A West embankment in compliance with the approved design specifications; therefore, existing information regarding financial qualifications is adequate for the Class A West embankment.

1.1.3 ORGANIZATIONAL STRUCTURE

Detailed requirements and qualifications for significant organizational positions are described in EnergySolutions' Class A LLRW license, Condition 32, Appendix I (currently approved revision is Rev. 22, August 2, 2010).

There will be no changes to the organization for purposes of constructing the Class A West embankment.

1.2 GENERAL FACILITY DESCRIPTION

Operations are conducted in Section 32, Township 1 South, Range 11 West, SLBM, Tooele County, Utah. This location is known as Clive, Utah (also referred to as South Clive). EnergySolutions' Clive disposal facility will be referred to herein as the facility. Engineering Drawing 0801-G03, *Site Layout and Facility Legend,* has been provided for reference in Attachment 2. The Class A West embankment will be located completely within Section 32. Engineering Drawing 10014-U01 illustrates the location of the Class A West embankment in relation to other site facilities.

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

Aside from the combination of the Class A and Class A North embankments into the Class A West embankment, there will be no change to existing facilities as part of this amendment request.

1.2.1 LAND USE

Most of the land within a 10-mile radius of the site is public domain administered by the Bureau of Land Management. Information with respect to and use near the site is located in Section 1.2.2 of the 2005 Class A LLRW RML License Renewal Application (June 20, 2005; hereafter referred to as the 2005 LRA). Figure 1a (Section 1.2) of the 2005 LRA delineates the property owned by EnergySolutions.

Land use in the immediate vicinity of the site will not be affected by the Class A West embankment, since the embankment is located entirely within the licensed area of Section 32.

1.2.2 PRINCIPLE FEATURES

1.2.2.1 RESTRICTED AREAS

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

The fence is conspicuously posted with "Caution -- Radioactive Materials" signs bearing the standard radiation symbol. Other signs are posted as appropriate. In accordance with the existing Clive Radiation Protection Program document, Revision 3, June 25, 2007, the restricted area boundary may change as waste placement proceeds in the Class A West embankment. There will not, however, be any changes to the requirements for control of the restricted areas as a result of the Class A West embankment, nor will there be any added waste handling facilities as a result of the Class A West embankment.

1.2.2.2 SITE BOUNDARY AND BUFFER ZONE

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

A buffer zone of at least 300 feet is maintained between the closest edge of any embankment (i.e., toe of waste) and the outside site boundary or property line. A buffer zone of at least 92.67 feet is maintained between the closest edge of any embankment and the Vitro property line. Although previous submittals reported the buffer zone to the Vitro property line as being a minimum of 100 feet, it was discovered in preparation of the design drawings for the Class A West embankment that the approved eastern waste limit for the Class A embankment ranges from 95 feet 4 inches in the northeast corner to 92 feet 8 inches in the southeast corner. Waste has already been placed along the entire eastern waste limit for the Class A embankment. Control points have been added for the eastern waste limit of the Class A West embankment to restore the buffer zone to 100 feet for future waste placement.

This discrepancy in the buffer zone for the eastern waste limit of the Class A embankment does not compromise the facility's ability to comply with the well network early warning requirement at Part I.F.1(f) of the GWQDP. Part I.F.1(f) requires that the monitoring well network be adequately spaced to provide early warning of a contaminant release from a waste embankment before the contaminant leaves the buffer zone. Exact distances for groundwater wells on the east side of the Class A embankment are provided in Table 1.2 below.

Table 1.2: Groundwater well and buffer zone distances

Well Number	Distance from waste limit	Distance from property line
GW-88	85.0	12
GW-89	84.0	11
GW-90	85.0	9
GW-91	85.5	8

Note: Distances to the nearest 0.5 foot. GW-88 distance is from Class A West waste limit; which is closer than its distance to the Class A waste limit.

Since the minimum distance between these wells and the property line is 8.0 feet, and groundwater travels no more than 2.7 feet per year (section 6.2.4 of Whetstone, 2011) there remains adequate time to detect a contaminant release before the contaminant leaves the buffer zone.

With the exception discussed above, Class A West embankment buffer zones are consistent with buffer zone dimensions approved for the current LARW, Class A, Class A North, Mixed Waste, and 11e.(2) embankments.

1.2.2.3 GROUNDWATER USERS

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

1.2.2.4 UTILITY SUPPLIES AND SYSTEMS

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

1.2.2.5 CLASS A WEST EMBANKMENT

The proposed embankment design is shown in detail in engineering drawing series 10014. The construction materials are comprised of native clays mined on Sections 5 and 29, located directly south and north of Section 32; and native rock from a local quarry.

1.2.2.6 COVERS

Cover design for the Class A West embankment is detailed on Drawing 10014-C03.

The cover for the Class A West embankment will have identical components, specifications, and construction procedures to the currently approved Class A and Class A North embankment cover.

1.2.2.7 SURFACE WATER CONTROL FEATURES

During construction, the Class A West embankment will be surrounded by run-on and run-off berms. Run-on berms are designed to prevent stormwater run-on, from ambient precipitation in the vicinity of the facility, into the emplaced waste before final cover is built.

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

1.2.2.8 INTRUDER BARRIERS

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

1.2.2.9 MARKERS

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

1.2.2.10 BOUNDARIES AND MARKERS

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

1.2.2.11 SURVEY CONTROL PROGRAM

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

1.2.2.12 SITE UTILIZATION PLAN

An updated site layout is provided as Figure 1. No existing facilities will be impacted by the Class A West embankment footprint; and no new facilities are proposed to specifically support this embankment. Waste placement will generally progress from the southern boundary of the existing Class A footprint to the north, with large component and Containerized Waste Facility disposal areas developed separately prior to being enveloped by bulk waste placement. This is consistent with current approved practices.

1.2.2.13 SUPPORT FACILITIES

This topic is addressed in the 2005 LRA (Section 1.2.3.13). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment. No new facilities are proposed to specifically support this embankment.

1.2.2.14 ADMINISTRATION BUILDINGS

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

1.2.2.15 STORAGE AND WASTE HANDLING AREAS

This topic is addressed in the 2005 LRA (Section 1.2.3.15). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment. Since the 2005 LRA, additional storage and waste handling areas have been permitted, constructed, and placed into operation; including the Shredder Facility and the Rotary Dump Facility. Design and operation of these facilities will be unaffected by the Class A West embankment.

1.2.2.16 DECONTAMINATION AREAS

This topic is addressed in the 2005 LRA (Section 1.2.3.16). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment. Since the 2005 LRA, additional decontamination and wastewater management facilities have been permitted, constructed, and placed into operation; including the Intermodal Container Wash Building, East Side Drainage and Gray Water System, and Northwest Corner Evaporation Pond. Design and operation of these facilities will be unaffected by the Class A West embankment.

1.2.2.17 PHYSICAL SECURITY

Site security procedures for the Clive facility are provided in the Site Radiological Security Plan (LLRW RML Condition 54, currently approved as revision 3, May 5, 2008). Because the plan requirements are general and do not specify particular embankment designs or waste placement locations, there will be no changes to the Site Radiological Security Plan for construction of the Class A West embankment.

1.2.2.18 EQUIPMENT AND EQUIPMENT STORAGE

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

1.2.2.19 EXCAVATED MATERIALS AREA

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

1.2.3 CURRENT EMBANKMENT CONDITIONS

Drawing 10014-C01 provides an overlay of the proposed Class A West embankment design. From this figure, it is evident that the proposed embankment will completely overlay the existing Class A and Class A North embankments. As evidenced from the drawing, existing collection lysimeters CL-W-3, CL-W4 and CL-N5 would need to be removed from service upon approval of the Class A West embankment amendment request. In accordance with Part IV.C.4 of the GWQDP, prior Executive Secretary approval will be required before abandoning these collection lysimeters. Similarly, in accordance with Part II.M of the GWQDP, an abandonment report will be required within 60 days of completion. Planned collection lysimeter CL-W2 was not constructed, with DRC approval. Locations for an additional 9 collection lysimeters are proposed on drawing 10014-C01, to provide comparable coverage to the approved networks for the Class A and Class A North cells. Table 1.3 below compares acres/lysimeter for the embankments.

Table 1.3: Acres per Collection Lysimeter

Embankment	Acres	# of Lysimeters	Acres/Lysimeter
Class A	73	7	10
Class A North	39	5	8
Class A West	133	14	9.5

1.3 SCHEDULES

EnergySolutions has conducted NORM waste disposal operations at the Clive facility since 1988. LLRW disposal operations began in 1991. Mixed waste disposal operations have been conducted since 1992. Construction activities necessary to combine the Class A and Class A North embankments into the Class A West embankment will begin immediately after approval of the amendment request. Waste placement to the increased shoulder height will begin on the south half of the existing Class A embankment, proceeding north.

1.3.1 CONSTRUCTION

Much of the liner for the Class A West embankment has already been constructed, including all of the existing Class A embankment and much of the Class A North embankment. Liner will need to be constructed in the area between the Class A and Class A North embankments. Cover has not yet been constructed over any waste in the Class A or Class A North embankments. Cover construction is expected to begin no later than 2016 for the area comprising the southeast corner of the current Class A embankment.

1.3.2 OPERATIONS

EnergySolutions estimates that disposal operations in the Class A West embankment may continue for up to 20 years.

1.3.3 CLOSURE

Closure of the Class A West embankment will take place during normal operations. As new areas are constructed, the filled areas will be covered to meet final design specifications before being closed. Closure activities will include a settlement monitoring program prior to cover construction as provided in the LLRW and 11e.(2) CQA/QC Manual, work element "Temporary Cover Placement and Monitoring." The settlement monitoring program includes a requirement that temporary cover be placed and monitored for at least one year prior to final cover construction, with evaluation of differential settlement. If differential settlement exceeds or is projected to exceed the established criteria, surcharging of affected areas will be required. This program will continue unchanged for the Class A West embankment. Upon final closure of all disposal embankments, the site will be decommissioned and the long-term surveillance period will begin.

1.4 INSTITUTIONAL INFORMATION

In accordance with a letter dated November 18, 1987, from the Director of the Bureau of Radiation Control (the agency has since been named the Division of Radiation Control), and in accordance with R447-25-9(2) an exemption was granted, allowing for disposal activities on privately owned land at Clive. A supplemental exemption was granted on March 8, 1991. These exemptions were not specific to a particular disposal embankment or land area. On March 16, 1993, Envirocare and the Utah Department of Environmental Quality entered into an Agreement Establishing Covenants and Restrictions related to LLRW disposal activities on privately owned land. This Agreement specifically applies to all of Section 32, less the defined property of the Vitro embankment. EnergySolutions continues to be bound by this Agreement.

Accordingly, since it will be located entirely within Section 32, the Class A West embankment is addressed by the existing land ownership exemption for LLRW management and disposal.

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

Funds for the closure, remediation and long-term surveillance of the facility are discussed in Section 10 below. Upon State of Utah request to draw upon the irrevocable letter of credit established at Zions First National Bank, funds are maintained in trust for the benefit of the State of Utah with Wells Fargo Bank. Furthermore, the State of Utah has established a Perpetual Care Fund with a target initial minimum balance of $100 million at the conclusion of the post-closure monitoring period (i.e., year 101 after site closure). The Perpetual Care Fund is funded by an annual payment and earnings accrued to the fund cash balance with an irrevocable letter of credit bringing the value to $13 million.

1.5 MATERIALS INCORPORATED BY REFERENCE

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

1.6 CONFORMANCE TO REGULATORY GUIDES

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

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

1.7 SUMMARY OF PRINCIPLE REVIEW MATTERS

EnergySolutions requests that DRC issue a license amendment for the proposed Class A West embankment.

EnergySolutions has reviewed LLRW RML #UT 2300249, and GWQDP No. UGW450005, as well as supporting documents for each. The embankment liner, waste placement, and cover systems for LLRW are identical to the existing Class A and Class A North embankments; therefore, many RML and GWQDP conditions and supporting documents are unaffected by the proposed Class A West embankment.

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

2.0 SITE CHARACTERISTICS

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

2.1 GEOGRAPHY, DEMOGRAPHY, AND FUTURE DEVELOPMENTS

2.1.1 SITE LOCATION AND DESCRIPTION

2.1.1.1 LOCATION OF THE FACILITY

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

The licensed disposal area is a parcel of land consisting of Section 32 of T1S, R11W, in Tooele County, Utah, with the exception of approximately 100 acres used in the Vitro Remedial Action project. The DOE owns the 100 acres used in the Vitro Remedial Action project. The Class A West embankment will be located entirely within Section 32.

2.1.1.2 NEARBY FACILITIES

This topic is addressed in the 2005 LRA (Section 2.1.1.2). Since there are not any new facilities in the area since that submittal, this discussion will be unaffected by the Class A West embankment.

2.1.2 POPULATION DISTRIBUTION

This topic is addressed in the 2005 LRA (Section 2.1.3). This information is unaffected by the Class A West embankment.

2.2 METEOROLOGY AND CLIMATOLOGY

EnergySolutions has operated a weather station at Clive since April 1992. The station monitors wind speed and direction, 2-m and 9-m temperatures, precipitation, pan evaporation and solar radiation. An 18-year summary report from January 1, 1993 through December 31, 2010 was provided to the Utah Water Quality Board on February 15, 2011 (CD11-0035). Since the Class A West embankment will be located entirely within Section 32, this information adequately characterizes the site. See also Section 2.3 of the 2005 LRA.

2.3 GEOLOGY AND SEISMOLOGY

2.3.1 REGIONAL and SITE GEOLOGY

This topic is addressed in the 2005 LRA (Section 2.4.1). This discussion is unaffected by the Class A West embankment.

2.3.2 SEISMOLOGY

This topic is addressed in the 2005 LRA (Section 2.4.2); and has been independently reviewed and updated by AMEC Earth & Environmental in the course of licensing the

CAC embankment in 2005-2006. References for the AMEC update report and interrogatory responses are provided below. Since this information applies to Section 32 as a whole, this discussion will be unaffected by the Class A West embankment.

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

The 2005 LRA summarizes work dating back to 1985, during the initial site investigation for the Vitro disposal cell. These investigations developed seismic design values for a Maximum Credible Earthquake of 6.5 with peak acceleration of 0.37g. The previously submitted CAC cell geometry was evaluated against this design value and found to meet acceptable safety factors. The Class A West cell geometry is essentially unchanged from the CAC embankment, except that the height of the Class A West embankment at its peak is lower by about 7 feet.

In reviewing the historical seismic design value work, AMEC found that it was both poorly-documented and conservative by current standards. Therefore, the seismic hazard was updated based on more current knowledge and information. The updated seismic hazard develops a design maximum earthquake of 7.1 with peak acceleration of 0.24g. These higher values were used in analysis of the CAC embankment in 2005-2006 and continue to be used in the analysis of the Class A West embankment.

2.4 HYDROLOGY

2.4.1 SURFACE WATER HYDROLOGY

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

2.4.2 GROUNDWATER CHARACTERIZATION

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

2.5 GEOTECHNICAL CHARACTERISTICS

2.5.1 FIELD INVESTIGATIONS

This topic is addressed in the 2005 LRA (Section 2.8.1). Since no new field investigations have been completed since that time, this discussion will be unaffected by the Class A West embankment.

2.5.2 FIELD AND LABORATORY TESTING AND ENGINEERING PROPERTIES

This topic is addressed in the 2005 LRA (Section 2.8.2). Since no new field investigations have been completed since that time, this discussion will be unaffected by the Class A West embankment.

2.5.3 GROUNDWATER CONDITIONS

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

2.5.4 BORROW MATERIALS

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

EnergySolutions estimated the difference in material quantities for the redesigned embankment compared with material needs for the Class A and Class A North embankments. Table 2.1 summarizes these estimates. The quantity of clay material required for the Class A West embankment is increased by approximately 84,509 cubic yards, since the design of the Class A West embankment encompasses the void space between the Class A and Class A north embankments. The rock materials needed to construct the Class A West cover system will increase by approximately 190,642 cubic yards for the same reason. The total volume of clay borrow and rock borrow materials needed for remaining cover construction for the entire site is estimated at 1,257,845 and 1,549,809 cubic yards respectively, as summarized in Table 2.2.

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

Table 2.1: Additional Borrow Material for Class A West

COVER MATERIALS	CLASS A WEST AREA (ft2)	CLASS A WEST THICKNESS (ft)	CLASS A WEST VOLUME (yd3)	CLASS A AREA (ft2)	CLASS A THICKNESS (ft)	CLASS A VOLUME (yd3)	CLASS A NORTH AREA (ft2)	CLASS A NORTH THICKNESS (ft)	CLASS A NORTH VOLUME (yd3)
Waste Footprint Area	5,801,781			3,164,247			1,713,768		
Waste Cover Area (to ditch centerline)	5,950,435			3,336,590			1,853,267		
Top Slope	4,128,092			2,095,395			795,564		
Temporary Cover (clay)		1	152,892		1.0	77,607		1.0	29,465
Radon Barrier (clay)		2	305,785		2.0	155,214		2.0	58,931
Erosion Materials (rock)		3.5	535,123		3.5	271,625		3.5	103,129
Side Slope	1,822,343			1,241,195			1,057,703		
Temporary Cover (clay)		1	67,494		1.0	45,970		1.0	39,174
Radon Barrier (clay)		2	134,988		2.0	91,940		2.0	78,348
Erosion Materials (rock)		4.5	303,724		3.5	160,896		3.5	137,110
Outer Ditch Slope Area (2 layers)	197,143			154,230			124,399		
Erosion Materials (rock)		1.5	10,952		1.5	8,568		1.5	6,911
TOTAL CLAY MATERIAL (BORROW)			**661,159**			**370,732**			**205,919**
TOTAL SAND & GRAVEL PRODUCTS			849,799			441,089			247,149
BORROW FACTOR			1.18			1.18			1.18
TOTAL SAND & GRAVEL BORROW			**1,002,763**			**520,485**			**291,636**
CAW ADDITIONAL CLAY RESOURCE REQUIRED			**84,509** yd3						
CAW ADDITIONAL SAND & GRAVEL RESOURCE REQUIRED			**190,642** yd3						

Table 2.2: Total Cover Construction Material Requirements

Embankments	Temp Cover	Radon Barrier	Total Clay Borrow	Erosion Materials	Erosion Materials Borrow
Class A West					
Embankment	220,386	440,773	661,159	838,847	989,839
Ditch	NA	NA	NA	10,952	12,924
Mixed Waste					
Embankment	NA	94,814	94,814	165,924	195,790
Ditch	NA	NA	NA	5,472	6,457
11e.(2)					
Embankment	NA	501,872	501,872	279,104	329,343
Ditch	NA	NA	NA	13,098	15,456
TOTALS			**1,257,845**		**1,549,809**

Notes:

1. All volumes are reported in cubic yards.
2. A borrow factor of 1.18 is applied to the erosion materials to account excess raw material needs to produce the various cover products.
3. "Embankment" accounts for materials over the embankment extending to the drainage ditch centerline. "Ditch" accounts for materials over the ditch outer slope.

2.5.5 STRATIGRAPHY AND DESIGN PARAMETERS

This topic is addressed in the 2005 LRA (Section 2.8.5). This discussion will be unaffected by the Class A West embankment.

2.6 GROUNDWATER HYDROLOGY

2.6.1 HYDROGEOLOGY

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

2.6.2 GROUNDWATER MODELING

Groundwater modeling was conducted for the Class A West embankment. The purpose of conducting this modeling was to simulate flow in the unsaturated and saturated zones to aid in understanding infiltration and groundwater flow below and adjacent to the Clive site.

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

The HELP infiltration modeling results indicate that 0.0937 in/yr (0.238 cm/yr) infiltration would occur through the CAW cell top slope, while 0.132 in/yr (0.335 cm/yr) would infiltrate through the side slope with 6-inch thick Type-B filter. In comparison, the July 19, 2000 modeling of the Class A Cell predicted infiltrations of 0.104 in/yr (0.264 cm/yr) through the top slope and 0.078 in/yr (0.198 cm/yr) through the side slope. The differences are due to an increase in precipitation input to the model (revising 7.92 in/yr up to 8.44 in/yr) and increases in embankment slope lengths (modeled as a top slope of 942 ft and side slope of 188 ft, in comparison to top and side slopes of 540 ft and 160 ft for the original Class A Cell). Based on these HELP-generated infiltration rates, the UNSAT-H model predicted that moisture contents would stabilize at 0.057 v/v in the waste and 0.043 v/v in the native soil below the top slope, at 0.0599 and 0.045 v/v in the waste and native soil below the side slope (which are comparable to those originally modeled for the Class A Cell).

The PATHRAE fate and transport modeling for the top slope (0.238 cm/yr infiltration case) indicates that all radionuclides modeled would remain below the GWPLs for at least 500 years at a compliance well located 240 feet from the edge of the top slope waste, provided that the concentrations of two radionuclides, Bk-247 and Cl-36, are received in limited concentrations of 1.92 and 73,900 pCi/g, respectively. All other modeled constituents would meet the groundwater standard if placed in the top slope area at Class A limits. By comparison, the July 2000 Class A Cell model projected that all

radionuclides modeled would remain below the GWPLs for the regulatory 500-year period.

The PATHRAE fate and transport modeling for the side slope with a 6-inch thick Type-B filter (0.335 cm/yr infiltration case) indicates that all radionuclides modeled would remain below the GWPLs for at least 500 years at a compliance well located 90 feet from the edge of the waste, provided that Cl-36 is received in limited concentrations of 10,600,000 pCi/g. All other modeled constituents would meet the groundwater standard if placed under the side slope at Class A limits. By comparison, the July 2000 Class A Cell model projected the need to limit concentrations for Al-36, Bk-247, Ca-41, Cf-249, Cf-250, Cl-36, Re-187, Tb-157, and Tb-158 in order to ensure GWPL compliance within 500 years. The differences are due to the reduced infiltration rate input to the model (revising 0.132 in/yr downward to 0.078 in/yr).

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

2.7 GROUNDWATER QUALITY AND GEOCHEMICAL CHARACTERISTICS

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

2.8 NATURAL RESOURCES

2.8.1 GEOLOGICAL RESOURCES

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

2.8.2 WATER RESOURCES

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

2.9 BIOTIC FEATURES

2.9.1 VEGETATION

Regional vegetation is characterized in the 11-Year Meteorologic Summary Report submitted to the DRC on January 12, 2004 (CD04-0016). This information is applicable to the Class A West embankment. Further discussion of this topic is addressed in the 2005 LRA (Section 2.10.1). Since vegetation was characterized for all of Section 32, this information is applicable to the Class A West embankment.

2.9.2 TERRESTRIAL LIFE

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

2.9.3 AQUATIC BIOTA

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

2.9.4 ENDANGERED AND THREATENED SPECIES

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

2.10 PREOPERATIONAL ENVIRONMENTAL MONITORING

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

3.0 FACILITY DESIGN AND CONSTRUCTION

Coordinates for the Class A West embankment and buffer zone are provided on Drawing 10014-U01.

For waste placement, EnergySolutions will utilize construction specifications that have already been approved and successfully implemented for the Class A embankments. No novel engineering designs or construction methods will be implemented for the Class A West embankment, nor will the waste disposed in the Class A West embankment differ from waste currently being disposed in the Class A and Class A North embankments in regards to radioactivity, physical form, or potential hazard.

EnergySolutions will construct the Class A West embankment in accordance with the waste placement, design and construction procedures and specifications found in the current LLRW and 11e.(2) CQA/QC Manual. Therefore, the engineering analyses performed for existing waste disposal practices at the Class A disposal embankments are also valid for the Class A West embankment. Similar information for other embankment features is provided in Tables 3.2, 3.3, and 3.4 of the 2005 LRA, and updated/redline copies of those tables are provided below. Detailed explanations of waste placement specifications and supporting documentation are located in the 2005 LRA (Section 3).

Table 3.2: Design Criteria of the Principle Design Features

Principal Design Feature	Required Function	Complementary Aspects	Design Criteria	Design Criteria Justification	Conditions	
Liner	Minimize contact of wastes with standing water	Minimize contact of wastes with standing water during operations	Permeability $\leq 1 \times 10^{-4}$ cm/sec	Prevent contact of water with waste. Operational experience shows that 10^{-4} cm/sec permeability promotes runoff and allows accumulation of water to occur. Water is then removed by pumping.	normal	25 yr. 24 hr. event (1.9 inches)
					abnormal	100 yr. 24 hr. event (2.4 inches)
					accident	Heavy equipment damage to liner
		Minimize contact of wastes with standing water after closure	Liner permeability ≥ cover permeability	Inflow into embankment < outflow out of embankment.	normal	Liner and cover retain design permeability over time
					abnormal	Degraded cover
					accident	Not required per NUREG-1199
	Ensure cover integrity	Mitigate differential settlement	Maximum allowable distortion in cover = 0.02	AMEC, October 4, 2000. "Allowable Differential Settlement and Distortion of Liner and Cover Materials." AMEC, May 27, 2005. "Geotechnical Study: Increase in Height and Footprint."	normal	Settlement completed during operations
					abnormal	One area to cover height with adjacent area less than 25 feet high
					accident	Not required per NUREG-1199
Waste Placement and Backfill	Ensure cover integrity	Mitigate differential settlement	Maximum allowable distortion in cover = 0.02	AMEC, October 4, 2000. "Allowable Differential Settlement and Distortion of Liner and Cover Materials." AMEC, May 27, 2005. "Geotechnical Study: Increase in Height and Footprint."	normal	All primary and portion of secondary settlement in soil layers complete during construction and 100-year institutional control period
					abnormal	Creep of compressible waste and additional secondary settlement of soils after 100-year institutional control period.
					accident	Not required per NUREG-1199
	Ensure structural stability	Maintain slope stability	Static safety factor ≥ 1.5 Seismic safety factor ≥ 1.2	State of Utah Statutes and Administrative Rules for Dam Safety, Rule R625-11-6	normal	Static conditions
					abnormal	Earthquake
					accident	Not required per NUREG-1199
Cover	Minimize infiltration	Minimize infiltration	Average Infiltration ≤ 0.0937 inches/year (0.238 cm/year) top slope 0.132 inches/year (0.335 cm/year) side slope	HELP model parameter that achieved performance based standards. Whetstone Associates, Inc., April, 2011. "EnergySolutions Class A West (CAW) Disposal Cell Infiltration and Transport Modeling."	normal	Average annual precipitation (7.92 ")
					abnormal	All abnormal conditions related to the Complementary Aspects of "Encourage Runoff", "Desiccation", "Frost Penetration", and "Biointrusion".
					accident	Not required per NUREG-1199
		Encourage runoff	Maintain positive drainage; Maximum design velocity within drainage layer > calculated drainage velocities; Do not allow water accumulation	Drainage (flow) needs to be maintained under all conditions	normal	100 yr. 24 hr. event (2.4 inches)
					abnormal	PMP (1-hour = 6.1 inches)
					accident	Downstream blockage
		Prevent desiccation	No desiccation cracking in Radon Barrier Clay	Ensure infiltration design criteria is attained	normal	Historic weather patterns
					abnormal	Drought
					accident	NA
					normal	Historic weather patterns

		Limit frost penetration	Thickness of rock/filter/sacrificial soil zones ≥ maximum depth of frost (3 feet)	Ensure infiltration design criteria is attained	abnormal	Monthly average minimum temperatures, 500 year return frequency
					accident	Not required per NUREG-1199
		Limit biointrusion	Biointrusion shall be discouraged and shall not cause increased infiltration	Ensure infiltration design criteria is attained	normal	Desert plant growth (shallow rooted)
					abnormal	Desert plant growth (deep rooted)
					accident	Not required per NUREG-1199
	Reduce Exposures	Surface dose rates	100 mrem TEDE	R313-15-301	normal	Low to moderate gamma emitters
					abnormal	High gamma emitter at top of waste
					accident	NA
Cover	Ensure Cover Integrity	Mitigate Differential Settlement	Maximum Allowable Distortion = 0.02	AMEC, October 4, 2000. "Allowable Differential Settlement and Distortion of Liner and Cover Materials." AMEC, May 27, 2005. "Geotechnical Study: Increase in Height and Footprint."	normal	All primary and portion of secondary settlement in soil layers complete, no container deterioration up to 100 years
					abnormal	Container deterioration after 100 years, allowing creep of compressible waste and additional secondary settlement of soils. Earthquake.
					accident	Not Required per NUREG-1199
	Ensure Cover Integrity	Prevent Internal Erosion	Water velocity < 3 ft/sec on Radon Barrier Clay	NUREG/CR-4620	normal	100 yr. 24 hr. event (2.4 inches)
					abnormal	PMP (1-hour = 6.1 inches)
					accident	Not Required per NUREG-1199
			Prevent Piping: D_{15}(filter)/D_{85}(soil) ≤ 5 AND D_{50}(filter)/D_{50}(soil) ≤ 25 Prevent Upward Migration of Fines D_{15}(Lower Layer)/D_{85}(Upper Layer) ≤ 4	Reduce plugging of lower filter layer. Cedergren, H.R., (1977), "Seepage, Drainage, and Flow Nets" second edition, John Wiley & Sons, New York, pp. 178-182. DOE, 1989. Technical Approach Document, Revision II, UMTRA-DOE/AI 050425.0002, pp. 82-83	normal	Performance calculations are developed for saturated conditions within dams. Conditions at Envirocare are much less severe. DOE ratios have been developed for abnormal saturated conditions within an UMTRA embankment.
					abnormal	
					accident	
		Material Stability / Endure Weathering, External Erosion	1000 year life	NUREG-1623	normal	Historic Weather Patterns
					abnormal	PMP (1-hour = 6.1 inches)
					accident	Not Required per NUREG-1199
	Ensure Structural Stability	Settlement	Long Term Cover Drainage (No Slope Reversal)	Minimize Ponding	normal	Evenly Distributed Weight Loading
					abnormal	Creep of compressible waste and additional secondary settlement of soils after 100-year institutional control period.
					accident	Not Required per NUREG-1199
			Maximum Total Settlement ≤ 15% of Embankment Height LARW – 8.4 feet Class A – 9.2 feet	Highway embankments and major waste storage embankments have settled up to 15% of their height and performed adequately	normal	Evenly Distributed Weight Loading
					abnormal	Creep of compressible waste and additional secondary settlement of soils after 100-year institutional control period.
					accident	Not Required per NUREG-1199
		Maintain Slope Stability	Static Safety Factor ≥ 1.5 Seismic Safety Factor ≥ 1.2	State of Utah Statutes and Administrative Rules for Dam Safety, Rule R625-11-6	normal	Static Conditions
					abnormal	Earthquake
					accident	Not Required per NUREG-1199
Drainage Systems	Provide Site Drainage	Facilitate flow away from the embankment	Depth of water < depth of ditch. Promote free flowing conditions. Freeboard ≥ 0.5 foot under normal conditions.	Minimize potential infiltration into the waste.	normal	25 yr. 24 hr. event (1.9 inches)
					abnormal	100 yr. 24 hr. event (2.4 inches)
					accident	Downstream Blockage
		Minimize Infiltration under flood conditions	Flood water shall dissipate faster than water travels through the cover system.	Ponded flood water would promote infiltration. So long as flood water drains or evaporates faster than the travel time through the cover, increased infiltration will be minimized.	normal	100 year flood (3,802 cfs)
					abnormal	PMF (48,500 cfs)
					accident	Downstream Blockage
	Ensure Ditch Integrity	Prevent Internal Erosion	Velocity < 3 ft/sec on Clay	NUREG/CR-4620	normal	100 yr. 24 hr. event (2.4 inches)
					abnormal	PMP (1-hour = 6.1 inches)
					accident	Not Required per NUREG-1199

Buffer Zone	Provide Site Monitoring	Not applicable	Sized adequate for monitoring and corrective measures	Compliance monitoring	normal	No releases
					abnormal	Contaminant releases
					accident	Not Required per NUREG-1199

Table 3.3: Pertinent Characteristics of the Principle Design Features

Principal Design Feature	Principal Design Element	Pertinent Characteristics	References
Liner	Clay Liner under Embankment	2 feet thick Permeability ≤ 1 x 10^{-6} cm/sec Compacted to 95% of a standard proctor Moisture between optimum and optimum +5% 85% fines (<0.075 mm) 10 < plasticity index < 25 30 < liquid limit < 50	Thickness, permeability: GWQDP Condition I.D.4.(c) Compaction and Moisture in Work Element - Clay Liner Placement; Compaction specification; Fines, plasticity index, and liquid limit in Work Element - Clay Liner Borrow Material, Material specification.
Bulk Waste Placement	Bulk Waste Placement	Compacted waste average lift thickness ≤ 24 inches Compacted with at least 4 machine passes of a CAT 826 compactor, and must meet CAES acceptance criteria. First one foot of material above liner debris-free native soil Last one foot before radon barrier debris-free Compressible debris ≤ 50% of uncompacted lift volume Incompressible debris ≤ 50% of uncompacted lift volume	CQA/QC Manual, Attachment II-A, Work Element – Waste Placement With Compactor
Cover	Clay Radon Barrier	1 foot of 1 x 10^{-6} cm/sec clay 1 foot of 5 x 10^{-8} cm/sec clay 85% fines (<0.075 mm) 10 < plasticity index < 25 30 < liquid limit < 50 Compacted to 95% of a standard proctor Moisture between optimum and optimum + 5% Top Slope: 2-4% Side Slope: 20%	Thickness, permeability, slope: GWQDP Condition I.D.4.a(5) Compaction and Moisture in CQA/QC Manual Attachment II-A, Work Element - Radon Barrier Placement, Compaction specification Fines, plasticity index, and liquid limit in CQA/QC Manual, Attachment II-A, Work Element - Clay Liner Borrow Material, Material specification.
	Lower Filter Zone Type B Filter	6 inches thick on the top and side slopes Permeability ≥ 3.5 cm/sec Type B filter and Sacrificial Soil gradations must meet specified ratios Rock Scoring Test > 50	Thickness, permeability: GWQDP Condition I.D.4.a(4) Gradation criteria on drawing 10014-C04 Rock Scoring Criteria in CQA/QC Manual, Appendix D and Attachment II-A, Work Element - Filter Zone, Quality of Rock specification

Cover	Sacrificial Soil	12 inches thick Residual moisture content ≥ 3.5% Type B filter and Sacrificial Soil gradations must meet specified ratios	GWQDP Condition I.D.4.a(3) Gradation criteria on drawing 10014-C04
	Upper Filter Zone Type A Filter	6 inches thick D100 ≤ 6 inches D70 ≤ 3 inches D50 ≤ 1.57 inch (40 mm) D15 ≤ 0.85 inch (22 mm) D10 ≥ No. 10 Sieve (2.0 mm) D5 ≥ No. 200 Sieve (~ 0.075 mm) Rock Scoring Test > 50	Thickness, gradation: GWQDP Condition I.D.4.a(2) Rock Scoring Criteria in CQA/QC Manual, Appendix D and Attachment II-A, Work Element - Filter Zone, Quality of Rock specification
	Erosion Barrier	18 inches thick Top Cover (Type B riprap): D100 ≤ 4.5 inches D50 ≥ 1.25 inches D10 ≥ 0.75 inch D5 ≥ No. 200 Sieve (~ 0.075 mm) Side Cover (Type A riprap): D100 ≤ 16 inch D90 ≤ 12 inch D50 ≥ 4.5 inch D10 ≥ 2 inch D5 ≥ No. 200 Sieve (~ 0.075 mm) Rock Scoring Test > 50	Thickness, gradation: GWQDP Condition I.D.4.a(1) Rock Scoring Criteria in CQA/QC Manual, Appendix D and Attachment II-A, Work Element - Filter Zone, Quality of Rock specification
Drainage Systems	Drainage Ditches	4 feet deep "Irregular quadrilateral" with a 2% bottom slope and 5:1 (H:V) sides slopes Borrow Material = CL or ML soils Natural Ground or Imported Borrow Material Compacted to 95% of a Standard proctor 6 inches of Type A filter material 12 inches of Type A RipRap material	Drawing 10014-C03 Borrow Material in CQA/QC Manual, Attachment II-A, Work Element - Drainage Ditch Imported Borrow, Material specification

Buffer Zone	Buffer Zone	94 feet from toe of waste to fence <90 feet from toe of waste to compliance well 300 feet from toe of waste to property line 92.7 feet from toe of waste to Vitro property line	Section 1.2.2.2 of this report

Table 3.4: Projected Performance of the Principle Design Features

Principal Design Feature	Required Function	Complementary Aspects	Design Criteria	Projected Performance	Performance Reference	Safety Factor
Liner	Minimize contact of waste with standing water	Minimize contact of wastes with standing water during operations	Permeability $\leq 1 \times 10^{-4}$ cm/sec	Design permeability = 1×10^{-6} cm/sec	CQA/QC Manual	100 (all conditions)
		Minimize contact of wastes with standing water after closure	Liner Permeability ≥ Cover Permeability	Liner design permeability = 1×10^{-6} cm/sec Cover design permeability = 5×10^{-8} cm/sec	CQA/QC Manual	20 (all conditions)
	Ensure Cover Integrity	Mitigate Differential Settlement	Maximum Allowable Distortion in Cover = 0.02	Normal maximum distortion = 0.001 Abnormal maximum distortion = 0.007	AGRA, 2000 AMEC, 2000 AMEC, 2005 AMEC, 2011	Normal = 20 Abnormal = 2.86
Waste Placement and Backfill	Ensure Cover Integrity	Mitigate Differential Settlement	Maximum Allowable Distortion in Cover = 0.02	Maximum differential settlement (distortion) calculated at 0.01 for bulk waste facility under abnormal conditions	AGRA, 2000 AMEC, 2005 AMEC, 2011	Abnormal: 2.0
	Ensure Structural Stability	Maintain Slope Stability	Static Safety Factor ≥ 1.5 Seismic Safety Factor ≥ 1.2	Static Safety Factor ≥ 2.1 Seismic Safety Factor = 1.2	AGRA, 1996 AGRA, 1999 AMEC, 2000 AMEC, 2005 AMEC, 2011	Static ≥ 2.5 (exceeds design criteria of 1.5) Seismic = 1.2 (meets design criteria of 1.2)
Cover	Minimize Infiltration	Minimize Infiltration	Average infiltration ≤ 0.0937 inches/year (0.238 cm/year) top slope 0.132 inches/year (0.335 cm/year) side slope	Infiltration meets performance criteria of transport to monitoring wells for at least 500 years.	Whetstone, 2011	Not applicable
		Encourage Runoff	Maintain positive drainage; Maximum design velocity within drainage layer > drainage velocities; Do not allow water accumulation	Cover design slope = 4%. See also Section 1.3.3.4.1. Maximum theoretical velocities: 3.45×10^{-3} ft/sec (top slope) 2.30×10^{-2} ft/sec (side slope) Maximum drainage velocities during PMP: 8.6×10^{-4} ft/sec (top slope) 8.0×10^{-4} ft/sec (side slope)	Whetstone, 2005 Envirocare, 2000 Sections 1.3.3.4.1, 1.3.3.1.5, and 1.3.3.3.2	Top Slope: 4.01 Side Slope: 28.75
		Prevent Desiccation	No desiccation cracking in Radon Barrier Clay	UNSAT-H modeling establishes that the steady-state moisture content of the clay radon barrier will remain constant through all conditions throughout the life of the embankment.	Whetstone, 2011	1.91 (all conditions)
		Limit Frost Penetration	Thickness of rock/filter/sacrificial soil zones (3.5 ft) ≥ maximum depth of frost	Top Slope frost depth = 3.4 feet Side Slope frost depth = 3.2 feet	Montgomery Watson, 1998 Montgomery Watson, 2000 Western Regional Climate Center, 2000	Top > 1.03 Sides > 1.09 (abnormal condition)

Cover	Minimize Infiltration	Limit Biointrusion	Biointrusion shall be discouraged and shall not cause increased infiltration	Due to increased evapotranspiration, vegetation decreases infiltration through the cover under both the normal and the abnormal conditions. Infiltration (normal) = 0.065 cm/sec Infiltration (abnormal) = 0.071 cm/sec	SWCA, 2000 Whetstone, 2005	Normal = 2.60 Abnormal = 1.86
	Reduce Exposure	Surface Dose Rates	100 mrem TEDE	3 mrem/year through cover using abnormal event of high-gamma source at the top of waste.	EnergySolutions, 2011	> 4.94 (abnormal condition)
	Ensure Cover Integrity	Mitigate Differential Settlement	Maximum Allowable Distortion = 0.02	Maximum differential settlement (distortion) calculated at 0.01 for bulk waste facility under abnormal conditions	AGRA, 2000 AMEC, 2005 AMEC, 2011	Abnormal: 2.0
		Prevent Internal Erosion	Water velocity < 3 ft/sec on Radon Barrier Clay	Interstitial Velocities at Radon Barrier/Filter Zone Interface: Top Slope = 1.5×10^{-2} ft/sec Side Slope = 9.7×10^{-2} ft/sec	Envirocare, 2000	Top = 2158.27 Side = 431.03 (all conditions)
			Prevent Piping: D15(filter)/D85(soil) ≤ 5 AND D50(filter)/D50(soil) ≤ 25 Prevent Upward Migration of Fines D_{15}(Lower Layer) / D_{85}(Upper Layer) ≤ 4	Incorporated as construction specification on drawing 10014-C04 Upper filter layer D_{15} / Type B riprap D_{85} = 22/76 = 0.29	EnergySolutions, 2011 Envirocare, 2000	Not applicable ≥13.79 (all conditions)
		Material Stability / External Erosion	1000 year life	Design Rip Rap D50: Top Slope = 1.25 inches Side Slopes = 4.5 inches	Envirocare, 2000	Top = 1.67 Side = 1.64 (all conditions)
				Weighted average quality scoring for specific gravity, absorption, sodium soundness, and L.A. abrasion. Reject rock with quality scoring < 50	CQA/QC Manual NUREG-1623	Not applicable
	Ensure Structural Stability	Settlement	Long Term Cover Drainage (No Slope Reversal)	Even if the total potential settlement were focused at the crest of the embankment, the drop in elevation from the crest to the shoulder eliminates the potential for slope reversal.	AMEC, 2001 AMEC, 2002	
			Maximum Total Settlement ≤ 15% of Embankment Height	Abnormal condition maximum = 3.0 feet	AGRA 2000	
		Maintain Slope Stability	Static Safety Factor ≥ 1.5 Seismic Safety Factor ≥ 1.2	Static Safety Factor ≥ 2.5 Seismic Safety Factor = 1.2	AGRA, 1996 AGRA, 1999 AMEC, 2000 AMEC, 2005 AMEC, 2011	Static ≥ 2.5 (exceeds design criteria of 1.5) Seismic = 1.2 (meets design criteria of 1.2)
Drainage System	Provide Site Drainage	Facilitate flow of precipitation away from the embankment	Depth of water < depth of ditch. Freeboard ≥ 0.5 foot under normal conditions.	Design ditch height = 4 feet. Max height of water during normal event = 2.72 feet at downstream limit of ditch system (conservative "V" ditch assumed). Max height of water during abnormal event = 2.83 feet at downstream limit of ditch system (conservative "V" ditch assumed). Downstream blockage improves post-closure performance	EnergySolutions, 2011	Downstream: Normal SF = 1.29 Abnormal SF = 1.41

		Minimize Infiltration under flood conditions	Flood water shall dissipate faster than water travels through the cover system.	Maximum depth of PMF is approximately one foot across the site. This depth would last about 15 hours. Water travel time through the cover system is over 89 years.	Bingham, 1996 Whetstone, 2001	Abnormal SF > 50,000
	Ensure Ditch Integrity	Prevent Internal Erosion	Velocity < 3 ft/sec on Clay	Interstitial velocity at the Clay / Rock interface $\leq 1.2 \times 10^{-3}$ ft/sec	Envirocare, 2000	≥ 2158.27 (all conditions)
Buffer Zone	Provide Site Monitoring	NA	Sized adequate for monitoring and corrective measures	No contaminants will reach the monitoring wells located approximately 90 feet from the edge of waste, within the buffer zone boundary of 94 feet) within 500 years.	Whetstone, 2011	Not applicable

3.1 PRINCIPLE DESIGN FEATURES

3.1.1 WATER INFILTRATION

The Class A West embankment cover has been designed to direct ambient precipitation away from the disposal unit. Cover design is detailed in Drawings 10014-C02 and 10014-C03.

Flow from offsite precipitation is controlled during disposal operations by run-on berms that completely surround the disposal unit. Construction specifications for run-on berms are provided in the LLRW and 11e.(2) CQA/QC Manual, Work Element – General Requirements, specification "Run-on Control During Project". No revision to this specification will be needed for construction of the Class A West embankment. Groundwater does not need to be directed away from the disposal cell, since the lowest top of liner elevation is 10 feet above the highest recorded elevation for the upper, unconfined aquifer. The lowest top of liner elevation will be at approximately 4265 feet above sea level (see Drawing 10014-C01); the highest recorded elevation for the upper, unconfined aquifer is 4255 feet above sea level.

The post-closure drainage system surrounding the Class A West embankment has been designed to direct flow from ambient precipitation away from the disposal unit. The current drainage system routes the flows from the Class A and Class A North embankments beginning from a high point at the north west corner, around both sides, to the south east corner. From that point, the combined flow runs south to the westward flowing ditch that runs along the south boundary of Section 32. That south ditch currently carries stormwater from all embankments in Section 32. The revised drainage system depicted on the drawings will isolate stormwater flows from the Class A West embankment and route them to the southwest corner of the Class A West embankment, then southward along the west edge of the 11e(2) embankment, where the flow will discharge at the southwest corner of Section 32.
Drainage system design for the Class A West embankment is detailed in Drawings 10014-C01, 10014-C02, and 10014-C03. Because the overall footprint of the Class A West embankment is slightly larger than the combined Class A and Class A North footprints, a site drainage evaluation was performed and total ditch flow calculations have been included with this License Amendment Request (LAR) as Attachment 4.

The ditch flow calculations provided in Attachment 4 were devised to determine whether ditch designs associated with the Class A West embankment were rigorous enough to withstand both the normal (25 year, 24 hour) and abnormal (100 year, 24 hour) storm conditions . Flow calculations were also performed for the 11e.(2) drainage ditch system as water for all of the embankments will flow through the 11e.(2) drainage ditches before reaching the drainage system outlet.

First, flow velocities for the Class A West and 11e.(2) drainage ditches were calculated based on the drawings provided in Attachment 2 to this LAR (particularly 10014-C01 and 10014-C03). Upon obtaining flow velocities, storm events were calculated using isopluvial maps and calculations provided by the National Oceanic and Atmospheric Administration (NOAA, Atlas 2, Volume VI). Drainage areas were calculated for all designed embankments at the Clive facility, including the Class A West embankment. These drainage areas, and ditch volume equations were used to ascertain whether

upstream storage would cause ditch overflow given the normal (25 year, 24 hour) and abnormal (100 year, 24 hour) storm conditions.

Drainage calculations were performed first for the Class A West ditches and then second for the 11e.(2) ditches (as a representation of total site drainage). These calculations illustrate that current ditch designs meet drainage systems design criterion for the Class A West embankment (described in Table 3.2), and are adequate to handle site-wide flows associated with both the normal and abnormal storm events during operations.

3.1.2 DISPOSAL UNIT COVER INTEGRITY

The cover system for the Class A West embankment consists of the same layers and material specifications as the existing Class A embankments. To date, no cover has been constructed over waste placed in either the Class A or Class A North embankment. Therefore, the cover's ability to perform for the required period of time and to avoid the need for continuing active maintenance has been assessed previously in permitting the Class A and Class A North embankments.

A comprehensive summary of cover integrity design criteria for the Class A embankment is provided in Sections 3.1.1.2, 3.1.2.1 and 3.1.3.3 of the 2005 LRA; performance assessments against these design criteria are discussed in Sections 3.3.1.2, 3.3.2.1 and 3.3.3.3 of that document. The scope of these assessments include differential settlement, internal erosion, and material stability/external erosion. These assessments have been updated by AMEC Earth & Environmental, Inc. (AMEC 2011) and the revised assessment is presented in Attachment 5. The cover's ability to resist degradation by biotic activity is addressed in Sections 3.1.3.1.5 and 3.3.3.1.5 of the 2005 LRA.

3.1.3 STRUCTURAL STABILITY

Waste placement in the Class A West embankment will be controlled in accordance with the LLRW and 11e.(2) CQA/QC Manual. No changes to waste placement specifications and controls will be necessary for the Class A West embankment. Structural stability has been assessed previously in permitting the Class A embankment. A comprehensive summary of structural stability design criteria for the Class A embankment is provided in Sections 3.1.2.2 and 3.1.3.4 of the 2005 LRA; performance assessments against these design criteria are discussed in Sections 3.3.2.2 and 3.3.3.4 of that document. These assessments have been updated by AMEC Earth & Environmental, Inc. (AMEC 2011) and the revised assessment is presented in Attachment 5.

3.1.4 CONTACT WITH STANDING WATER

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

3.1.5 SITE DRAINAGE

There are no surface water features within 5 miles of Section 32, as established in Section (x) and Appendix J of "Pre-licensing Plan Approval Application" dated March 15, 2000. Therefore, site drainage is addressed in terms of direct precipitation runoff and sheet flow

associated with the Probable Maximum Flood event. The post-closure drainage system surrounding the Class A West embankment has been designed to direct water from precipitation or sheet flow away from the disposal unit. Drainage system design for the Class A West embankment is detailed in Drawings 10014-C01, 10014-C02, and 10014-C03, and are included with this LAR as Attachment 2.

3.1.6 SITE CLOSURE AND STABILIZATION

Long-term isolation of the waste in the Class A West embankment will be ensured consistent with cover design features and waste placement specifications in place for the existing Class A and Class A North embankments. Preventing the need for active maintenance is addressed within the analyses referenced in Sections 3.1.1 and 3.1.2 above. A cover system designed to minimize infiltration without the need for active maintenance is considered a complementary feature that has improved the site's natural characteristics.

3.1.7 LONG-TERM MAINTENANCE

Preventing the need for active maintenance is addressed within the analyses referenced in Sections 3.1.1 and 3.1.2 above. Design criteria for the various elements of the liner, waste placement, and cover systems have been set to incorporate a factor of safety of at least 1.0 against failure under normal, abnormal, and accident conditions. Tables 3.2 and 3.4 of the 2005 LRA provide a comprehensive discussion of embankment design criteria, their basis, conditions evaluated, and projected performance for the Class A embankment. This discussion is applicable to the Class A West embankment because liner, waste placement, and cover specifications are the same for each embankment.

3.1.8 INADVERTENT INTRUDER BARRIER

Both during site operations and after closure, barriers are maintained to prevent inadvertent intrusion to LLRW. The barrier consists of chain link fencing. Post-closure fencing shall be constructed in accordance with the LLRW and 11e.(2) CQA/QC Manual, Work Element – Permanent Chain Link Fences. In addition, the embankment cover system provides a further barrier to inadvertent intrusion, with 3.5 feet of rock layers plus 2 feet of clay and 1 foot of non-contaminated native soil "temporary cover" material above the waste.

3.1.9 DOSE AFTER CLOSURE

EnergySolutions performed MicroShield® calculations to determine the Total Effective Dose Equivalent (TEDE) for the completed CAW embankment and ensure that it was less than the 100 mrem TEDE specified in UAC R313-15-301 (EnergySolutions, 2011). See Figure 1, below, for details.

An abnormal condition involving a 55-galon drum containing a total activity of 11 curies was assumed to be placed on its side at top of waste, just below the Class A West cover. MicroShield® projected a contact dose rate on top of the completed cover of approximately 3 mrem, well within the regulatory requirement of 100 mrem.

Figure 1: MicroShield® Case Title – Class A West Cover

MicroShield 8.03
D620L-XP20708-V1-ESSTD (8.02-0000)

Date	By	Checked
1-10-11	Mark Ledoux	

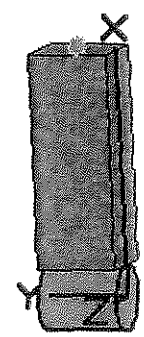
Filename	Run Date	Run Time	Duration
Class A West Drum.msd	January 10, 2011	11:28:12 AM	00:00:00

Project Info

Case Title	Class A West Cover
Description	Cover Contact DR with 55-gallon Drum Below
Geometry	7 - Cylinder Volume - Side Shields

Source Dimensions

Height	76.0 cm (2 ft 5.9 in)
Radius	30.0 cm (11.8 in)



Dose Points

A	X	Y	Z
#1	229.12 cm (7 ft 6.2 in)	38.0 cm (1 ft 3.0 in)	0.0 cm (0 in)

Shields

Shield N	Dimension	Material	Density
Source	7.589 ft³	Concrete	1.6
Transition		Air	0.00122
Shield 3	6.5 ft	Concrete	1.6
Air Gap		Air	0.00122

Source Input: Grouping Method - Actual Photon Energies

Nuclide	Ci	Bq	μCi/cm³	Bq/cm³
Co-60	1.1000e+001	4.0700e+011	5.1190e+001	1.8940e+006

Buildup: The material reference is Shield 3

Integration Parameters

Radial	10
Circumferential	10
Y Direction (axial)	20

Results

Energy (MeV)	Activity (Photons/sec)	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.6938	6.639e+07	4.072e-10	5.464e-08	7.861e-13	1.055e-10
1.1732	4.070e+11	1.148e-03	5.251e-02	2.052e-06	9.384e-05
1.3325	4.070e+11	4.488e-03	1.620e-01	7.787e-06	2.810e-04
Totals	**8.141e+11**	**5.637e-03**	**2.145e-01**	**9.839e-06**	**3.748e-04**

3.1.10 SITE MONITORING

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

3.1.11 BUFFER ZONE (Sean)

Buffer zone coordinates for the Class A West embankment are provided on Drawing 10014-U01. A discussion of the design criteria and projected performance of the buffer zone is located in the 2005 LRA, Sections 3.1.5 and 3.3.5, respectively. See also Section 1.2.2.2 of this document.

3.1.12 OCCUPATIONAL EXPOSURE

Occupational exposure is discussed in Section 7 of this LAR.

3.2 DESIGN CONSIDERATIONS FOR NORMAL/ABNORMAL/ACCIDENT CONDITIONS

Principal design criteria applicable to the Class A West embankment are located in the 2005 LRA, Section 3.0. Specifically, design criteria of the principal design features are summarized in Table 3.2 of that document. Projected performance against these design criteria are summarized in Table 3.4 of that document. The 2005 LRA focuses on the Class A embankment; this discussion is generally applicable to the Class A West embankment because the liner, waste placement, and cover systems are identical for both embankments. Updated performance projections are included in Tables 3.2, 3.3 and 3.4 of this document.

3.2.1 WATER INFILTRATION

Water infiltration is evaluated through infiltration and transport modeling provided as Attachment 3 to this LRA. The approach and methodology for this modeling are similar to previous evaluations performed for other embankments at the Clive facility.

Infiltration values for the top and side slopes of the Class A West embankment were determined to be 0.238 cm/yr and 0.335 cm/yr respectively. These values compare with modeled infiltration of 0.265 cm/yr for the top slope and 0.364 cm/yr for the side slope of the Class A embankment.

At these modeled average infiltration rates, PATHRAE modeling of the fate and transport of radioactive and hazardous constituents from the waste demonstrates that the Ground Water Protection Levels will not be exceeded for at least 500 years for radiological constituents and at least 200 years for heavy metals, provided that the concentrations of 2 radionuclides are restricted as presented in Table 3.5 below:

Table 3.5: Class A West Limiting Concentrations

Isotope	pCi/g	Ci/m^3
Bk-247	1.92	3.46E-06
Cl-36	73,900	1.33E-01

Whetstone reports different limiting concentrations under the top and side slopes. The lower value is reported here. These limiting concentrations are captured in Condition 55 of the draft RML provided in Attachment 1a.

3.2.2 DISPOSAL UNIT COVER INTEGRITY

Design criteria for protecting the disposal unit cover against internal and external erosion are provided in Sections 3.1.3.3.2 and 3.1.3.3.3 of the 2005 LRA. Projected performance of the cover system against these design criteria is provided in Sections 3.3.3.3.2 and 3.3.3.3.3 of the 2005 LRA. These analyses are applicable to the Class A West embankment because the cover materials and specifications are essentially identical to that of the Class A embankment.

Design criteria for settlement and subsidence are provided in Sections 3.1.1.2, 3.1.2.1 and 3.1.3.3 of the 2005 LRA. Projected performance of the cover system against these design criteria is discussed in Sections 3.3.1.2, 3.3.2.1 and 3.3.3.3 of that document. These assessments have been updated by AMEC Earth & Environmental, Inc. (AMEC 2011) and the revised assessment is presented in Attachment 5. Updated performance projections are included in Tables 3.2, 3.3 and 3.4 above to this document.

3.2.3 STRUCTURAL STABILITY

Evaluations of structural stability in terms of settlement and differential settlement are discussed in Section 3.2.2, above. Design criteria for ensuring structural stability are provided in Sections 3.1.2.2 and 3.1.3.4 of the 2005 LRA. Projected performance of the cover system against these design criteria is provided in Sections 3.3.2.2 and 3.3.3.4 of the 2005 LRA. These assessments have been updated by AMEC Earth & Environmental, Inc. (AMEC 2011) and the revised assessment is presented in Attachment 5. See also Section 2.3.2 above. Updated performance projections are included in Tables 3.2, 3.3 and 3.4 above to this document.

3.2.4 CONTACT WITH STANDING WATER

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

3.2.5 SITE DRAINAGE

Design criteria for drainage systems pertaining to the Class A West embankment are provided in Section 3.1.4 of the 2005 LRA and reiterated in Table 3.2 above. The ditch flow calculations within Attachment 45 project the performance of the drainage ditches against these criteria. These calculations conservatively assume "V" ditch geometry of the ditches and utilize Manning's formula along with the design lengths and slopes to arrive at design flow velocities and storage capacities of the drainage ditches around the Class A West embankment.

Under the normal condition 25 year, 24 hour storm event, the maximum height of water within the Class A embankment ditch system is calculated at 2.72 feet in the western ditch. The design criterion for this event is a freeboard of at least 0.5 feet, or a maximum depth of 3.5 feet. The safety factor for this design is then 3.5/2.72 = 1.29.

For the abnormal condition 100 year, 24 hour storm event, the maximum height of water around the Class A embankment again occurs in the western ditch at a 2.83 feet. The design criterion for this event is that the ditches retain the water, or a maximum depth of 4.0 feet. The safety factor for this design is then 4.0/2.83 = 1.41.

Additional calculations are included in Attachment 45 that demonstrate the ditches around the 11e.(2) embankment are adequately designed to contain all water generated at Clive during both the normal and abnormal storm events.

3.2.6 SITE CLOSURE AND STABILIZATION

Closure of the Class A West embankment will be accomplished by construction of final cover as areas of the embankment reach their design height. Accordingly, all of the principal design criteria discussed herein are applicable to site closure and stabilization, as these criteria affect embankment construction. Each of the performance assessments referenced herein includes analysis of the effects of design-basis abnormal events.

3.2.7 LONG-TERM MAINTENANCE

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

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

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

3.2.8 INADVERTENT INTRUDER BARRIER

Both during site operations and after closure, a barrier is maintained to prevent inadvertent intrusion to LLRW. During site operations, the barrier consists of chain link fencing. Post-closure fencing shall be constructed in accordance with the LLRW and 11e.(2) CQA/QC Manual, Work Element – Permanent Chain Link Fences. The embankment cover system provides the long-term barrier to inadvertent intrusion, with 3.5 feet of rock layers plus 2 feet of clay plus one foot of non-contaminated native soil "temporary cover" above the waste. Material stability of cover rock layers is evaluated for the Class A embankment in Section 3.1.3.3.3 of the 2005 LRA. Projected performance against these design criteria is provided in Section 3.3.3.3.3 of the 2005

LRA. These analyses are applicable to the Class A West embankment because the erosion barrier materials and material specifications are identical to that of the Class A embankment.

3.2.9 OCCUPATIONAL EXPOSURE

Occupational Exposure Standard requirements for receiving, inspection, handling, storage, and disposal areas are discussed in Section 7, below. Wastes received at the Class A West embankment will be identical to those approved under the current license for the Class A and Class A North embankments; therefore, there is no need to evaluate required shielding for higher activity wastes. Energy*Solutions'* procedures for handling the accidental rupture of nonstable waste containers are discussed in Section 4.5, below.

3.2.10 SITE MONITORING

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

3.2.11 BUFFER ZONE

A discussion of the design criteria and projected performance of the buffer zone is located in the 2005 LRA, Sections 3.1.5 and 3.3.5, respectively. See also section 1.2.2.2 above.

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

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

3.3 CONSTRUCTION CONSIDERATIONS

Storm Water Management General Requirements: Temporary runoff control berms will be constructed around the waste placement areas in accordance with the LLRW and 11e.(2) CQA/QC Manual, Work Element – General Requirements, specification "Runoff Control During Project". The waste will be placed to divert storm water runoff away from the waste and to the toe of the cells.

3.3.1 CONSTRUCTION METHODS AND FEATURES

Construction methods for the Class A West embankment will be unchanged from current approved practices as provided in the LLRW and 11e.(2) CQA/QC Manual.

3.3.1.1 SITE PREPARATION AND CURRENT CONDITIONS

Site preparation requirements for the Class A West embankment are provided in the LLRW and 11e.(2) CQA/QC Manual, Work Element – Foundation Preparation. Because these specifications are identical to those of the Class A and Class A North embankments, no revision to the LLRW and 11e.(2) CQA/QC Manual is needed. The existing surface as of April, 2011 includes areas of approved clay liner, areas excavated to near-foundation elevation; and areas that have been disturbed but remain at or near the original native elevation. As indicated on Drawing 10014-U02, existing groundwater wells GW-81 through GW-86, GW-109 through GW-117, and GW-140 and 141 are

located within the embankment footprint and will be abandoned prior to liner construction. Collection lysimeters CL-W3, CL-W4, and CL-N5 will also need to be abandoned and relocated prior to liner construction. See also Section 1.2.3 above.

3.3.1.2 CONTROL AND DIVERSION OF WATER

Surface water is controlled by a system of run-on and run-off berms. A comprehensive discussion of berm systems for the Class A embankment is provided in Section 3.4.4 of the 2005 LRA. This discussion is applicable to the Class A West embankment because berm requirements will be identical for the Class A and the Class A West embankments. As discussed in section 3.1.1 above, the highest groundwater elevation is 10 feet below the top of liner elevation; therefore, groundwater control will not be necessary.

3.3.1.3 CONSTRUCTION OF DISPOSAL UNITS

The Class A West embankment will be constructed to the existing liner, waste placement, and cover requirements of the LLRW and 11e.(2) CQA/QC Manual. See also engineering drawing series 10014.

3.3.1.4 CONCRETE AND STEEL CONSTRUCTION

One aspect of disposal at the Class A West embankment will incorporate concrete as a component of disposal facility construction: Controlled Low-Strength Material (CLSM) used to fill voids in debris placement. CLSM use will be controlled in accordance with existing requirements applicable to disposal in the Class A embankment. CLSM requirements are located in the LLRW and 11e.(2) CQA/QC Manual, Work Element – Waste Placement, specification "CLSM Pours". CLSM is a low-strength void filling material; no reinforcing steel is used.

3.3.1.5 BACKFILLING

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

3.3.1.6 CLOSURE OF INDIVIDUAL DISPOSAL UNITS

The cover over the Class A West embankment will be constructed in accordance with the LLRW and 11e.(2) CQA/QC Manual, Work Elements – Temporary Cover Placement and Monitoring, Radon Barrier Borrow Material, Radon Barrier Test Pad, Radon Barrier Placement, Filter Zone, Sacrificial Soil Placement, and Rock Erosion Barrier. See also drawing series 10014.

3.3.1.7 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

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

3.3.1.8 CONSTRUCTION MATERIALS AND QUALITY ASSURANCE

Construction materials for the Class A West embankment will consist of native soils and rock. Specifications for each component are provided as discussed above. Quality assurance and quality control measures required for construction are provided in the

LLRW and 11e.(2) CQA/QC Manual. All construction materials and procedures for the Class A West embankment will be identical to those currently approved for the Class A embankment.

3.3.1.9 SITE PLANS, ENGINEERING DRAWINGS, AND CONSTRUCTION SPECIFICATIONS

Engineering drawing series 10014 details the Class A West embankment and is provided as Attachment 2 to this amendment request. In accordance with Condition I.H.6 of the GWQDP, EnergySolutions is required to provide an annual as-built report and drawing set documenting embankment construction.

3.3.2 CONSTRUCTION EQUIPMENT

Construction equipment will consist of standard heavy construction and earth-moving equipment. Equipment used to construct the Class A West embankment will be equal to that used in construction of the Class A embankment.

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

Below ground vaults are defined as warehouse-sized vaults buried beneath grade. Concrete bunkers are defined as concrete lined trenches with compartmental separation for different waste classes. EnergySolutions does not perform either of these types of disposal and therefore this topic is not applicable to the Class A West embankment.

3.4 DESIGN OF AUXILARY SYSTEMS AND FACILITIES

3.4.1 UTILITY SYSTEMS

A discussion of site utility systems is located in the 2005 LRA, Section 3.4.1. This discussion is applicable to the Class A West embankment because no additional utility systems will be needed for the embankment.

3.4.2 AUXILIARY FACILITIES

A discussion of auxiliary facilities is located in the 2005 LRA, Section 3.4.2. This discussion is applicable to the Class A West embankment because no additional auxiliary facilities will be needed for the embankment. Since the 2005 LRA, new facilities including the Northwest Corner Pond, Rotary Dump Facility, and Shredder Facility have been permitted, constructed, and placed into operation in the northwest portion of Section 32; however, the Class A West embankment has been sized and located to prevent any impact to these facilities.

3.4.3 FIRE PROTECTION SYSTEM

A discussion of the fire protection system is located in the 2005 License Renewal Application, Section 3.4.3. This discussion is applicable to the Class A West embankment because no additional fire protection system will be needed for the embankment.

3.4.4 EROSION AND FLOOD CONTROL SYSTEM

For information regarding site drainage and flood protection following closure, please refer to Sections 3.1.5 and 3.2.5, above. A discussion of operational erosion and flood control is located in the 2005 LRA, Section 3.4.4. This discussion is applicable to the

Class A West embankment because EnergySolutions will implement identical run-on and run-off control berms around the Class A West embankment.

4.0 FACILITY OPERATIONS

4.1 RECEIPT AND INSPECTION OF WASTE

Incoming shipments of Class A wastes will be inspected and received in accordance with the LLRW Waste Characterization Plan (RML condition 58, current approved revision date October 8, 2009). There will be no changes to this requirement for purposes of constructing the Class A West embankment.

4.1.1 PROCEDURE FOR VISUAL EXAMINATION OF SHIPPING DOCUMENTS

This topic is addressed in the LLRW Waste Characterization Plan, Step 3. Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment.

4.1.2 PROCEDURE FOR VISUAL EXAMINATION OF WASTE PACKAGES

This topic is addressed in the Waste Characterization Plan, Step 3. Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment.

4.1.3 PROCEDURE FOR VERIFICATION SURVEYS

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

4.1.4 PROCEDURE ON VERIFYING WASTE CLASS

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

4.1.5 PROCEDURE FOR ANALYTICALLY VERIFYING WASTE CHARACTERISTICS AND FORM

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

4.1.6 OTHER PROCEDURES TO ENSURE WASTE ACCEPTANCE CRITERIA ARE MET

This topic is addressed in the current Waste Characterization Plan. Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment.

4.2 WASTE HANDLING AND INTERIM STORAGE

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

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

4.3 WASTE DISPOSAL OPERATIONS

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

4.3.1 WASTE EMPLACEMENT

Waste placement will be controlled in accordance with the LLRW and 11e.(2) CQA/QC Manual. It is anticipated that bulk Class A waste placement in the Class A West embankment will proceed northward as the Class A embankment reaches capacity. The exact sequence will necessarily depend on timing and volumes of bulk Class A waste receipts.

4.3.2 FILLING OF VOID SPACES

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

4.3.3 WASTE COVERING

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

4.3.4 LOCATION DISPOSAL UNITS AND BOUNDARY MARKERS

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

4.3.5 DISPOSAL UNIT CLOSURE AND STABILIZATION

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

4.3.6 BUFFER ZONE (Sean)

This topic is addressed in the 2005 LRA (Section 4.3.6). The Class A West embankment is generally designed with a 100 foot buffer zone. See also section1.2.2.2 above.

4.4 OPERATIONAL ENVIRONMENTAL MONITORING AND SURVEILLANCE

4.4.1 REVIEW AND AUDIT OF FACILITY OPERATIONS

EnergySolutions' program for facility review and audit is provided in the 2005 LRA, Appendix V, Quality Assurance Manual. Since there is no change to the types of waste that will be managed, this plan will be unaffected by the Class A West embankment.

4.4.2 FACILITY ADMINISTRATION AND OPERATING PROCEDURES

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

4.4.3 ENVIRONMENTAL MONITORING AND SURVEILLANCES

A well spacing analysis for the Class A West embankment has been performed and is provided as Attachment 6 to this amendment request. The well spacing analysis provides reasonable assurance that releases from the Class A West embankment can and will be detected.

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

4.5 EMERGENCY AND CONTINGENCY PLAN

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

5.0 SITE CLOSURE PLAN AND INSTITUTIONAL CONTROLS

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

5.1 SITE STABILIZATION

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

5.1.1 SURFACE DRAINAGE AND EROSION PROTECTION

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

5.1.2 GEOTECHNICAL STABILITY

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

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

Below ground vaults are defined as warehouse-sized vaults buried beneath grade. Concrete bunkers are defined as concrete-lined trenches with compartmental separation for different waste classes. EnergySolutions does not perform either of these types of disposal and therefore this topic is not applicable to the Class A West embankment.

5.3 DECONTAMINATION AND DECOMISSIONING

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

5.4 POST-OPERATIONAL ENVIRONMENTAL MONITORING

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

6.0 SAFETY ASSESSMENT

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

6.1 RELEASE OF RADIOACTIVITY

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

6.1.1 DETERMINATION OF TYPES, KINDS, AND QUANTITIES OF WASTE

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

6.1.2 INFILTRATION

This topic is addressed in the 2005 LRA (Section 6.3.1.4). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment. Section 3.2.1 of this amendment request discusses infiltration modeling results for the Class A West embankment.

6.1.3 RADIONUCLIDE RELEASE – NORMAL CONDITIONS

Because of changes forecasted for infiltration, limiting waste concentrations for waste disposal beneath the Class A West Cell's Top Slope were added for Bk-247 and Cl-36 (as presented in Section 2.6.2). Similarly, the analysis demonstrates that reductions in side slope infiltration eliminates the necessity to limit waste disposal concentrations beneath the Class A West's side slope for Al-36, Bk-247, Ca-41, Cf-249, Cf-250, Cl-36, Re-187, Tb-157, and Tb-158, as originally modeled in 2000.

6.1.4 RADIONUCLIDE RELEASE – ACCIDENTAL OR UNUSUAL OPERATIONAL CONDITIONS

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

6.1.5 RADIONUCLIDE TRANSFER TO HUMAN ACCESS LOCATION

Because of changes modeled for the groundwater transport of infiltration, limiting waste concentrations for waste disposal beneath the Class A West Cell's Top Slope were added for Bk-247 and Cl-36 (as presented in Section 2.6.2). Similarly, the model demonstrates that reductions in side slope infiltration eliminates the necessity to limit waste disposal concentrations beneath the Class A West's side slope for Al-36, Bk-247, Ca-41, Cf-249, Cf-250, Cl-36, Re-187, Tb-157, and Tb-158, as originally modeled in 2000.

6.1.6 ASSESSMENT OF IMPACTS AND REGULATORY COMPLIANCE

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

6.2 INTRUDER PROTECTION

6.2.1 NORMAL RELEASES

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

6.2.1.1 CONTROL OF WINDBORNE DISPERSION

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

6.2.1.2 CONTROL OF SURFACE CONTAMINATION

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

6.2.2 POTENTIAL ACCIDENTAL RELEASES

Construction of the proposed Class A West embankment will not change the nature of possible potential accidental releases that have been addressed in EnergySolutions' previous licensing actions. No new emergency response or contingency plans will be generated, as the nature of the waste that will be disposed of in the proposed Class A West embankment is identical to the waste currently being disposed of in the Class A and Class A North embankment.

6.2.3 POTENTIAL RELEASES FOLLOWING OPERATIONS

6.2.3.1 RADIONUCLIDE TRANSFER TO HUMAN ACCESS LOCATIONS

The construction of the proposed Class A West embankment will not change the nature of possible transfer to human access locations discussed in previous licensing actions.

6.2.3.2 PROJECTED DOSES TO MEMBERS OF THE GENERAL PUBLIC

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

6.3 LONG-TERM STABILITY

6.3.1 SURFACE DRAINAGE AND EROSION PROTECTION

This topic is addressed in sections 3.1.5, 3.2.5, and 3.4.4 above.

6.3.2 SLOPE STABILITY

This topic is addressed in the 2005 LRA (Section 6.4.3.3). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment. Updated performance projections are included in Tables 3.2, 3.3 and 3.4 above, and the basis for the projections is included in Attachment 5.

6.3.2.1 SITE AND SLOPE AREA CHARACTERIZATION

This topic is addressed in the 2005 LRA (Section 6.4.3). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment.

6.3.3 SETTLEMENT AND SUBSIDENCE

Design criteria for settlement and subsidence are provided in Sections 3.1.1.2, 3.1.2.1 and 3.1.3.3 of the 2005 LRA. Projected performance of the cover system against these design criteria are discussed in Sections 3.3.1.2, 3.3.2.1 and 3.3.3.3 of that document. These analyses are applicable to the Class A West embankment because the liner, waste placement, and cover materials and material specifications are identical to that of the Class A and Class A North embankments. Updated performance projections are included in Tables 3.2, 3.3 and 3.4 above, and the basis for the projections is included in Attachment 5.

7.0 OCCUPATIONAL RADIATION PROTECTION

7.1 OCCUPATIONAL RADIATION EXPOSURES

7.1.1 POLICY CONSIDERATIONS

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

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

The waste type and classification that will be disposed of in the Class A West embankment will be no different than waste currently being disposed of in the Class A and Class A North embankments. Therefore, the ALARA Program will not require revision for the Class A West embankment.

The Class A West embankment was presented to and discussed by the Clive Radiation Safety Committee in accordance with the ALARA program. The committee's review and ALARA evaluation is provided as Attachment 7 to this amendment request.

7.1.2 DESIGN CONSIDERATIONS

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

7.1.3 OPERATIONAL CONSIDERATIONS

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

7.2 RADIATION SOURCES

The types and quantities of materials received for disposal in the Class A West embankment will be no different than materials disposed of in the Class A and Class A North embankments. Therefore, radiation protection, access control to restricted areas, and personnel protective equipment policies will not change from current standards.

7.3 RADIATION PROTECTION DESIGN FEATURES

7.3.1 FACILITY DESIGN FEATURES

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

7.3.2 SHIELDING

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

7.3.3 VENTILATION

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

7.3.4 AREA RADIATION AND AIRBORNE RADIOACTIVITY MONITORING INSTRUMENTATION

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

7.3.5 EQUIPMENT, INSTRUMENTATION, AND FACILITIES

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

7.4 RADIATION PROTECTION PROGRAM

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

7.4.1 ORGANIZATION

The specific organization of the radiation protection program is defined by the Class A RML, condition 32.A. These requirements will be unaffected by the Class A West embankment.

8.0 CONDUCT OF OPERATIONS

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

8.1 ORGANIZATIONAL STRUCTURE

Detailed requirements and qualifications for significant organizational positions are described in the RML, Condition 32, Appendix I (currently approved revision is Rev. 22, August 2, 2010).

8.2 QUALIFICATIONS OF APPLICANT

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

8.3 TRAINING PROGRAM

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

8.4 EMERGENCY PLANNING

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

8.5 REVIEW AND AUDIT

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

8.6 FACILITY ADMINISTRATIVE AND OPERATING PROCEDURES

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

8.7 PHYSICAL SECURITY

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

9.0 QUALITY ASSURANCE

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

10.0 FINANCIAL ASSURANCE

In order to protect the State of Utah from financial damage arising from having to close and decommission the facility in the event that Energy*Solutions* is unwilling or unable to do so, the LLRW financial surety will be revised to include cost estimates for the closure of the Class A West embankment.

The annual surety review is submitted annually on or before December 1st. Because the 2010 surety update is still under review by DRC, a revised surety estimate is not included with this amendment request. Energy*Solutions* anticipates that the surety will need to be revised to include new groundwater monitoring points; and may require an adjustment for fencing and construction of haul roads. Adjustments will be made to the surety revision approved at the time this license amendment is approved, then funded prior to initiating any waste placement in portions of the Class A West embankment that exceed

horizontally or vertically beyond the current approved Class A and Class A North designs.

10.1 FINANCIAL QUALIFICATIONS OF APPLICANT

EnergySolutions' financial qualifications are discussed in Section 1.1.1.2 above.

10.2 FUNDING ASSURANCES

10.2.1 SPECIFIC ACCEPTABLE FINANCIAL ASSURANCES

10.2.1.1 SURETIES OR PERFORMANCE BONDS

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

10.2.1.2 LETTERS OF CREDIT

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

Upon DRC approval of the Class A West embankment and associated financial surety calculations, and prior to placing waste in portions of the Class A 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 as necessary to ensure funding for closure and post-closure monitoring of the Class A West embankment.

10.3 FINANCIAL ASSURANCE FOR INSTITUTIONAL CONTROLS

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

11.0 REFERENCES

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