RULEMAKING ISSUE
(NOTATION VOTE)

October 7, 2008 SECY-08-0147

FOR: The Commissioners

FROM: R. W. Borchardt
Executive Director for Operations

SUBJECT: RESPONSE TO COMMISSION ORDER CLI-05-20 REGARDING DEPLETED URANIUM

PURPOSE:

The purpose of this paper is to respond to the Commission direction provided in Order CLI-05-20 (In the Matter of Louisiana Energy Services [LES], October 19, 2005). In this Order, the Commission directed staff, "outside of the LES adjudication, to consider whether the quantities of depleted uranium (DU) at issue in the waste stream from uranium enrichment facilities warrant amending section 61.55(a)(6) or the section 61.55(a) waste classification tables." This paper presents four possible regulatory approaches in response to this direction and requests approval of the recommended approach selected in this paper. This paper does not address any new commitments.

SUMMARY:

Staff completed a technical analysis (see Enclosure 1) to understand the impacts of near-surface disposal of large quantities of DU, such as those expected to be generated at uranium enrichment facilities. The technical analysis addressed whether amendments to § 61.55(a) are necessary to assure large quantities of DU are disposed of in a manner that meets the performance objectives in Subpart C of 10 CFR Part 61. The analysis concluded that

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near-surface disposal of large quantities of DU may be appropriate, but not under all site conditions. Shallow disposal of large quantities of DU or disposal at humid sites with a potable groundwater pathway would likely result in the performance objectives not being met. Because of the unique characteristics of the waste and the additional considerations required for its disposal, staff concluded that existing regulations need to be amended to ensure that large quantities of DU are disposed of safely.

Staff recommends conducting a limited rulemaking to revise Part 61 to specify the need for a disposal facility licensee or applicant to conduct a site-specific analysis that addresses the unique characteristics of the waste and the additional considerations required for its disposal prior to disposal of large quantities of DU and other unique waste streams such as reprocessing waste. The technical requirements associated with disposal of large quantities of DU would be developed through the rulemaking process. Specific parameters and assumptions staff recommends for conducting the site-specific analysis would be incorporated into a guidance document that would be issued for public comment prior to being finalized.

BACKGROUND:

The licensing of new uranium enrichment facilities in the United States has brought DU to the forefront of low-level waste (LLW) disposal issues. The DU waste stream is unique; the relatively high concentrations and large quantities of DU that are generated by enrichment facilities were not considered in the Final Environmental Impact Statement (FEIS) supporting the development of 10 CFR Part 61.[1] When the FEIS was issued in 1982, there were no commercial facilities generating large amounts of DU waste, therefore, the FEIS considered only the types of uranium-bearing waste streams being typically disposed of by U.S. Nuclear Regulatory Commission (NRC) licensees at the time.[2] The NRC concluded that those waste streams posed an insufficient hazard to warrant establishing a concentration limit for uranium in the waste classification tables in 10 CFR 61.

With the existing U.S. Department of Energy (DOE) stockpile of DU at the Paducah and Portsmouth Gaseous Diffusion Plants, and the recent licensing of LES National Enrichment Facility (NEF) and the United States Enrichment Corporation (USEC) American Centrifuge Plant, more than 1 million metric tons of depleted uranium hexafluoride (DUF_6) will need a disposition path.[3] Existing disposal facilities such as the Energy*Solutions* facility in Clive, Utah and the proposed Waste Control Specialists (WCS) LLW facility in Andrews County, Texas have expressed interest to their Agreement State regulators in disposal of large quantities of DU at their sites.

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[1] Part 61 FEIS, NUREG-0945, Vol. 1, (November 1982) at 5-38. The FEIS relies on extensive analysis and calculations found in the Draft Environmental Impact Statement (DEIS) that are incorporated by reference. The references in this paper to the FEIS include the supporting information found in the DEIS.

[2] The Part 61 FEIS (NUREG-0945, November 1982) considered 17 Curies of U^{238} compared to approximately 100,000 - 200,000 Curies of U^{238} that will be generated from LES during its 25-year lifespan (FEIS for the Proposed National Enrichment Facility in Lea County, New Mexico, NUREG-1790, June 2005).

[3] Draft Supplement Analysis for Locations to Dispose of DU Conversion Product Generated from DOE's Inventory of DUF_6, (DOE/EIS-0359-SA1 and DOE/EIS-0360-SA1), March 2007 at p. 43; FEIS for the Proposed National Enrichment Facility in Lea County, New Mexico, NUREG-1790, June 2005 at p. 2-27; FEIS for the Proposed American Centrifuge Plant in Piketon, Ohio, NUREG-1834, April 2006) at p. 4-51.

As the Commission indicated in Order CLI-05-20, the current waste classification for DU is "based upon § 61.55(a)(6), which specifies that if radioactive waste does not contain any of the radionuclides listed in either of two listed waste classification tables, it is Class A waste. Depleted uranium does not contain the radionuclides listed in the specified tables, and therefore under a plain reading of the regulation, depleted uranium is a Class A waste." As such, any existing disposal facility currently licensed to accept Class A waste represents a potential disposal path for the DU waste stream.

To fully understand how DU is currently being disposed of, staff communicated with Agreement State regulators that oversee existing or proposed LLW disposal facilities in their States (i.e., South Carolina, Texas, Utah, and Washington). Most of these disposal facilities have accepted small quantities of DU in the past. In general, these State regulators agreed with the need to handle large quantities of DU as a unique waste stream, regardless of its current waste classification, and agreed that additional analysis should be conducted prior to its disposal. The Utah Division of Radiation Control indicated that Energy*Solution*s has completed site-specific performance modeling for disposal of natural uranium at their Clive, Utah site, and Energy*Solution*s concluded that even when the disposal cells were assumed to contain 100 percent natural uranium, risks were found to be within Utah Administrative Code regulatory limits, which are comparable to those in Part 61. Energy*Solution*s compared the risk from natural uranium to the risk associated with DU and found that DU can be safely placed in their facility.[4] This conclusion is based on numerous assumptions that can be found in Energy*Solutions'* performance assessment.

Similarly, the Texas Commission on Environmental Quality (TCEQ) requires its licensees and applicants to perform additional analysis prior to disposal of large quantities of DU. For example, the draft license for WCS' LLW disposal facility issued August 12, 2008, states that in order to dispose of DU, "information on complete waste profiles, radionuclide information, total radioactivity, radionuclide concentrations, chemical constituents, and analysis of any impacts to members of the public and the environment must be submitted as an application for amendment to this license." Currently, the TCEQ has not received information from WCS to satisfy this requirement. Finally, the Washington Department of Health has completed a performance assessment for the U.S. Ecology LLW disposal facility related to site closure that does not currently include large quantities of DU; however, the analysis could be modified to include the impacts from DU disposal. Staff did not contact enrichment facility licensees or other potential licensees when conducting its analysis.

In order to develop an informed response to the Commission direction, the staff performed a technical analysis to evaluate the impacts of near-surface disposal of large quantities of DU and to determine if amendments to § 61.55(a) are necessary to assure that large quantities of DU are disposed of in a manner that meets the performance objectives of Part 61.[5] The results of

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[4] "Review of the Institute of Energy and Environmental Research Report Related to Shallow Land Disposal of Depleted Uranium," Enchemica, LLC, (November 21, 2007).

[5] The staff also considered whether requirements for uranium mill tailings impoundments in 10 CFR Part 40, Appendix A, could be applied to disposal of large quantities of DU in a Part 61 LLW disposal facility. For example, Part 40 requires that the disposal design control radiological hazard from radon for 1,000 years. However, uranium mill tailings are a significantly different source term than the large quantities of DU from enrichment facilities, because the concentration of radium and radon in mill tailings is generally at its maximum concentration when disposed of and slowly decreases over time, in comparison to DU, where these daughter products increase over time and exceed the

this technical analysis are summarized in the discussion below; Enclosure 1 provides additional detail. Following the summary of the technical analysis, this paper presents four possible regulatory approaches to respond to the Commission direction.

In addition to these four approaches, the staff also evaluated the use of § 61.58 during development of this paper. This section of Part 61 may have been designed to allow licensees to perform and submit evaluations to address the performance requirements in Subpart C to Part 61 without a rule change. But the use of an exception provision like § 61.58 to *require* an additional site-specific study on certain Class A waste streams, without any associated rule change, is inconsistent with the basic premise of an exception. Specifically, the purpose of building an exception into a generally applicable rule is to allow an activity that would not otherwise be permitted, rather than to impose an additional requirement (e.g., performance of a site-specific study) on an activity that is already permitted (e.g., near-surface disposal of Class A waste). Thus, if § 61.58 were utilized to approve an alternate classification or characteristic, such action would provide additional options for a licensee, but would not require use of a particular option. Compliance with the approved alternative would not be the *only* method of compliance. Therefore, if the staff intended to use § 61.58 in order to develop an alternate waste classification or alternate characteristics for a Class A waste stream such as DU, *and to require licensees to conform to the alternate classification or characteristics as the sole method of compliance in place of (as opposed to as an alternative to) the existing regulations*, a rule change would be necessary.[6]

DISCUSSION:

Summary of Results of Technical Analysis

Staff developed a screening model to evaluate the radiological risk and uncertainties associated with near-surface disposal of large quantities of DU at a generic LLW disposal site. The generic disposal site had a broad range of climatic (e.g., humid or arid), hydrological, and geochemical conditions. The model was used to understand the impacts of key variables such as: disposal configurations, performance periods, institutional control periods, waste forms, site conditions, exposure pathways, and receptor scenarios. Calculations were performed probabilistically to

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mill tailings concentration about the 1,000 year time frame. For similar disposal conditions, the peak risk (at 2 million years) from radon from DU is orders of magnitude larger than from uranium mill tailings. However, even after 1,000 years, if the radon barrier is lost (meaning that the institutional controls had failed), radon hazards at uranium mill tailings impoundments would likely produce doses to intruders that exceed 500 millirem/yr, the intruder dose objective used in the development of the Part 61 waste classification system (NUREG-0706, Final Generic EIS on Uranium Milling, September 1980). Therefore, the staff concluded that specific and unique guidance was needed for disposal of large quantities of DU in LLW facilities to mitigate the potential impacts to the intruder.

[6] This is consistent with the discussion of § 61.58 in NUREG-1854, "NRC Staff Guidance for Activities Related to U.S. Department of Energy Waste Determinations: Draft Final Report for Interim Use." Specifically, NUREG-1854 states:

> 10 CFR 61.58 was intended to allow the NRC the flexibility of establishing alternate waste classification schemes when justified by site-specific conditions *and does not affect the generic waste classifications established in 10 CFR 61.55.* Thus, if the results of concentration calculations performed in a manner consistent with the principles and examples described previously in this document indicate that radionuclide concentrations in the waste exceed Class C limits, then the waste is greater than Class C waste for waste classification purposes. If it can be demonstrated that the performance objectives of 10 CFR Part 61 can be satisfied, then the waste would be suitable for near-surface disposal. " *Id.* at 3-36 (emphasis added).

represent the impact of variability and uncertainty on the results. The analysis methodology used in the model is consistent with the technical analysis methodology found in the FEIS supporting Part 61. The model framework is based on several key assumptions, which are detailed in Enclosure 1.

The technical analysis concluded that near-surface disposal (i.e., at a depth of less than 30 meters [m], as defined in Part 61) may be appropriate for large quantities of DU under certain conditions. However, unfavorable site conditions, such as shallow disposal (i.e., at a depth of less than 3 m) or disposal at humid sites with a potable groundwater pathway, could exceed the performance objectives of Part 61, Subpart C. Although shallow disposal for large quantities of DU is not likely to be appropriate regardless of site conditions, small quantities (approximately 1 – 10 metric tons) of DU could be disposed of at shallow depths.

Regulatory Options for Waste Classification

Based on the results of the technical analysis, staff believes that a change to existing regulations or a generic communication is necessary to ensure large quantities of DU are disposed of safely. Staff identified four options that it believes would facilitate safe disposal. Each option would likely draw significant stakeholder input from LLW disposal facilities interested in disposing of DU; commercial enrichment facilities generating DU; as well as DOE, who has responsibility for disposal of DU from NRC licensed enrichment facilities, if requested,[7] and responsibility for disposal of Greater than Class C (GTCC) waste.

The options and a summary of the pros and cons for each option are discussed below. The resources required for each option are presented in Enclosure 2. A complete discussion of the staff's evaluation of the use of § 61.58 is presented in Enclosure 3.

Option 1 – Generic Communication to Clarify Need to Demonstrate Compliance with Performance Objectives

In Order CLI-05-05 (In the Matter of LES, January 18, 2005), the Commission stated "In the end, the 'bottom line for disposal' of low-level radioactive wastes are the performance objectives of 10 C.F.R. Subpart C, which set forth the ultimate standards and radiation limits for (1) protection of the general population from releases of radioactivity; (2) protection of individuals from inadvertent intrusion; (3) protection of individuals during operations; (4) and stability of the disposal site after closure." Under Option 1, staff would issue a generic communication (e.g., a regulatory issue summary) that would reiterate the Commission's statement expressed in Order CLI-05-05 and would clarify acceptable methods for dealing with unique waste streams like large quantities of DU. The generic communication would emphasize that compliance with the existing performance objectives needs to be demonstrated through analysis and that classification under § 61.55(a)(6) should not be relied upon for this purpose. After developing the generic communication, staff would revise the associated guidance documents to describe an acceptable method for conducting a site-specific analysis for nuclides or concentrations not specifically covered in the waste classification tables. The specific parameters and assumptions

[7] Section 3113 of 1996 USEC Privatization Act.

If the radioactive waste does not contain any nuclides listed in either Table 1 or 2, it is Class A.

Proposed Change: Modify paragraph 61.55(a)(6) to include a statement that, for unique waste streams including, but not limited to, large quantities of depleted uranium, the requirements of § 61.55(a)(9) of this part must be met. Section 61.55(a) would then be modified to include a paragraph (a)(9), which would include a requirement that *the disposal facility licensee must perform, and the Commission must approve, a site-specific analysis demonstrating that the unique waste stream, including large quantities of depleted uranium, can be disposed of at the site in conformance with the performance objectives in subpart C to Part 61.*

Staff proposes that the rule language be broad enough to include other unique waste streams that may arise in the future, so that additional rulemakings may not be necessary. The term "unique waste streams" would be defined in the rule language. As currently envisioned, unique waste streams could include those that may result from spent fuel reprocessing, or other types of waste streams that could emerge in the future from new kinds of facilities that generate significantly different concentrations and quantities of waste not previously considered in the Part 61 FEIS. Similarly, staff intends to define "large quantities" of DU in the rule language as quantities similar to those being generated at uranium enrichment facilities. Staff does not intend to submit a rulemaking plan to the Commission for the rulemaking under this option.

In order to ensure that the site-specific analyses that would be conducted by licensees and applicants are consistent with the analysis performed in the Part 61 FEIS, and to be protective of public health and safety, staff believes certain technical requirements will also need to be specified in the rule language in paragraph (a)(9). For example, the type of receptors used to assess protection of the general population from releases of radioactivity, the exposure scenarios evaluated to protect individuals from inadvertent intrusion, and the period of performance evaluated are key parameters that affect the determination of suitability of disposal of large quantities of DU. Therefore, under Option 2, the specific technical requirements associated with disposal of large quantities of DU (as well as other unique waste streams) would be developed in the notice and comment rulemaking process. Option 2 also involves developing and issuing a guidance document that would provide the Agreement State regulators, and their licensees and applicants, technical guidance to conduct these site-specific analyses.

The primary advantage of Option 2 is that it creates a legally binding requirement, which ensures a site-specific analysis is performed by licensees and applicants and reviewed and approved by the Commission or Agreement State regulators. The staff believes that this outcome is consistent with the Commission's expectations set forth in its June 2, 2006, Order CLI-06-15 (In the Matter of LES). Specifically, the Commission stated "*We would expect the appropriate regulatory authority to conduct any site-specific evaluations necessary to confirm that radiological dose limits and standards can be met at the disposal facility, in light of the quantities of depleted uranium envisioned.*" (emphasis added). Because the Commission expects such an analysis to be conducted, staff believes it is appropriate to codify this expectation in the rulemaking under this option. Furthermore, several Agreement State regulators indicated that they preferred this option because it could be easily enforced. In addition, this option ensures the protection of health and safety by imposing an additional

requirement for large quantities of DU in a risk-informed manner that will be consistent with the analysis performed to develop the waste classification tables in § 61.55. The primary disadvantage of Option 2 is that, unlike other radionuclides in the waste classification tables, large quantities of DU would require a site-specific analysis instead of the use of a convenient table with a specific concentration limit. This option would also be more resource intensive than Option 1.

Option 3 – Determine classification for DU within existing classification framework

Staff believes some stakeholders may be interested in a specific waste classification for DU, within the existing Part 61 waste classification framework. Therefore, Option 3 involves developing a generic waste classification (e.g., A, B, C, or GTCC) for DU and an associated concentration limit to be added to the waste classification tables. Staff would begin with the technical analysis described in Enclosure 1, which was consistent with the Part 61 methodology but updated to include recent advances in modeling and performance assessment techniques. The result of staff's additional analysis would be a concentration limit for a generic LLW site in the United States. Consistent with the assumptions in the original Part 61 analysis, this concentration limit would likely be based conservatively on potential disposal at a "reference" humid, eastern LLW disposal site.[10] Subsequent to completion of this analysis, staff would initiate a rulemaking to revise the waste classification tables to explicitly include DU.

The primary advantage of Option 3 is that DU would be given a specific concentration limit, similar to the other radionuclides currently listed in § 61.55, and a specific waste classification that would apply to any LLW disposal site in the United States. The development of such a generic classification could prove useful if the current LLW environment were to change drastically in the future (e.g., if several new LLW disposal facilities are proposed) because it would eliminate the need for a site-specific analysis for large quantities of DU. The primary disadvantage of Option 3 is that the concentration limit developed could be so low for a reference site that it would unnecessarily constrain disposal options at sites with significantly different characteristics (e.g., humid vs. arid). As such, this approach would be prescriptive rather than a risk-informed approach, which would take into account the performance of the waste in a specific disposal environment. Another drawback to Option 3 is that it propagates the existing waste classification system, which was developed using often conservative assumptions based on the environment for LLW at the time the Part 61 FEIS was developed; some of these assumptions are not necessarily applicable in today's environment of limited disposal options and improved performance assessment capabilities.

Option 4 – Re-examine the existing waste classification framework

A final option staff considered is to risk-inform the entire waste classification framework by using updated modeling and performance assessment techniques to evaluate and revise the existing waste classification tables for all radionuclides, if necessary, not just for DU. This revision would likely involve different methodologies and assumptions than the original Part 61 methodology for key variables, such as: disposal configurations, performance periods,

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[10] "To help provide conservative bounds to potential costs and impacts of waste disposal, the reference LLW disposal facility is assumed to be sited in a humid eastern environment." Part 61 FEIS, NUREG-0945, Vol. 1, (November 1982) at 4-10.

institutional control periods, waste forms, site conditions, exposure pathways, and receptor scenarios. The existing Part 61 waste classification framework is well accepted by the LLW disposal industry, and has been used successfully for more than two decades. However, as mentioned above, some of the assumptions built into the framework could be considered conservative and inconsistent with today's movement towards risk-informed regulation. In addition, the approaches to incorporate and evaluate the impacts of uncertainty and variability were more limited than those used currently.

Staff could also consider, for example, the International Atomic Energy Agency's waste classification system to determine if it would be appropriate for use in the United States. [11] Subsequent to completion of this analysis, staff would initiate a rulemaking to revise the waste classification tables. This rulemaking would likely draw the most stakeholder input of all the options presented in this paper, as it could potentially make significant changes to the entire existing waste classification environment.

The primary advantage of Option 4 is that the waste classification framework would reflect current knowledge of the performance of LLW disposal facilities and would present risk-informed concentration limits for all radionuclides, not selectively for DU. An update of the methodology used to develop the concentration limits could result in higher or lower concentration limits than currently used, which could actually increase or decrease disposal options for some types of wastes (e.g., current Class B/C waste could become Class A waste). However, some stakeholders may view this to be "deregulation" of LLW. A disadvantage of Option 4 is that the efficiency that could be gained from updating the existing waste classification framework may not be the most effective use of agency resources, given the relatively low increase in health and safety achieved and the small number of currently operating LLW disposal facilities. Option 4 is well beyond the scope of what the Commission directed the staff to consider in Order CLI-05-20, and would require a large amount of time and resources.

RECOMMENDATIONS:

Staff concluded that large quantities of DU can be disposed of in a near-surface disposal facility under certain conditions and meet the performance objectives of Part 61. However, staff believes a change to existing regulations is necessary to ensure large quantities of DU are disposed of safely due to the unique characteristics of the waste and additional considerations required for its disposal.

The staff recommends the Commission approve:

1. Option 2 — Rulemaking to specify a requirement for a site-specific analysis for large quantities of DU in § 61.55(a)(6) and technical requirements for such an analysis. This option provides a risk-informed approach to protecting public health and safety while causing minimal disruption to the existing waste classification system, yet codifying the requirement for a site-specific analysis in Part 61 for use by NRC, Agreement States, licensees, and future license applicants.

[11] International Atomic Energy Agency, "Classification of Radioactive Waste--A Safety Guide," Safety Series No.111-G-1.1. Currently being revised. See Draft Safety Guide No. DS 390, "Classification of Radioactive Waste."

2. That staff develop a guidance document for public comment that will outline the appropriate parameters and assumptions to use in conducting a site-specific analysis for disposal of large quantities of DU.

RESOURCES:

Staff's recommended option will require 2.0 full time equivalents (FTE) in FY10 to complete the documentation of the staff's technical analysis and to finish a draft of the guidance document. An additional 0.5 FTE is required to complete the technical basis for the rulemaking and to obtain stakeholder input on the guidance document. This 2.5 FTE will be obtained through a re-allocation of the common prioritization process for FY10 rulemakings. The remaining resources are needed in FY11 and FY12, and they will be requested through the budget process and the common prioritization process for upcoming rulemakings.

Enclosure 2 presents a detailed table of the resources required for each option presented in this paper.

COORDINATION

The Office of the General Counsel has no legal objection concerning this paper. The Office of the Chief Financial Officer has reviewed this paper for resource implications and has no objections. Staff coordinated with Agreement States (Washington, Utah, South Carolina, and Texas) and DOE during the development of options for this paper.

/RA/

R. W. Borchardt
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Enclosure:
1. Analysis of Depleted Uranium Disposal
2. Resources
3. Depleted Uranium - Additional Options Evaluated

ANALYSIS OF DEPLETED URANIUM DISPOSAL

OVERVIEW:

A screening model has been developed by staff of the performance assessment branch in the Division of Waste Management and Environmental Protection to evaluate the risk and uncertainties of depleted uranium (DU) disposal as low-level waste (LLW) with near-surface disposal at a generic site. The model was developed to understand the impacts of key variables on the risks from disposing of DU in near-surface disposal, such that staff could respond to Commission direction to consider whether the quantities of DU in the waste stream from uranium enrichment facilities warrant amending the waste classification tables in 10 CFR Part 61 (Part 61). The model was developed to evaluate the radiological risk to potential future residents and intruders (acute or chronic exposures) near or on the land overlying a hypothetical disposal facility for the large quantities of DU anticipated to be disposed of as a result of fuel enrichment facility operations. The model was designed to provide the user flexibility in evaluating different waste types and forms, disposal configurations, performance periods, institutional control periods, pathways, and scenarios.

The model was constructed with the dynamic simulation software package GoldSim®, developed by GoldSim Technology Group of Issaquah, WA. Goldsim is a Monte Carlo simulation software solution for dynamically modeling complex systems in business, engineering and science. GoldSim is used for decision and risk analysis by simulating future performance while quantitatively representing the uncertainty and risks inherent in all complex systems. GoldSim has been used by U.S. Nuclear Regulatory Commission (NRC) staff to risk-inform reviews of U.S. Department of Energy (DOE) performance assessments (Esh, 2002; Esh, 2006). GoldSim is used by over 30 organizations in the field of radioactive waste management. A component or modular approach can be used in GoldSim to build a performance assessment model, which is the approach used in this analysis. Main submodels include inventory, source term, infiltration, radon, groundwater transport, and biosphere. Submodels use deterministic and probabilistic input values or distributions.

The model was used to understand the impacts of key variables on the risks from disposing of DU in near-surface disposal. Key variables evaluated were: disposal configurations, performance periods, institutional control periods, waste forms, site conditions, pathways, and scenarios. Calculations were performed probabilistically to represent the impact of variability and uncertainty on the results. The analysis methodology in the current assessment was consistent with the technical analysis methodology used for the development of the environmental impact statements supporting Part 61. This approach allowed constraints to be identified for the safe disposal of large quantities of DU in near-surface disposal. Because there were a wide range of variables considered, summary conclusions are not absolute; *a site-specific analysis may demonstrate compliance with the performance objectives when the summary conclusions found below indicate otherwise*. However, the properties and characteristics of DU present constraints on approaches for disposal. The summary conclusions provide the technical framework for policy decisions. The main technical observations are:

- Depleted uranium has some characteristics that are dissimilar from commercial LLW.
  - A large percentage of the activity is associated with very long-lived radionuclides.

  - Radioactive decay results in increasing hazard with time until after 1 million years, as a result of increasing concentrations (and higher mobility) of decay products.
  - In-growth of significant quantities of a daughter in gaseous form (^{222}Rn)
- Estimated risks are sensitive to the performance period.
- Estimated risk from radon is sensitive to the disposal depth.
- Radon fluxes to the environment are very sensitive to the long-term moisture state of the system.
- Large uncertainties (and little available data) associated with some transfer factors for uranium daughter products.
- Estimated disposal facility performance is strongly dependent on site-specific hydrologic and geochemical conditions.
- Radon is limiting at arid sites and for shallow disposal.
- The groundwater pathway is limiting at humid sites.
- Grouting of the waste may improve the likelihood of an arid site meeting the performance objectives with respect to radon; however, grout may enhance the mobility of uranium in the groundwater pathway after the grout degrades.

The summary conclusions from the technical analysis are:

- Near-surface disposal (i.e., less than 30 meters [m], as defined in Part 61) may be appropriate for large quantities of DU under certain conditions. However, unfavorable site conditions can result in the performance objectives not being met. Examples of unfavorable conditions include shallow disposal (< 3 m depth) and humid sites with a potable groundwater pathway.
- Because of the in-growth of radon and other daughter products, periods of performance of 1,000 years or less result in a significant truncation of estimated risk.
- Shallow disposal (< 3m deep) is likely to not be appropriate for large quantities of DU, regardless of site conditions. Shallow disposal may be possible if robust intruder barriers, excluding the possible excavation of DU, and a robust radon barrier that can effectively limit radon fluxes over the period of performance are installed, and their performance is justified. Small quantities (1 – 10 metric tons) could be disposed of at shallow depths.
- Depleted uranium can be disposed of under arid conditions and meet the Part 61 performance objectives for 1,000 to 1 million year performance periods, if the waste disposal depth is large, or robust barriers are in place to mitigate radon.
- Disposal under humid conditions with viable water pathways is probably not appropriate for large quantities of DU.

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Acronyms

ACNW	Advisory Committee on Nuclear Waste
AEA	Atomic Energy Act
CFR	Code of Federal Regulations
DEIS	Draft Environmental Impact Statement
DOE	Department of Energy
DU	Depleted uranium
EPA	Environmental Protection Agency
FEIS	Final Environmental Impact Statement
HLW	High-Level Waste
ICRP	International Committee on Radiation Protection
LLW	Low-Level Waste
LLRW	Low-Level Radioactive Waste
LLRWPAA	Low-Level Radioactive Waste Policy Act Amendments
NAS	National Academy of Sciences
NRC	Nuclear Regulatory Commission
TEDE	Total Effective Dose Equivalent

INTRODUCTION

The NRC staff is conducting a technical analysis to assess the potential impacts of disposal of large quantities of DU in a generic near-surface disposal facility and to determine if current low-level radioactive waste (LLRW) classification criteria warrant modification for large quantities of DU. Staff of the performance assessment branch in the Division of Waste Management and Environmental Protection developed a screening model to evaluate the risk and uncertainties associated with the disposal of DU in near-surface disposal. The model was developed to understand the impacts of key variables on the risks from disposing of DU as LLW, such that the staff could respond to Commission direction to consider whether the quantities of DU in the waste stream from uranium enrichment facilities warrant amending the waste classification tables in Part 61.

The model was developed to evaluate the radiological risk to potential future residents and intruders (acute or chronic exposures) near or on the land overlying a hypothetical disposal facility for DU. The model was designed to provide the user with flexibility to evaluate different waste forms, disposal configurations, performance periods, institutional control periods, pathways, and scenarios. The impact of these variables on projected radiological risk can be significant. Therefore, the model was developed as a first-order assessment tool to risk-inform decision making. Refinement of the model would be necessary if it was to be used for licensing decisions, and rigorous validation would be needed. Because site-specific waste management decisions or other variables can strongly influence whether performance objectives can be met, care should be taken not to take the model results out of the analysis context.

The model was constructed with the dynamic simulation software package GoldSim®, developed by GoldSim Technology Group of Issaquah, WA. Goldsim is a Monte Carlo simulation software solution for dynamically modeling complex systems in business, engineering, and science. GoldSim is used for decision and risk analysis, by simulating future performance while quantitatively representing the uncertainty and risks inherent in all complex systems. GoldSim has been used by NRC staff to risk-inform reviews of DOE performance assessments (Esh, 2002; Esh, 2006). GoldSim is used by over 30 organizations in the field of radioactive waste management.

This report is not intended to provide full documentation of the technical analysis performed to develop the risk insights associated with DU. The report is intended to provide a summary of the analysis and resultant risk insights developed by the staff.

PROBLEM CONTEXT

The NRC LLRW regulatory program ensures the continued safe and secure LLRW disposal under the Atomic Energy Act (AEA) of 1954 and the Low-Level Radioactive Waste Policy Act Amendments (LLRWPAA) of 1985. A primary goal of the LLRWPAA is to ensure that disposal capacity would be available for all classes of LLRW generated by AEA licensees. Criteria for determining the classification of LLRW are specified in Part 61 of Title 10 of the Code of Federal Regulations (CFR). The original development of Part 61 did not explicitly consider a waste stream involving the large amounts of DU that has ensued from the operation of a commercial uranium enrichment facility (NRC, 1981). Therefore, the Commission directed the staff to consider whether the quantities of DU in the waste stream from uranium enrichment facilities warrant amending the waste classification tables in Part 61 (NRC, 2005). The nature of the

radiological hazards associated with DU presents challenges to the estimation of long-term effects from its disposal – namely that its radiological hazard gradually increases due to the in-growth of decay products, eventually peaking after 1 million years, rather than decreasing significantly over a few hundred years like that of typical LLW.

Characteristics of DU

Depleted uranium can have a variety of chemical and physical forms dependent on the enrichment process used. Depleted uranium is produced in the enrichment process as a waste product or byproduct. The source term results from the fact that the enrichment process concentrates both the ^{235}U and ^{234}U in the product, and therefore, these radionuclides are depleted in the waste or byproduct. Metallic DU contains approximately 99.75 percent ^{238}U, 0.25 percent ^{235}U, and 0.002 percent ^{234}U (Kozak, 1992). Depleted uranium oxide contains approximately 85 percent uranium by mass. In comparison, a low-grade uranium ore common in the United States may contain 0.1 percent uranium by mass. The most prevalent forms of DU for disposal resulting from fuel cycle activities are depleted uranium hexafluoride (UF_6) and depleted uranium oxide (UO_2 or U_3O_8), which results from deconversion of fluoride forms. Uranium oxides include UO_2, U_3O_8, and uranium trioxide. Both UO_2 and U_3O_8 are solids that are significantly more stable than UF_6 over common disposal conditions, making the oxide forms more suitable for long-term storage or disposal. Uranium hexafluoride reacts with water to form corrosive hydrogen fluoride (HF).

Depleted uranium contains three principal radionuclides after production: ^{238}U, ^{235}U, ^{234}U. Over time, the parent radionuclides decay through the uranium series decay chains producing daughter radionuclides. In natural ores, the daughter radionuclides are generally in secular equilibrium with the parent radionuclides. For mill tailings, a significant portion of the total activity at the time of disposal is associated with radium, therefore disposal or management decisions can focus on the radiological inventory at the time of disposal. For example, a barrier to attenuate the emanation of radon from mill tailings can be designed based on the concentration of the material at the time of disposal. On the other hand, DU is essentially depleted in the daughter radionuclides but concentrated (compared to natural ore or mill tailings) in the parent radionuclides. Over long periods of time, the uranium parent radionuclides have the potential to produce quantities of daughter radionuclides significantly in excess of natural ores or mill tailings because the DU source has much higher concentrations of uranium. For example, mill tailings commonly have from 0.004 to 0.02 wt percent U_3O_8, 26 to 400 pCi/g ^{226}Ra, and 70 to 600 pCi/g ^{230}Th at the time of disposal (Robinson, 2004). Depleted uranium (in oxide form) would have approximately 99.9 percent uranium oxide at the time of disposal and greater than 300,000 pCi/g ^{226}Ra and ^{230}Th approximately 1 million years after disposal (values cited were calculated with a simple decay/in-growth calculation). Because the daughter radionuclides are different elements, they have different mobility in the environment than the parent radionuclides and in some cases are significantly more mobile (e.g., radon).

Figure 1 provides the ratio of the activity of DU at various times to its initial activity. For comparison, a similar ratio for a commercial LLW facility is provided based on data from Barnwell, South Carolina (Chem-Nuclear Systems, 1995). Whereas the activity in a commercial LLW facility decreases to a few percent of the initial value over a few hundred years, the activity in a facility for DU would be expected to remain relatively constant initially, but begin increasing

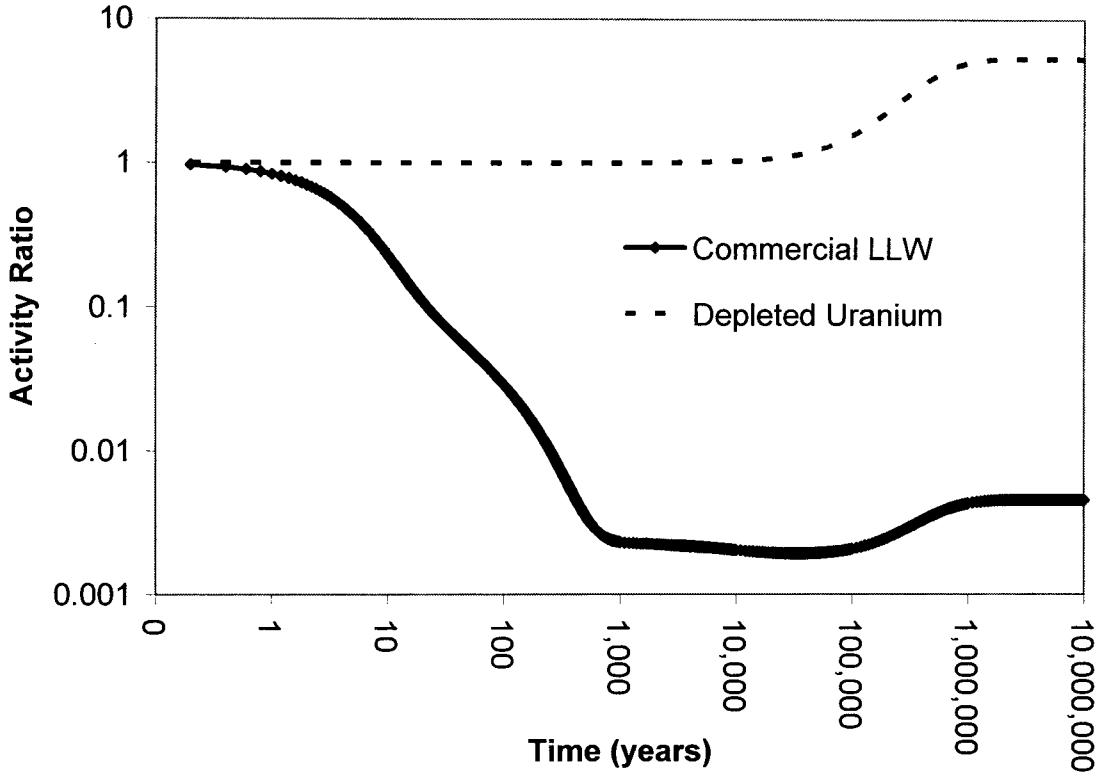


Figure 1 Activity Ratios of DU and a Commercial LLW Facility. The activity ratios are defined as the initial activity to the activity at various points in time.

at around 1,000 years. Peak activity, assuming no release from the source, would not be attained until after 1 million years after disposal. The ratio for DU shown in Figure 1 is determined by the number of daughter radionuclides represented in the decay chain, because the daughter radionuclides are in secular equilibrium with the long-lived parents for long periods of time. In addition, the activity of some risk significant radionuclides (e.g., ^{222}Rn, ^{210}Pb) increase by a much more significant amount than the overall activity. The activity of ^{222}Rn and ^{210}Pb in particular increase by more than a factor of 1,000 between 1,000 years to 1 million years after disposal. Because different elements can have different mobility and radiotoxicity, total activity cannot be directly translated to risk (dose). As a result of these characteristics of the source term, assessment of the risk of DU disposal in the near-surface requires an evaluation of a number of different features, events, and processes over timeframes that could be substantial.

Past Regulatory Approaches to LLW Analysis

The Draft Environmental Impact Statement (DEIS) (NUREG-0782), the Final Environmental Impact Statement (FEIS) (NUREG-0945), and an update to the impact analysis methodology (NUREG/CR-4370) for Part 61 provide a description of the analysis approach for evaluation of near-surface disposal of commercial LLW. These references provide a full description of the analysis approach. This section provides a summary of key aspects and assumptions for the analysis in order to provide context for the current problem.

The analysis to support development of Part 61 considered different periods of institutional control (NRC, 1981). The final regulations in 10 CFR 61.59(b) specify that institutional controls may not be relied upon for more than 100 years. At the time of development of Part 61, it was envisioned that LLW in a disposal facility would decay, in a maximum of 500 years, to activity levels that would not pose a significant risk to an inadvertent intruder, and that there would not be significant quantities of long-lived isotopes which would pose unacceptable long-term risks to the public from releases from the facility. In developing Part 61, NRC considered longer periods of institutional control in the DEIS (NRC, 1981). Assumptions about the persistence of institutional controls in the international community were considered and a series of public meetings were conducted to get input from stakeholders. The consensus among the stakeholders was that it is not appropriate to assume institutional controls will last for more than a few hundred years. The resultant regulatory framework for commercial LLW disposal assumes material that does require institutional control for much longer than 100 years to demonstrate compliance with the performance objectives would generally be determined to not be suitable for near-surface disposal as LLW. The regulatory philosophy is that the engineered and natural system should afford protection to the public, without total reliance on institutional control of the site, because of the relatively large uncertainty associated with predicting societal systems. The institutional controls allow monitoring and maintenance of the disposal facility to be completed and also restrict access to a disposal facility after closure (NRC, 1981).

The analysis for development of Part 61 applied the following assumptions with respect to receptors and eventual use of the disposal site. After the period of active institutional control ended (as discussed above), the public receptor was assumed to engage in residential, agricultural, or other activities at the boundary of the disposal site. These assumed activities were consistent with current regional practices. The disposal site included a buffer zone around the disposal area, where the disposal area circumscribed the disposal units (NRC, 1982). An appropriate buffer zone was expected to extend approximately 100 m (330 feet [ft]) from the disposal area, although buffer zones up to 1,000 m (3,300 ft) were considered. A receptor engaging in activities on the disposal site, rather than outside the buffer zone, was regarded as the inadvertent intruder. A receptor engaging in activities at the edge of the buffer zone was regarded as a member of the public. Figure 2 provides a schematic representation of the concepts considered.

The Part 61 impacts analysis was generic in nature and focused toward helping to establish generic criteria for LLW management and disposal, including developing requirements for waste classification (NRC, 1981). A fairly large number of variables were considered in the analysis, including, but not limited to: waste form and processing, disposal environment, facility design, control, and technical indices for aspects such as leachability, dispersibility, stability, and chemical content. Impacts were assessed for offsite members of the general public as well as onsite acute and chronic scenarios resulting from exposure to or disruption of the waste. Inadvertent intrusion was assumed to occur following a breakdown of institutional controls. The intruder was assumed to excavate and construct a residence on the disposal site (intruder-construction), or occupy a dwelling located on the disposal site (intruder-agriculture) and ingest food grown in contaminated soil (NRC, 1981). The intruder-agriculture scenario was assumed to be possible only if the waste had degraded to an unrecognizable form. Exposure to radionuclides through inhalation of contaminated soil and air, direct radiation, and ingestion of contaminated food and water were considered. Additional exposed waste scenarios were considered as well as other potential exposure pathways. The intruder-agriculture scenario,

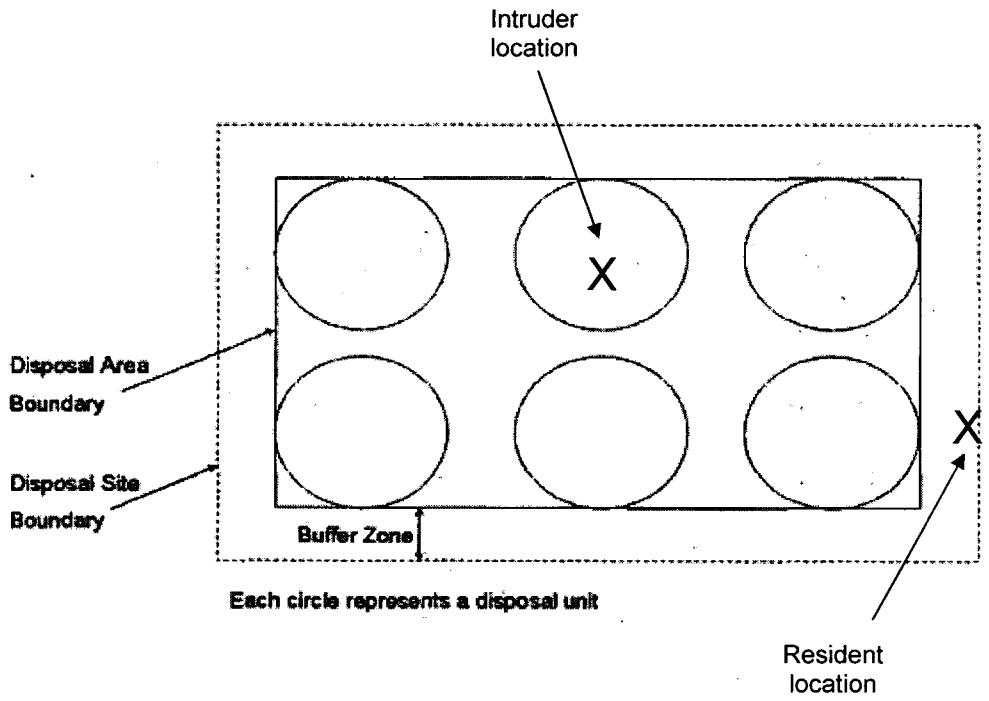


Figure 2 Geometric Relationship of the Disposal Units, Disposal Area, and Buffer Zone of a Disposal Site. Adapted from the Final Environmental Impact Statement for Part 61 (NRC, 1982).

along with a 500 millirem (mrem) dose value, was used to develop the waste classification tables found at 10 CFR 61.55. Requirements for a specific intruder scenario or dose value are not found in Part 61. The use of a higher dose value for the inadvertent intruder analysis (500 mrem), compared to the value specified in 10 CFR 61.41 for the general public (25 mrem/yr), implies that the loss of institutional control by a state or federal agency was believed to be unlikely, if a similar level of protection was being afforded to a member of the public whether they were an intruder or resident receptor. The approach to developing the waste classification system was believed to provide protection of public health and safety under a variety of conditions. However, it was also recognized that unique characteristics of waste, disposal sites, and methods of disposal may lead to alternative requirements for waste classification.

The update of the Part 61 impacts analysis methodology explicitly addressed the effects of radon gas generation (NRC, 1986), which is important for disposal of DU in the near-surface. Radon was recognized to be generated in some waste streams, in which case the in-growth of radon gas in buildings was expected to be included in the intruder-agriculture scenario. The impacts analysis update provided approaches to calculate radon doses, and stated that the doses should be added to other impacts calculated for the intruder-agriculture scenario. However, the DEIS and FEIS did not envision large quantities of material that could generate radon would be disposed of as LLW. The Part 61 DEIS assumed 17 Curies (Ci) of ^{238}U and 3 Ci of ^{235}U would be disposed of in 1 million m^3 of waste over a 20-year generic LLW site operating life (NRC, 1981). The performance objectives in Subpart C of Part 61 do not provide explicit requirements for radon. Radon is discussed in NUREG-1573, *A Performance Assessment Methodology for Low-Level Radioactive Waste Disposal Facilities: Recommendations of NRC's Performance Assessment Working Group,* as being included as part of the assessment of

gaseous releases in LLW disposal (NRC, 2000). The U.S. Environmental Protection Agency (EPA) standards for uranium mill tailings (40 CFR 192) provide a ^{222}Rn release rate limit of 20 picocuries (pCi)/m^2-s from the cover over the tailings and a ^{222}Rn concentration in free air (outside the site, above background) of 0.5 pCi/L. The DOE takes a similar approach to managing radon from disposal facilities, through specification of a 20 pCi/m^2-s flux limit. For comparison, the mean value for atmospheric radon in the United States is approximately 0.25 pCi/L. Studies of indoor radon levels indicate an average concentration of from 1.5 to 4.2 pCi/L (Alter and Oswald, 1987; Nero et al, 1986). Daily intake of radon is generally much more significant from indoor exposure than from outdoor exposure. Indoor radon concentrations are higher because the flow rate of clean air (i.e., the exchange rate) is much lower than outdoors, and other factors. Daily intake of radon indoors is as much as ten times higher than outdoors (Cothern et al., 1986). The flux limit standard of 20 pCi/m^2-s would generally result in inhalation doses to a hypothetical resident next to the disposal facility on the same order as the 10 CFR 61.41 dose limit of 25 mrem/yr. However, the translation of a flux rate to dose is dependent on a number of site-specific and receptor scenario variables.

Period of Performance

The staff has reviewed various approaches for the period of performance under several NRC regulations. The following discussion summarizes current NRC regulatory approaches to the period of performance in waste management.

A value for the performance period is not provided in Part 61, in part due to the site-specific and source-specific influence on the timing of projected risk from a LLW facility. A performance period of 10,000 years was included in the DEIS for Part 61 (NUREG-0782). The recommended performance period by the performance assessment working group for a typical commercial LLW facility is 10,000 years (NRC, 2000). This performance period is considered to be sufficiently long to capture the risk from the short-lived radionuclides, which comprise the bulk of the activity disposed, as well as the peaks from the more mobile long-lived radionuclides, which tend to bound the potential doses at longer timeframes (greater than 10,000 years). The recommendations of the NRC's performance assessment working group, found in NUREG-1573, noted that there would be exceptions to the 10,000 year performance period recommendation. Disposal of large quantities of uranium or transuranics was one of the examples of an exception provided in NUREG-1573. The issue of the performance period was presented to the Commission in SECY-96-103. The Advisory Committee on Nuclear Waste (ACNW) expressed a similar concern as the performance assessment working group. The ACNW, in a February 11, 1997, letter to the Commission, stated:

> "The potential for significant quantities of certain long-lived radionuclides, such as uranium in near-surface LLW sites, is greater than was anticipated in the DEIS for 10 CFR Part 61. The result is that peak doses may not occur until a long period of time has passed, perhaps tens or hundreds of thousands of years. In addition, the risk from decay products may be higher than that of the parent. If the calculated doses at very long periods exceed the standard by significant factors, the LLW disposal system may require modification."

A required performance period for robust engineered barriers used in the disposal of Class C waste is specified in Part 61 as 500 years [10 CFR 61.52(a)(2)]. This performance period is necessary to ensure that the Class C waste can be protected from inadvertent intrusion until it

decays to safe levels. Class C waste can be disposed of with a robust intruder barrier or be disposed of at depths below 5 m; either measure would be protective of public health and safety (see Part 61). The performance period for engineered barriers used to limit inadvertent intrusion and demonstrate compliance with 10 CFR 61.42 is not the same as the performance period for demonstration of compliance with 10 CFR 61.41, protection of the public. For example, demonstration of compliance with 10 CFR 61.41 typically involves assessment of radionuclide transport through groundwater pathways, and the associated travel time for some radionuclides is typically in excess of 500 years. The processes and pathways potentially leading to exposure to the public under 10 CFR 61.41 are typically indirect, whereas the processes and pathways leading to exposure to the public (inadvertent intruder) under 10 CFR 61.42 are direct. The peak doses for inadvertent intrusion usually occur in the year of intrusion, because commercial LLW contains a significant fraction of short-lived radionuclides, whereas the peak doses for demonstration of compliance with 10 CFR 61.41 are usually delayed as a result of transport through the environment. The performance period for engineered barriers, combined with the waste classification system, ensures that the public health and safety would be protected in the event of inadvertent intrusion into the waste.

Other waste management programs that use a period of performance include decommissioning, high-level waste (HLW) disposal, and management of mill tailings. Subpart E of 10 CFR Part 20 provides that the analysis for decommissioning of sites should estimate the peak annual dose within the first 1,000 years after decommissioning. However, at most, but not all, facilities undergoing decommissioning, the quantity of long-lived radionuclides of concern are generally limited. In addition, the contamination is generally distributed in the accessible environment and the analysis for unrestricted use assumes direct land use of the contaminated site. Because there is generally assumed to be direct (inadvertent) access to the contamination, the risk from long-lived radionuclides that may have long environmental transport times is captured with the 1,000 year period of performance.

The period of performance for geologic disposal of high-level nuclear waste is based on a number of considerations, including but not limited to: sufficient period of time to ensure safety of humans and the environment for the release of radiation following loss of integrity of engineered barriers; adequate time period to incorporate significant processes and events that impose greatest risk; restricted time period during which uncertainties can be prescribed with reasonable assurance; and sufficient time such that the source term is greatly reduced and roughly equivalent to the hazard from a natural ore body (NRC, 2001). The generic (i.e., for sites other than Yucca Mountain) standards and regulations for HLW disposal (40 CFR Part 191 and 10 CFR Part 60) specify a compliance period of 10,000 years. Site-specific standards and regulations have been developed for HLW waste disposal at Yucca Mountain, Nevada, as directed by statute. The compliance period for Yucca Mountain was specified in EPA's standard (40 CFR Part 197) at 10,000 years. However, the compliance period was remanded on a procedural basis because the findings and recommendations of the National Academy of Science (NAS) were not adequately considered as required by the Energy Policy Act of 1992. The NAS stated that compliance assessment is feasible for most physical and geologic aspects of repository performance on the time scale of 1 million years at Yucca Mountain. For HLW disposal, the NAS recommended that the compliance assessment be conducted for the time when the greatest risk occurs, within the limits imposed by the long-term stability of the geologic environment. As a result of the remand, EPA has proposed a revised standard (i.e., different dose limit, and further constraints for performance assessment for the period beyond 10,000 years) to address the difficulties and uncertainties in conducting analyses beyond 10,000 years.

The standards for the management of uranium mill tailings in 10 CFR Part 40, Appendix A, requires disposal in accordance with a design that provides reasonable assurance of control of radiological hazards for 1,000 years and, in any case, for at least 200 years. The standard also requires perpetual governmental ownership and long-term surveillance of the site (which may include monitoring as necessary). Therefore, no prolonged inadvertent access or use of the site is assumed during this period. Flux limits are applied for ^{222}Rn averaged over the cover system and standards for groundwater protection are specified. As discussed previously, two primary differences between the source terms for uranium mill tailings and DU are the concentrations of uranium and the initial and eventual concentration of daughter radionuclides. Depleted uranium has much higher initial concentrations of uranium and much lower initial concentrations of daughter radionuclides. However, the eventual concentrations of daughter radionuclides in DU will be much higher than mill tailings.

Internationally, there is no consensus on the approaches used for period of performance (NEA, 2002). Many countries consider a multi-step approach with early and longer assessment periods, although some countries do not specify a time of compliance. The NRC LLW regulations do not specify a period of performance. However, the documentation supporting the environmental impact statements for Part 61 and related guidance documents recognized the need to use a period of performance commensurate with the persistence of the hazard of the source (NRC, 1981; NRC, 1982; NRC, 2000). Selection of a period of performance generally considers the characteristics of the waste, the analysis framework (assumed scenarios, receptors, and pathways), societal uncertainties, and uncertainty in predicting the behavior of natural systems over time.

ANALYSIS FRAMEWORK

The primary objective of the analysis was to understand the impacts of key variables on the risks from disposing of DU as LLW such that staff could respond to Commission direction to consider whether the quantities of DU in the waste stream from uranium enrichment facilities warrant amending the waste classification tables in Part 61. Therefore, the current analysis used a framework similar to the analysis performed for the DEIS and FEIS supporting Part 61, as discussed below. Although computational tools and methods to incorporate and evaluate uncertainty have improved, and therefore, were used in the current analysis, staff believed the regulatory framework used in the development of Part 61 remains appropriate today.

Evaluation of protection of the general population from releases of radioactivity (10 CFR 61.41) was performed for leaching of contaminants to a water pathway and diffusion of radon to the atmosphere. The general population was assumed to reside offsite during the institutional control period, and then outside a buffer zone surrounding the disposal area boundary after the institutional control period. The model was structured such that the length of the institutional control period was evaluated in the analysis in order to assess the sensitivity of the results to the institutional control period. The protection of individuals from inadvertent intrusion was evaluated with acute and chronic exposure scenarios following either excavation into the waste, excavation above the waste but not into the waste, or drilling through the waste. The particular intruder scenario evaluated was based on the depth to waste. Below a disposal depth of 3 m, disruption of the waste via excavation was not believed to be credible for a resident-intruder scenario. Notable differences from the analysis performed to support Part 61 were (current analysis described): probabilistic assessment of uncertainty and variability, and use of updated dose conversion factors and the International Committee on Radiation Protection (ICRP) 26 and 30 dosimetry models. Also as previously noted, the purpose of the screening analysis was

to evaluate key variables such as disposal configurations (disposal depth and barriers), performance periods, institutional control periods, waste forms, site conditions, pathways, and scenarios. Some of these variables were evaluated outside of ranges that may have been used in the LLW impacts analysis.

Key assumptions for the analysis included:

- Depleted uranium would be disposed of in an oxide form. The model included the capability to look at other forms, but those capabilities were not used in the analysis.
- Although smaller disposal quantities were evaluated, most analyses assumed approximately 300,000 m^3 of DU in the fluoride form would be converted to an oxide for disposal. The quantities assumed were 700,000 metric tons from DOE and 700,000 metric tons from operation of commercial uranium enrichment facilities (DOE, 2007; NRC, 2006; NRC, 2005).
- There was no co-disposal of other waste that would impact release or mobility of the DU.
- The basic disposal configuration was placement of 200 L carbon steel packages of DU in below ground disposal cells that were backfilled with native soil.
- The disposal system was assumed to have an engineered cover that would limit infiltration (performance set by the user in the analysis).
- The disposal system was assumed to have a clay layer as a radon barrier. The thickness of the clay was assumed to be 0.5 m for the results reported in this report.
- Additional performance credit of engineered features was not assumed, given the long-timeframes evaluated and the current types of technology used in near-surface disposal. Engineered features can have a large impact on performance, but justification of that credit beyond hundreds of years can be challenging.
- The liquid saturation of various materials in the analysis was temporally-invariant, but varied stochastically with each probabilistic realization.
- After the active institutional control period, the resident receptor would be located outside a buffer zone surrounding the disposal area.
- Site stability requirements would be achieved. There will not be significant releases of waste to the environment from fluvial or aeolian erosion.
- Extreme events, such as pyrophoricity, would be avoided through disposal conditions or other requirements.
- Soil-to-plant transfer factors are valid over the range of concentrations of radionuclides projected to be released to the soil from DU.
- Radon was included in the dose assessment. The concentration of radon that a member of the public is exposed to is equal to the atmospheric concentration over the site (e.g., the site is large enough such that additional dilution during transport to a receptor located at the disposal site boundary is limited).
- Radon gas was assumed to be transported through the system by diffusion. Barometric pumping was not included. The validity of this assumption is questionable for shallow disposal depths in arid environments in particular. However, under those conditions, the doses were sufficiently large that the primary output metric of whether the system could meet the performance objectives would not be impacted (i.e., the results already exceeded the performance objectives).
- The quantity of material being disposed is sufficiently large such that lateral dispersion during transport through groundwater can be neglected.
- Colloidal transport was neglected.

MODEL DESCRIPTION

A screening model was developed as a first-order assessment tool to evaluate the radiological risk to future residents and intruders (acute or chronic exposures) near or on the land overlying a hypothetical disposal facility for DU. The model was designed to provide the user with flexibility to evaluate different waste types and forms (e.g., fluoride types, oxides types, powdered forms, and solid forms), disposal configurations, performance periods, institutional control periods, pathways, and scenarios. Refinement of the model would be necessary if it was to be used for licensing decisions, and rigorous validation would be needed. Because site-specific waste management decisions or other variables can strongly influence whether performance objectives can be met, the results should not be taken out of the analysis context.

The model was constructed with the dynamic simulation software package GoldSim®. A hierarchical design to the modeling was used with containers to organize information. At the top level, containers are provided for *Simulation_Settings*, *Materials*, *DU_Analysis_Model*, *Results*, and *Documentation*. Figure 3 provides a screen snapshot of the top level of containment for the model. For version 7.1, the model contains 3,252 GoldSim elements of 19 different types with 10 levels of containment. Stochastic inputs are specified for over 400 variables. Figure 4 provides a screen snapshot of the model structure within the *DU_Analysis_Model* container. The hierarchical design and use of submodels facilitated different team members working on different portions of the model concurrently. The arrows in Figure 4 show the flow of information between containers in the model. The time to execute 100 realizations (repetitions of a probabilistic simulation) is approximately 7 minutes on a quad core 2.66 gigahertz (GHz) personal computer with 3 gigabytes (GB) of random access memory (RAM).

Most controlling parameters for a simulation were organized in the *Simulation_settings* container. This container provides various controls such as parameters for specifying the intrusion time, waste depth, pathway settings (e.g., turn radon or groundwater on/off), and residential properties (presence or absence of a basement, location of the resident with respect to the buried source). Within the *Simulation_settings* container are containers for intruder settings, such as well properties and excavation properties, and source input settings. Source input settings are clones of other elements within the model to allow the user ease of access to change the waste form type, site environment (i.e., humid or arid), and presence of grout. Clones are duplicates of model elements that, when edited, propagate the changes to all of the associated clones.

The *Materials* container provides the species element, solubilities, solids, partition coefficients, and tortuosity calculations. The species element for this model is a vector of the radioisotopes provided in the model including their half-lives and decay chains. The current model explicitly considers 11 radionuclides, although one of the radionuclides is a dummy of ^{222}Rn used to incorporate the effect of variation in emanation, such as if the DU was grouted. The model contains seven different types of solid phases, each which can have different physical properties such as density, porosity, tortuosity, and partition coefficients. Tortuosity of the partially saturated porous media in the engineered cap is specified with one of five different methods. Particular approaches for modeling some of the technical aspects are discussed in further detail in the following paragraphs. The *Results* container provides selected outputs, such as plots of dose histories by scenario, pathway, or radionuclide.

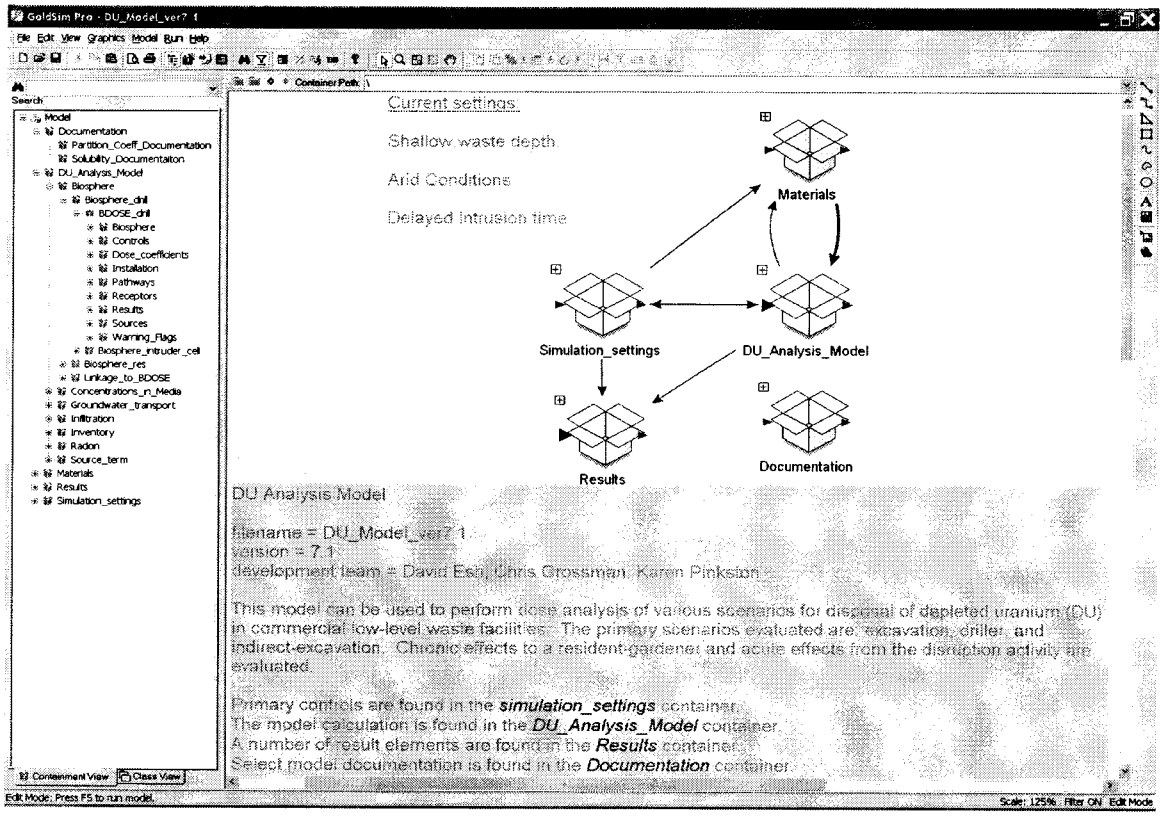


Figure 3 Top-level Containment of the DU Analysis Model

Main submodels include inventory, source term, infiltration, radon, groundwater transport, and biosphere. Submodels use both deterministic and probabilistic input values or distributions. Submodels can be summarized as:

- The inventory model allows the user to specify the quantity and radiologic distribution of the source. The model includes ^{238}U, ^{235}U, ^{234}U and their associated decay chains. Decay chains have been simplified by including the dose contribution of short-lived daughters with the parent radionuclide using a half-life cut off of 30 days. The ^{234}U decay chain explicitly included: ^{230}Th, ^{226}Ra, ^{222}Rn, ^{210}Pb, and ^{210}Po. The ^{238}U decay chain included ^{234}U and its daughter radionuclides previously listed. The ^{235}U decay chain included: ^{231}Pa and ^{227}Ac. The decay of ^{226}Ra is fractioned to ^{222}Rn and a dummy radionuclide, ^{222}Du, to account for emanation loss of ^{222}Rn. This approach results in a decrease in the source concentration of radon, and therefore, decreases the diffusion rate of radon from the source. The fraction of ^{226}Ra that decays to the ^{222}Du is immobile as ^{222}Du. The ^{222}Du decays in place to the next member of the decay chain, thereby not impacting the groundwater pathway calculation.

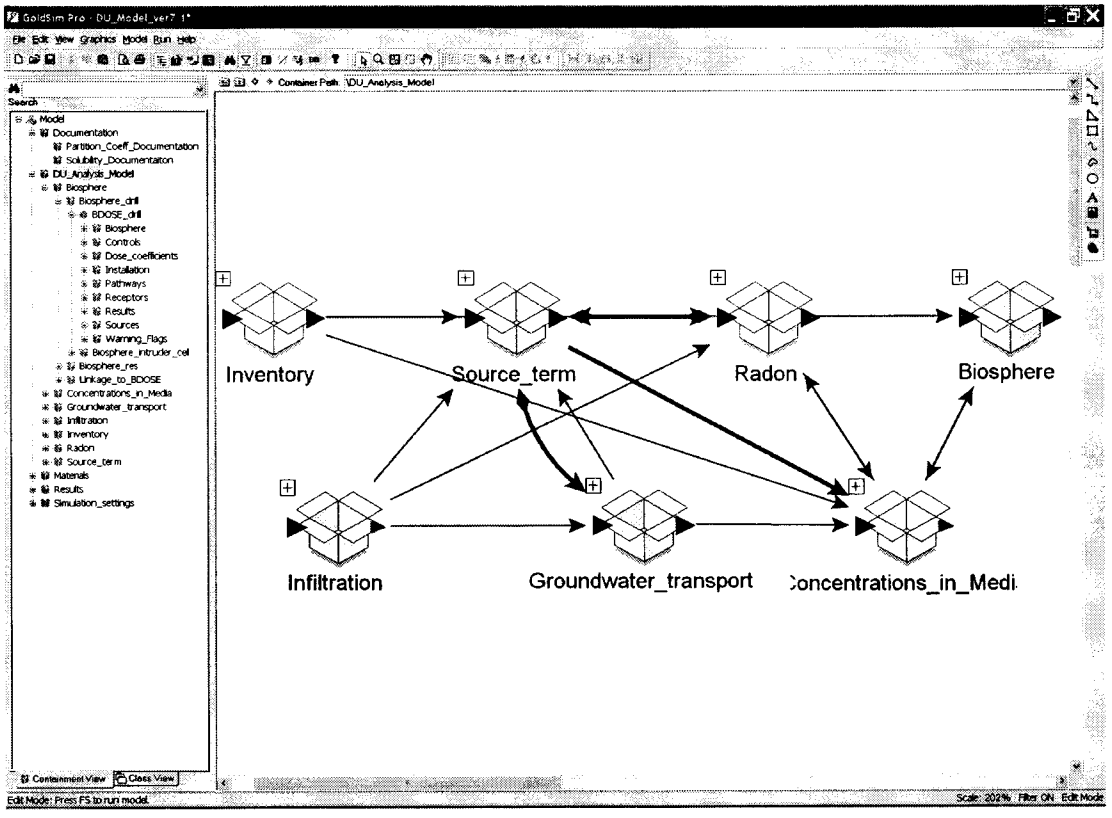


Figure 4 Model Structure within the Main Model Container

- The source term submodel is used to define the quantity, type, and form of the material being disposed; its associated physical and chemical properties; and the geometry of disposal (waste thickness, depth, etc.). The source term submodel can represent the failure of waste containers over time as well as the gradual degradation of the waste form. Waste released from the waste form is available for partitioning between media and release from transport processes. The source term model applies distribution coefficients, based on material type, to partition radionuclides between solid and liquid phases. Solubility limits are also applied, in addition to partitioning, to estimate liquid phase concentrations of radionuclides. The model makes use of cloning of elements with localized containers to apply different solubility limits in different portions of the model. Localization of a container prevents the model portions outside of the container from seeing or manipulating the contents inside the container unless the user specifies otherwise. Partition coefficients are selected with multi-dimensional lookup tables based on sampled values for liquid saturation, pH, and carbonate concentration. An environmental condition switch is used to represent different site types (e.g., humid or arid) by selecting different liquid saturation, pH, and carbonate concentrations. The calculated partition coefficients from this approach were compared to literature values. Numerous references were used to develop the lookup tables and are found in the reference section of this report.

- The infiltration submodel is an abstracted representation of what are complex and dynamic physical processes; the infiltration rate is not calculated in the model but is specified by the user of the model. The user specifies the effectiveness of an

engineered cap to reduce infiltration, and how the performance of the cap decreases over time. This approach allows ease of use to evaluate a full range of infiltration scenarios. Complex infiltration rate profiles could be provided; however, the current analysis was for hypothetical sites without specific infiltration rate data or engineered cover designs. In most analyses, the infiltration cover was assumed to lose its effectiveness a few hundred years after site closure. For arid sites, the long-term infiltration rate was assumed to be on the order of a few millimeters per year. For humid sites the long-term infiltration rate was assumed to be on the order of tens of centimeters per year.

- The radon submodel is used to estimate the flux of radon into the interior of a residence placed over the disposal area or to the external environment. Radon that emanates from radium present in the DU is modeled as diffusing to the surface through an engineered cap. The engineered cap contains a clay layer as well as a soil layer. The thicknesses of the layers are specified by the user. Modeling of radon transport in partially saturated media is subject to a high degree of uncertainty. The gas phase diffusion of radon in partially saturated porous media is highly dependent on the saturation of the media. To take this into account, the tortuosity used in the diffusion calculations is corrected for the saturation of the pore space in the soil and the clay. The model allows the use of one of five different relationships between tortuosity and saturation. The outdoor concentration of radon is calculated by modeling the air above the site as a mixing cell in which the radon is diluted and removed by wind. If a residence is located over the DU disposal area, the radon is also modeled as diffusing through the foundation of the house and into the house. The indoor concentration of radon is calculated by modeling the interior of the house as a mixing cell that has inputs from the diffusive flux of radon from the subsurface and from radon that is brought in from the outdoor air through the ventilation system. Staff compared the estimated radon fluxes with values calculated using Regulatory Guide 3.64 (NRC, 1989).

- Because the assessment was designed to evaluate a range of sites, the groundwater transport modeling was relatively simple from the perspective of temporal and spatial variability. Transport through the unsaturated zone was assumed to be vertical to the saturated zone; transport through the saturated zone was assumed to be horizontal or lateral to a receptors well. Groundwater transport through the unsaturated zone is represented with a series of mixing cells. Advection, partitioning between liquid and solid phases, solubility limits, and decay and in-growth are included in the mathematical representation of a cell. Diffusion can be included in cell elements but has not been included in the current representation because advective transport of radionuclides dominates diffusive transport except under very low flow conditions. Cell elements implicitly include dispersion. Groundwater transport through the saturated zone is represented with GoldSim pipe elements. Pipes are modeled as reactive columns and include advection, partitioning between liquid and solid phases, decay and in-growth, and dispersion. Additional features are available with pipe elements, such as exchanges between immobile storage zones (e.g., matrix diffusion), that are not used in the current analysis. The flux of radionuclides from the unsaturated zone is mixed in the saturated zone based on the characteristic length of the source (the square root of the source area) and a user-defined well screen depth typically set at approximately 5 m. The flow of water entering the saturated zone pipe is based on the hydraulic gradient and hydraulic conductivity of the saturated zone. Because the analysis was generic and hydrologic systems can have widely variable properties, the input distributions were fairly

wide, resulting in hydraulic residence times in the pipe from less than ten to greater than 1,000 years.

- The concentration in media model component is used to provide the outputs of radionuclide concentrations from the source, radon, and groundwater submodels for use in the biosphere submodel to estimate radiological risk.

- The biosphere submodel utilizes the probabilistic dose model BDOSE developed for the NRC by the Center for Nuclear Waste Regulatory Analyses (Simpkins, et al. 2007). BDOSE was verified by hand calculation and comparison to RESRAD. The submodel considers unit inputs of groundwater concentrations and estimates dose for a resident farmer or a resident gardener. Acute and chronic intruder scenarios are also considered, using inputs of actual waste concentrations with units of activity per unit volume. Exposure pathways include external exposure from surface, air, and water; internal exposure from inhalation of air; and internal exposure from ingestion of drinking water, vegetables/fruits, milk, beef, game, fish, and soil. The submodel provides flexibility in defining specific exposure pathways for each receptor type. Within BDOSE, individual receptor pathways are established by selecting to include or exclude possible pathways in a defined *Pathway vector* that defines a receptor. Potential pathway doses are stochastically evaluated for each receptor type and pathway, based on user defined ingestion, inhalation rates, and exposure time distributions. Key biosphere model settings within BDOSE are controlled by switch elements that are centrally located in a single *Controls* module. Switches and data elements were included to allow the user to control aspects of the analysis such as: the use of alternative dose coefficients (ICRP 72 or Federal Guidance Report No. 11 (EPA, 1988)) for internal radionuclide dose calculations, the time for loss of institutional controls, the model used to evaluate soil concentrations, the exposure to different types of contaminated water sources, and receptor pathway definitions. BDOSE is supplied with seven soil models that can be used to evaluate radionuclide buildup in the soil from irrigation with contaminated groundwater. These multiple models provide various considerations for deposition processes (irrigation and in-growth) and removal processes (decay, soil erosion, and leaching into deep soil). BDOSE evaluates radionuclide concentrations for several animal products including: beef, milk, poultry, eggs, fish, and game. BDOSE evaluates radionuclide concentrations for multiple vegetation types, including those used for human consumption (vegetables, leafy green vegetables, fruits, and grains), and those used for animal feed (animal specific grains and fodders). For a full description of BDOSE see Simpkins et al. (2007).

Figure 5 is a diagram of the conceptual model evaluated in the analysis, with the main elements of the problem. Figure 5 does not reflect every scenario or configuration evaluated in the analyses, but is intended to give an overview of the basic conceptual model. The dashed line on Figure 5 delineates the two primary types of receptors: resident or intruder. The DU source releases to a backfill assumed to surround the DU in the disposal cells. Radon can partition between the gas and liquid phases, and diffuse in the gas phase through clay, soil, and basement foundation layers, as applicable. Radionuclides released to the backfill are vertically transported via advection through unsaturated zone cells to an underlying aquifer, where they are transported to a receptor well. Contaminated water is then extracted and used for farming or domestic purposes. Figure 6 shows the primary transport pathways implemented in the GoldSim model. The clay, soil, and foundation elements are comprised of many GoldSim cells in order to limit numerical dispersion (not shown on the figure).

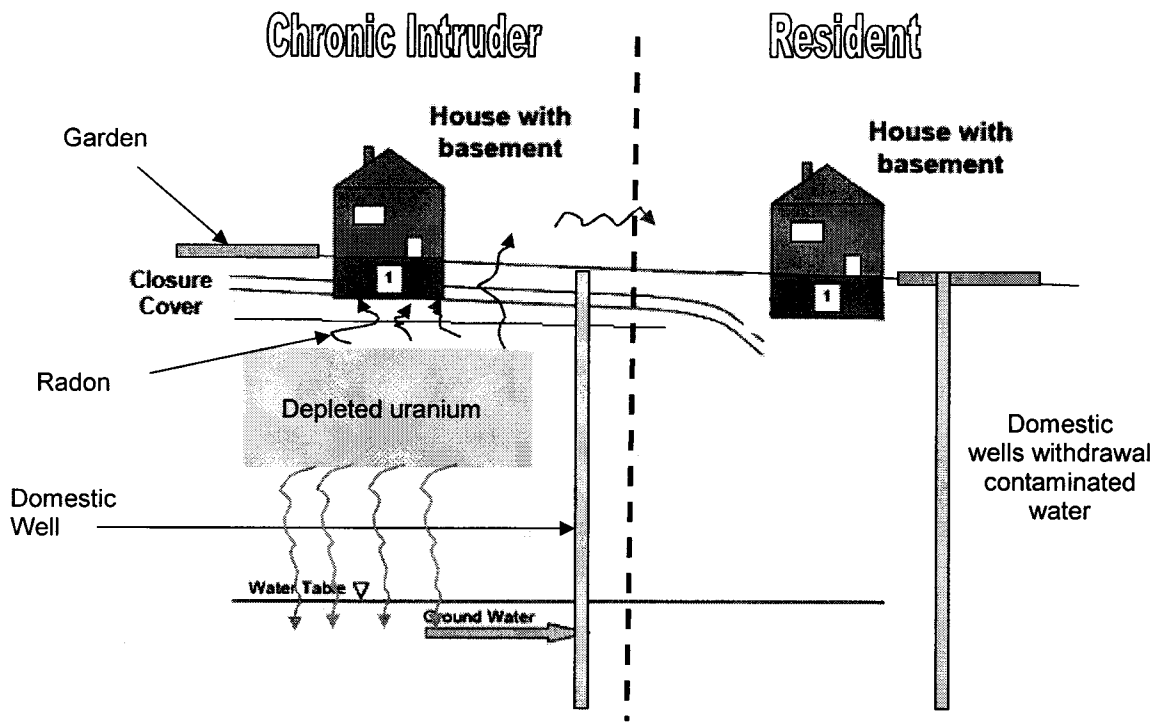


Figure 5 Conceptual Model Showing the Primary Scenarios.

KEY RESULTS AND UNCERTAINTIES

The model was used to evaluate whether large quantities of DU can be disposed of in the near-surface as commercial LLW. Key variables evaluated included: disposal configurations, performance periods, institutional control periods, waste forms, site conditions, pathways, and scenarios.

Summary Results

- Depleted uranium has characteristics that are dissimilar from commercial LLW:
  - Large percentage of the activity is associated with very long-lived radionuclides
  - Decay results in increasing hazard with time until after 1 million years, as a result of increasing concentrations (and higher mobility) of decay products
  - In-growth of significant quantities of a daughter in gaseous form (^{222}Rn)
- Estimated risks are sensitive to the performance period.
- Estimated risk from radon is sensitive to the disposal depth.
- Radon fluxes to the environment are very sensitive to the long-term moisture state of the system.
- Large uncertainties (and little available data) associated with some transfer factors for uranium daughter products.
- Estimated disposal facility performance is strongly dependent on site-specific hydrologic and geochemical conditions.
- Radon is major contributor at arid sites with shallow disposal.
- The groundwater pathway is limiting at humid sites.

- Grouting of the waste may improve the likelihood of an arid site meeting the performance objectives; however, grout may enhance the mobility of uranium in the groundwater pathway after the grout degrades.

The summary conclusions from the technical analysis are:

- Near-surface disposal (i.e., less than 30 m, as defined in Part 61) may be appropriate for large quantities of DU under certain conditions. However, unfavorable site conditions can result in the performance objectives not being met. Examples of unfavorable conditions include shallow disposal (< 3 m depth) and humid sites with a potable groundwater pathway.
- Because of the in-growth of radon and other daughter products, periods of performance of 1,000 years or less result in a significant truncation of estimated risk.
- Shallow disposal (< 3m deep) is likely to not be appropriate for large quantities of DU, regardless of site conditions. Shallow disposal may be possible if robust intruder barriers, excluding the possible excavation of DU, and a robust radon barrier that can effectively limit radon fluxes over the period of performance are installed, and their performance is justified. Small quantities (1 – 10 metric tons) could be disposed of at shallow depths.
- Depleted uranium can be disposed of under arid conditions and meet the Part 61 performance objectives for 1,000 to 1 million years performance periods, if the waste disposal depth is large, or robust barriers are in place to mitigate radon.
- Disposal under humid conditions with viable water pathways is probably not appropriate for large quantities of DU.

Detailed Results

As noted above, disposal facility performance is strongly dependent on site-specific hydrologic and geochemical conditions. There is a large amount of uncertainty in a generic assessment, such as this one, and the associated risk insights should not be interpreted as anything more than providing understanding for decision making. The assessment was designed to be a first-order evaluation of key variables, and should not be misinterpreted as providing more information than a first-order assessment. The additional challenge, from a technical perspective, is presenting the results. Site-specific hydrologic conditions such as infiltration rates, liquid saturation, hydraulic gradient, unsaturated zone thickness, hydraulic conductivities, and geochemical conditions, such as pH and carbonate, and the resultant partition coefficients and solubilities were represented in the analysis as epistemic uncertainty over a broad range of sites. In reality, many of these parameters can be constrained for a particular site and disposal system. For example, uranium solubility limits applied in this model represent dissolved concentrations for a range of environmental conditions. Primary environmental factors for uranium solubility include the reduction-oxidation potential, pH, and dissolved carbonate concentration. Reducing conditions, such as those that may be present due to cementitious phases, as in reducing grout, typically result in sparingly soluble uranium species. Solubility limits for uranium, as applied in this model, can be as low as 10^{-8} moles per liter such as may

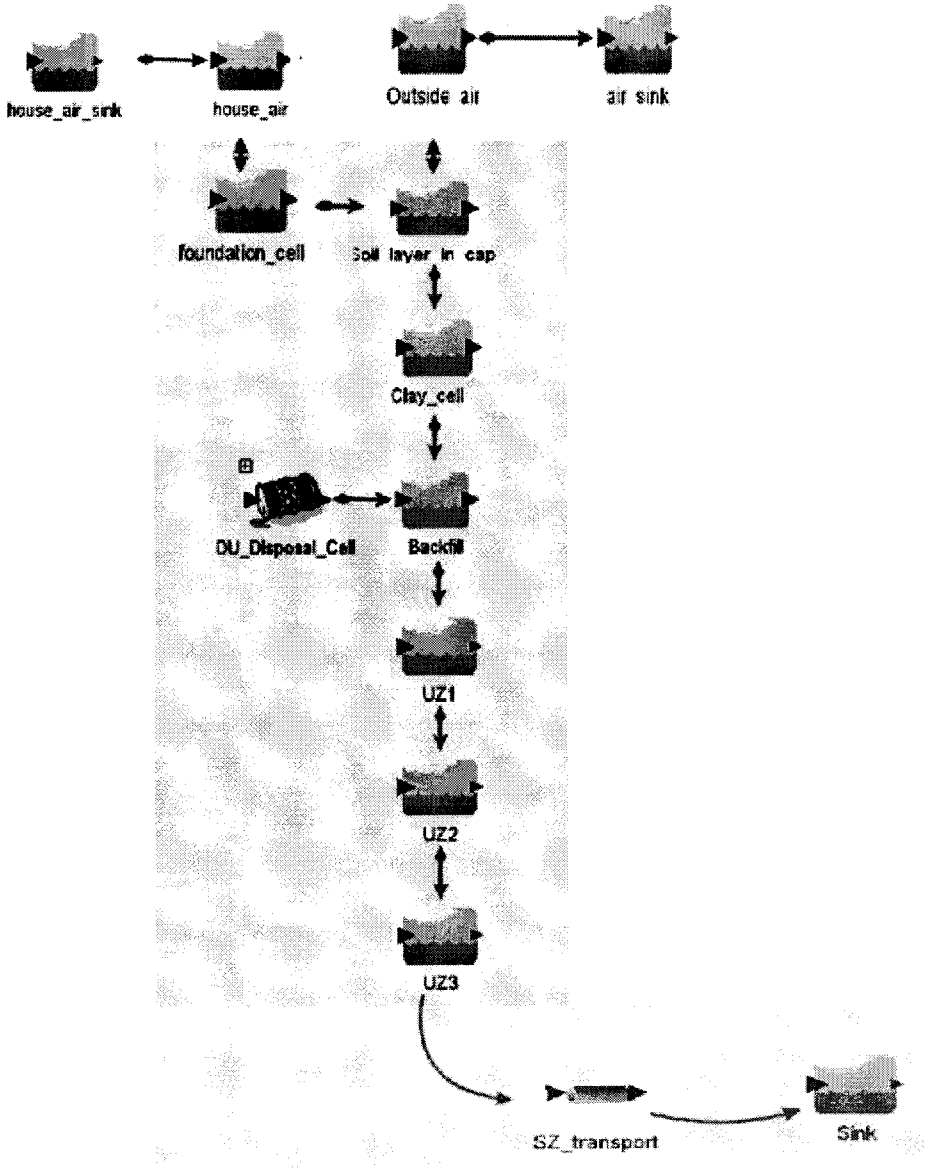


Figure 6 Main Transport Pathways Implemented in the GoldSim Model

occur under strongly reducing conditions. In contrast, under increasingly oxidizing conditions, uranium tends to exhibit more soluble species. The solubility of uranium under oxidizing conditions can vary over a wide range of concentrations and may include unlimited solubility. In addition, the presence of complexing ligands, principally carbonates at pH ranges typical of oxidized natural waters, can influence the solubility of uranium. The model represents this uncertainty for oxidizing conditions by varying solubility limits over many orders of magnitude as a function of pH and carbonate concentration. For an arid site with oxidizing conditions, the solubility of uranium generally varied from 10^{-6} to 10^{-4} moles per liter.

A typical output that NRC staff evaluates for a probabilistic analysis is the peak of the mean dose curve. The peak of the mean dose curve is compared to the performance objective (e.g., 25 mrem/yr). In this type of analysis, the peak of the mean is not the appropriate output

Table I Percent of Probabilistic Realizations that Meet the Performance Objectives

Scenario	Performance Period (yr)	Resident[1]			Chronic Intruder[2]
		Total dose	Drinking water	Inhalation	Total dose
Arid, 1 m disposal depth	1,000	**100**	**100**	**100**	<2
	10,000	40	**90**	**50**	0
	100,000	10	**60**	20	0
	1,000,000	<1	40	8	0
Arid, 3 m disposal depth	1,000	**100**	**100**	**100**	2
	10,000	**80**	**90**	**100**	0
	100,000	**50**	**60**	**80**	0
	1,000,000	20	40	**70**	0
Arid, 5 m disposal depth	1,000	**100**	**100**	**100**	**100**
	10,000	**80**	**90**	**100**	**100**
	100,000	**50**	**60**	**90**	**90**
	1,000,000	30	40	**90**	**70**
Humid, 5 m disposal depth	1,000	**70**	**70**	**100**	**100**
	10,000	0	0	**100**	20
	100,000	0	0	**100**	0
	1,000,000	0	0	**97**	0
Arid,[3] 5 m disposal depth, Grout	1,000	**100**	**100**	**100**	**100**
	10,000	**90**	**90**	**100**	**100**
	100,000	**70**	**70**	**100**	**90**
	1,000,000	**60**	**60**	**90**	**80**

[1] Percent of realizations that are below 25 mrem/yr total effective dose equivalent (TEDE). The resident consumes contaminated plants raised at the site, but does not consume contaminated animals. The results for the resident do not have radon diffusing into the basement, but the resident does get exposure to radon in the ambient environment while outdoors and indoors. Results are rounded to one significant figure.

[2] Percent of realizations that are below 500 mrem/yr TEDE. When the waste depth is greater than 3 m, the waste disruption process is through well drilling, not home excavation.

[3] The performance of grout over long periods of time is very uncertain. If the initial low leachability of grouted waste can be maintained, a performance benefit can be realized.

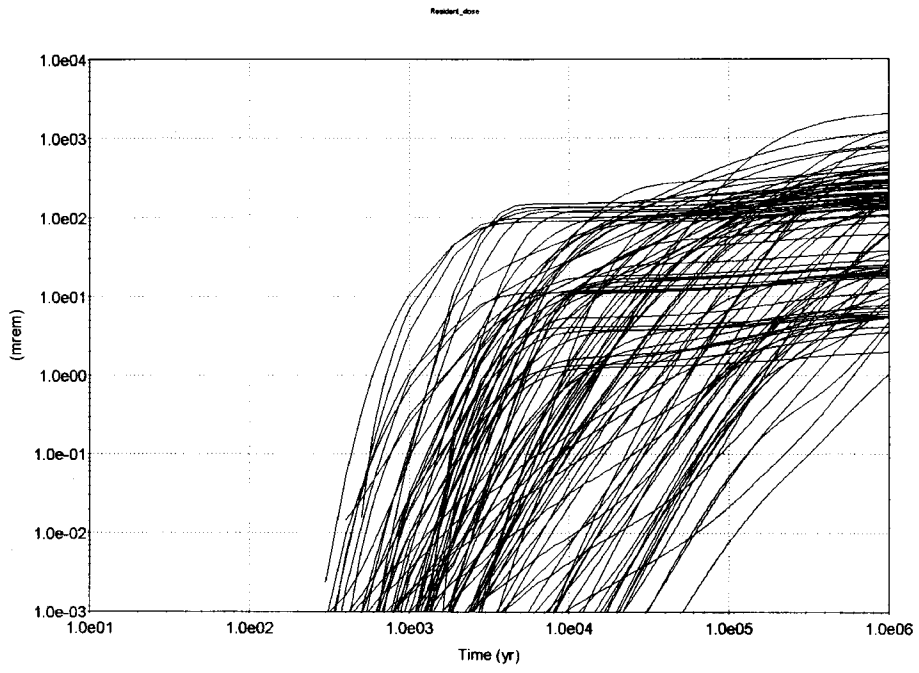
statistic, because the mean is strongly affected by a few extreme results which would represent an unfavorable site or disposal system. It is more informative to look at the median result or the fraction of probabilistic realizations that may be above or below certain values. This information could be interpreted as reflecting the likelihood that a specific scenario or configuration could achieve a particular outcome.

Table I provides the percent of realizations that meet the applicable dose limits of 25 mrem/yr to the public and 500 mrem/yr to the intruder for a variety of scenarios and configurations. Figure 7a provides example dose plots for the resident receptor and Figure 7b provides the results for the same calculation by exposure pathway. The results shown on Figure 7b are the mean dose for each pathway. The results in Table I demonstrate that performance period, disposal depth at arid sites, and site conditions are important variables to consider for the disposal of DU. With a short performance period, many sites and disposal configurations would be able to meet the performance objectives. For an arid site, radon has not ingrown sufficiently when the performance period is short (1,000 years). For both arid and humid sites, the delay in transport is sufficient to achieve the performance objectives, except for shallow disposal. Disposal of

large quantities of DU at depths less than 3 m results in projected chronic intruder doses much in excess of 500 mrem/yr. At longer performance periods and if water from the aquifer is used for consumption or for other domestic practices, such as irrigation, disposal under humid conditions would likely not meet the performance objectives. Disposal under arid conditions can achieve the performance objectives and the likelihood of compliance is significantly improved if the disposal depth is larger.

An uncertainty analysis was performed using genetic variable select algorithms using a neural network software product, Neuralware NeuralWorks Predict® (Neuralware, 2001). For the water dependent pathways at an arid site, important parameters were the hydraulic conductivity and gradient of the aquifer, the infiltration rate, and geochemical conditions that determine sorption and solubilities. For radon at an arid site, the liquid saturation of the materials and properties of the residence and scenario, such as house height, foundation porosity, air exchange rate in the house, and fraction of time spent indoors, were most significant. For animal pathways, there is very limited data on transfer factors for some of the daughter radionuclides. Additional research may be needed to develop more robust estimates of transfer factors.

(a)



(b)

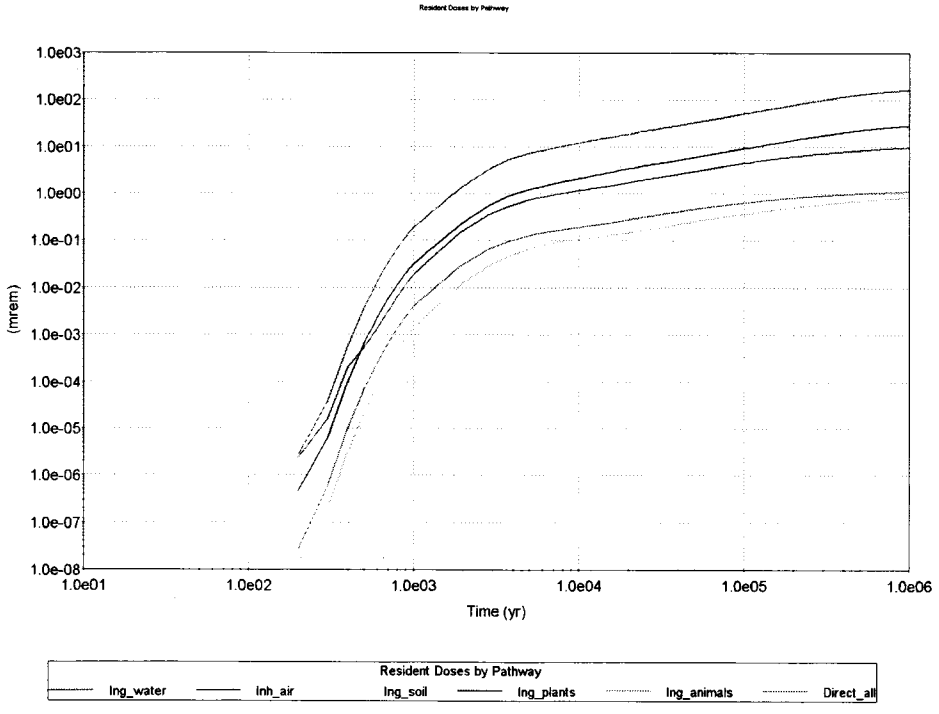


Figure 7 (a) Example of Dose Histories Generated for a Probabilistic Simulation. (b) Dose Histories for a Resident Calculation by Exposure Pathway. The lines from top (highest) to bottom are: ingestion of water, ingestion of plants, inhalation (primarily radon), direct radiation, and ingestion of soil. Shown is the mean result by pathway for 100 realizations.

CONCLUSIONS AND RECOMMENDATIONS

Near-surface disposal of large quantities of DU may be appropriate, but not under all site conditions. It is important to note that this same conclusion would likely be reached for the disposal of commercial LLW, if it was evaluated in this analysis. However, the types and degree of constraints would be different for disposal of large quantities of DU in the near-surface compared to typical LLW. The requirements provided in Part 61 are intended to ensure that unfavorable conditions for commercial LLW disposal will be avoided. The characteristics of DU differ from commercial LLW. As shown in Figure 1, the radiologic hazard of DU is more persistent than typical commercial LLW. It also has a much lower initial specific activity compared to its eventual specific activity, which is a problem because confidence is higher shortly after disposal that institutional controls will be maintained, engineered barriers will perform their function, and stability of the disposal site can be ensured. Therefore, whereas commercial LLW requires a greater level of protection with respect to direct radiation and impacts to workers, DU requires a greater consideration of long-term stability and isolation from the accessible environment over longer timeframes. It is recommended that large quantities of DU be disposed of at a minimum of 3 m from the current land surface, if the land surface is stable, or the future land surface as estimated by geomorphologic projections over the compliance period. Ideally, even deeper disposal depths would be favorable for mitigating long-term radon hazards associated with the disposal of DU. Site-specific hydrologic and geochemical conditions should be carefully considered in assessment of the risk impacts from the disposal of large quantities of DU in the near-surface. The uranium parents and some of the daughter products can be moderately mobile in the environment. The quantity and concentration of the source, combined with the moderate mobility, can result in it being very difficult to achieve the 10 CFR 61.41 performance objective under humid conditions, if potable aquifers or aquifers that are used for irrigation of plants for human or animal consumption are impacted. Therefore, disposal of large quantities of DU under humid conditions is not recommended.

Considering the technical aspects of the problem, the performance assessment staff recommends a performance period of *10,000 years* for the analysis of *DU* disposal. However, analyses should be performed to peak impact, and if those impacts are significantly larger than the impacts realized within 10,000 years, then the longer term impacts should be included in the site environmental evaluation. This recommendation is consistent with previous NRC guidance found in NUREG-1573 and considers the characteristics of the DU and uncertainty in estimating societal behavior and engineered and natural system performance over very long periods of time. Uncertainty in the projected doses from factors other than the physical characteristics and transport parameters of the system likely dominate at times larger than 10,000 years. Potentially high doses relative to the performance objectives could occur within a timeframe longer than 10,000 years from the disposal of large quantities of DU. However, the majority of sites, waste forms, and disposal configurations that can meet the performance objectives at 10,000 years will continue to meet the performance objectives at longer time periods. A simple approach that should be considered to ensure the eventual risk of radon is managed is to select a waste disposal depth and cover thickness based on the projected peak in-growth of the daughter species, rather than the in-growth over the performance period.

It is essential that the site hydrology and geochemistry be well-understood, because site-specific conditions are the primary determinant of the safety of the near-surface disposal of large quantities of DU. Uranium and daughter radionuclide speciation and partitioning, as well as, radon transport in natural systems are complex processes; the analysis of the near-surface disposal of DU must adequately evaluate and manage this uncertainty. Under improper

disposal systems, configurations, or unfavorable site conditions, disposal of significant quantities of DU can exceed the 10 CFR 61.41 and 10 CFR 61.42 performance objectives by a significant margin. The analysis to assess performance of DU disposal at a particular site should be supported by as much site-specific data as practical. In particular, measurements of infiltration rates, radionuclide sorption and solubilities, radon diffusion and emanation rates, waste release rates, and soil-to-plant transfer factors can greatly reduce the uncertainty in the estimated future performance of a disposal site.

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Activity	Office/Division	FY09		FY10		FY11		FY12		FY13	
Option 1 – Generic communication and guidance document 3.6 FTE and $200,000		Funds ($)	FTE	Funds ($)	FTE	Funds ($)	FTE	Funds ($)	FTE	Funds ($)	FTE
	FSME/DWMEP		2.6	200,000	1.0						
	Total		**2.6**	**200,000**	**1.0**						
Option 2 – Rulemaking and guidance document 7.8 FTE and $450,000	FSME/DWMEP				2.5	450,000	2.4		0.7		
	FSME/DILR						0.7		0.7		
	OIS						0.1		0.1		
	OGC						0.2		0.2		
	ADM						0.1		0.1		
	Total				**2.5**	**450,000**	**3.5**		**1.8**		
Option 3 – Classify DU and rulemaking 7.1 FTE and $800,000	FSME/DWMEP			200,000	2.5	600,000	1.7		0.7		
	FSME/DILR						0.7		0.7		
	OIS						0.1		0.1		
	OGC						0.2		0.2		
	ADM						0.1		0.1		
	Total			**200,000**	**2.5**	**600,000**	**2.8**		**1.8**		
Option 4 – Revise classification tables and rulemaking 11.1 FTE and $1,400,000	FSME/DWMEP					500,000	6.0	900,000	2.2		0.7
	FSME/DILR								0.7		0.7
	OIS								0.1		0.1
	OGC								0.2		0.2
	ADM								0.1		0.1
	Total					**500,000**	**6.0**	**900,000**	**3.3**		**1.8**

Enclosure 2

Depleted Uranium - Additional Options Evaluated

In addition to the options discussed in the paper, staff evaluated the possible use of 10 CFR 61.58 "Alternate requirements for waste classification and characteristics" to require that a site-specific analysis be performed prior to disposal of large quantities of DU. 10 CFR 61.58 states:

> The Commission may, upon request, or on its own initiative, authorize other provisions for the classification and characteristics of waste on a specific basis, if, after evaluation of the specific characteristics of the waste, disposal site, and method of disposal, it finds reasonable assurance of compliance with the performance objectives in subpart C of this part.

10 CFR 61.58 is an exception provision that allows the Commission, either upon request or on its own initiative, to authorize alternate provisions for classification or characteristics of LLW. [1] The requirements for waste classification and characteristics are found in §§ 61.55 and 61.56, respectively.[2] Such alternate provisions could be authorized after an evaluation showing that the specific waste, disposal site, and disposal method being proposed would provide reasonable assurance of compliance with the performance objectives in Subpart C of Part 61.

Under Option 1, the staff would issue a generic communication clarifying the need to demonstrate compliance with the performance objectives prior to the disposal of large quantities of DU. Therefore, § 61.58 does not apply.

Under Option 2, which is the staff's recommended option, the staff is proposing that disposal facility licensees be required to perform an analysis in order to confirm that near-surface disposal of large quantities of DU, and other "unique waste streams," can be undertaken at specific sites in conformance with the performance objectives in Subpart C to 10 CFR part 61. This would be accomplished via rulemaking to modify 10 CFR 61.55. On the other hand, use of an exception provision like § 61.58 to *require* an additional site-specific study on certain Class A waste streams, without any associated rule change, seems inconsistent with the basic premise of an exception. Specifically, the purpose of building an exception into a generally applicable rule is to allow an activity that would not otherwise be permitted, rather than to impose an additional requirement (e.g., performance of a site-specific study) on an activity that is already permitted (e.g., near-surface disposal of Class A waste). Thus, if § 61.58 were utilized to approve an alternate classification or characteristic, such action would provide additional options for a licensee, but would not require use of a particular option. Compliance with the approved alternative would not be the only method of compliance. Therefore, if the staff intended to use § 61.58 in order to develop an alternate waste classification or alternate characteristics for a Class A waste stream such as DU, and to require licensees to conform to the alternate classification or characteristics as the sole method of

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[1] 10 CFR 61.58 is analogous to 10 CFR 61.54, "Alternate Requirements for design and operations," which provides similar flexibility with regards to the technical requirements specified in §§ 61.51, 61.52 and 61.53.

[2] 10 CFR 61.56(a) describes minimum requirements for all classes of waste that are intended to facilitate handling at the disposal site and provide protection of health and safety of personnel at the disposal site. 10 CFR 61.56(b) provides stability requirements for Class B and C waste.

compliance in place of (as opposed to as an alternative to) the existing regulations, a rule change would be necessary.[3]

The staff also considered whether the Commission could, on its own initiative, undertake a site-specific analysis for large quantities of DU pursuant to § 61.58. While the language of § 61.58 certainly provides for such a Commission-initiated analysis, as discussed above, performance of such an analysis pursuant to § 61.58 alone, without an associated rule change, would not replace the existing regulations as the sole method of compliance. In addition, a Commission evaluation undertaken pursuant to § 61.58 would likely have no direct effect on Agreement State licensees, as any alternate waste classification or characteristics would need to be evaluated and authorized by the Agreement State under its analog to § 61.58 or § 61.6 (general exemption provision), neither of which are currently required for compatibility.

While ineffective for Option 2, § 61.58 could play a role if the Commission were to direct the staff to implement Option 3 or 4, depending on how DU was ultimately classified. For example, if large quantities of DU were reclassified generically as Class C or GTCC using a "reference LLW disposal site assumed to be sited in a humid eastern environment" under Option 3, NRC licensees — or the Commission itself — could use § 61.58 to provide an alternate classification after performing an evaluation showing that the specific waste, disposal site, and disposal method being proposed would provide reasonable assurance of compliance with the performance objectives in Subpart C of Part 61. In this example, the waste in question could then be disposed of in accordance with the general reclassification developed under Option 3 or 4 (e.g., Class C or GTCC), or in accordance with the alternate classification authorized pursuant to § 61.58. But, as described above, such a § 61.58 analysis would likely have no direct effect on Agreement State licensees, as any alternate waste classification would need to be evaluated and authorized by the Agreement State under its analog to § 61.58 or § 61.6 (general exemption provision).

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[3] This is consistent with the discussion of § 61.58 in NUREG-1854, "NRC Staff Guidance for Activities Related to U.S. Department of Energy Waste Determinations: Draft Final Report for Interim Use." Specifically, NUREG-1854 states:

> "10 CFR 61.58 was intended to allow the NRC the flexibility of establishing alternate waste classification schemes when justified by site-specific conditions *and does not affect the generic waste classifications established in 10 CFR 61.55.*"

Id. at 3-36 (emphasis added).

March 18, 2009

MEMORANDUM TO: R. W. Borchardt
Executive Director for Operations

FROM: Annette L. Vietti-Cook, Secretary /RA/

SUBJECT: STAFF REQUIREMENTS – SECY-08-0147 – RESPONSE TO COMMISSION ORDER CLI-05-20 REGARDING DEPLETED URANIUM

Previously, in the adjudicatory proceeding for the Louisiana Enrichment Services (LES) license application, the Commission determined that depleted uranium is properly classified as low-level radioactive waste. Although the Commission stated that a literal reading of 10 CFR 61.55(a)(6) would render depleted uranium a Class A waste, it recognized that the analysis supporting this section did not address the disposal of large quantities of depleted uranium. Outside of the adjudication, the staff was tasked to evaluate this complex issue and provide specific recommendations to the Commission. SECY-08-0147 is the result of the Commission's direction and provides recommendations for a path forward.

As an initial approach to addressing this complicated issue, the Commission has approved the staff's recommended Option 2 to 1) proceed with rulemaking in 10 CFR Part 61 to specify a requirement for a site-specific analysis for the disposal of large quantities of depleted uranium (DU) and the technical requirements for such an analysis; and 2) to develop a guidance document for public comment that outlines the parameters and assumptions to be used in conducting such site-specific analyses.

In revising 10 CFR 61.55(a)(6) in this limited scope rulemaking, the Commission is not proposing to alter the waste classification of depleted uranium. Eventual changes to waste classification designations in the regulations must be analyzed in light of the total amount of depleted uranium being disposed of at any given site. However, the Commission is stating that for waste streams consisting of significant amounts of depleted uranium, there may be a need to place additional restrictions on the disposal of the depleted uranium at a specific site or deny such disposal based on unique site characteristics and those restrictions should be determined by a site specific analysis which satisfies the requirements of the proposed new 61.55(a)(9). This thought should be clearly indicated in the proposed rulemaking package seeking public comment. As part of this rulemaking, the staff should promptly conduct a public workshop inviting all potentially affected stakeholders, including licensees, state regulators and federal agencies. At this workshop, the staff should discuss the issues associated with the disposal of depleted uranium, the potential issues to be considered in rulemaking, and technical parameters of concern in the analysis so that informed decisions can be made in the interim period until the rulemaking is final.

As a longer term action, in a future budget request the staff should propose the necessary resources for a comprehensive revision to risk-inform the 10 CFR Part 61 waste classification framework, with conforming changes to the regulations as needed, using updated assumptions and referencing the latest International Committee on Radiation Protection methodology. As part of this effort, staff should also identify any corollary or conforming legislative changes necessary to support this rulemaking, if any, as well as recommendations on how to proceed absent such legislation being enacted and other agencies that may be impacted by any changes. This effort should explicitly address the waste classification of depleted uranium. In addition, this effort should include the performance of a technical analysis for public comment concerning the disposal in a near surface facility of any long-lived radionuclide, including uranium. This analysis and the resulting comments should inform the staff's eventual recommendation to the Commission on an appropriate generic requirement addressing such disposals.

cc: Chairman Klein
Commissioner Jaczko
Commissioner Lyons
Commissioner Svinicki
OGC
CFO
OCA
OPA
Office Directors, Regions, ACRS, ASLBP (via E-Mail)
PDR

Communication Plan Key Messages

These key messages represent the collective views of workshop participants and may not represent the final regulatory position of the NRC.

- The rulemaking will not alter the waste classification of depleted uranium.
- There is a need for interim guidance to be issued by the NRC for use by disposal facility operators and Agreement State regulators during the period before the rulemaking becomes final.
- The technical parameters for the site-specific analysis should be specified in the rule language, which would provide uniformity in the technical approaches used by the Agreement States and their disposal facility licensees and allow more alignment across the disposal sites. The NRC will also publish regulatory guidance on implementation to help ensure more uniformity.
- DU is currently Class A waste by default since it contains radionuclides not specified listed in Table 1 and Table 2 of 10 CFR 61.55.
- It is prudent not to define the term "significant quantity" of depleted uranium in the regulation, as the performance assessment would determine the amount of waste appropriate for disposal.
- General agreement among stakeholders not to define the term "unique waste streams" during the initial rulemaking was expressed, as the performance assessment would determine the amount of waste appropriate for disposal.
- Large amounts of DU were not analyzed in the final low level waste EIS: the draft of that EIS only considered 17 curies of U-238 or 3 curies of U-235.
- Technical details of modeling disposal of large amounts of DU that form the basis of the analysis in SECY-08-0147 were discussed. Limitations of the model include the following: A broad range of climate states were imposed and persisted for the duration of the simulations, climate change was not considered; the clay barrier to radon migration into a home built over or near the disposal area was assumed to stay intact for the duration of the simulations because iw was assumed the facility would be licensed under Part 61 and need to meet the stability requirements.
- The period of performance should be specified in rule language with other criteria, such as exposure scenarios, specified in guidance. Development of a numerical value for period of performance needs to balance practical considerations of demonstrating compliance with 10 CFR Subpart C, and the feasibility of modeling longer time periods with high uncertainty.
- Due to the potential long period of performance, the requirement to perform and update a disposal facility's performance assessment on a periodic basis should be specified in the rule.
- Because large quantities of depleted uranium may be disposed before NRC completes its rulemaking, it would be prudent for the site operator and state regulator to review the existing site-specific performance assessment. The performance assessment should consider the key elements of the analysis of depleted uranium disposal the NRC staff identified in SECY-08-0147.
- Consideration should be made to determine if exposure scenarios should be site specific as opposed to setting the regulatory limit for radon dose for an intruder.
- Changes to sections of 10 CFR Part 61 (e.g., the performance objectives to specify the inadvertent intruder dose limit) may be necessary and should include more risk and performance based assessments.

Frequently Asked Questions in the Communication Plan

On this page:

Many links on this page are to documents in Adobe Portable Document Format (PDF). See our Plugins, Viewers, and Other Tools page for more information. For successful viewing of PDF documents on our site please be sure to use the latest version of Adobe.

What is low-level radioactive waste?

Low-level radioactive waste is not defined by physical characteristics (e.g., half-life or decay rate). It is legally defined by its origin, and the definition depends on what the waste is "not." The definition in 10 CFR 61.2 for waste states:

Waste means those low-level radioactive wastes containing source, special nuclear, or byproduct material that are acceptable for disposal in a land disposal facility. For the purpose of this definition, low-level waste has the same meaning

as in the Low-Level Radioactive Waste Policy Act, that is, radioactive waste **not classified** as high-level radioactive waste, transuranic waste, spent nuclear fuel, or byproduct material as defined in section 11e.(2) of the Atomic Energy Act (uranium or thorium tailings and waste).

TOP

What is depleted uranium? Why is it considered low-level radioactive waste?

Depleted uranium is created when natural uranium is enriched to increase the concentration of Uranium-235. Uranium slightly enriched in Uranium-235 is used as fuel in nuclear reactors in the United States. The waste-product from this enrichment process is depleted uranium. Depleted uranium can be fed back through the process multiple times until it is uneconomical to extract any more Uranium-235. There are many uses for depleted uranium because of its physical characteristics and its relatively low radiological hazard. Stockpiles of depleted uranium have been maintained for a variety of reasons, including the potential for new enrichment processes that would allow more Uranium-235 to be retrieved from the depleted uranium. However, at some point, the depleted uranium may be declared, by the entity possessing it, to have no foreseeable use. At that point, the depleted uranium, whether it was stockpiled material or had been used in some product such as ballast or military ammunition, becomes waste and must be categorized using the definition quoted in the answer to question 9 above.

Depleted uranium is defined as source material (10 CFR 40.2 "*Source Material* means: (1) Uranium or thorium, or any combination thereof, in any physical or chemical form...") and, according to the staff's generic screening analysis, may be able to be disposed in a near-surface facility, even in large volumes, depending on the facility design and site performance.

Depleted uranium is not high-level radioactive waste or spent nuclear fuel as defined in 10 CFR 60.2:

High-level radioactive waste or HLW means: (1) Irradiated reactor fuel, (2) liquid wastes resulting from the operation of the first cycle solvent extraction system, or equivalent, and the concentrated wastes from subsequent extraction cycles, or equivalent, in a facility for reprocessing irradiated reactor fuel, and (3) solids into which such liquid wastes have been converted.

Depleted uranium is not transuranic waste as defined in Section 11.ee of the Atomic Energy Act (as amended):

The term "transuranic waste" means material contaminated with elements that have an atomic number greater than that of uranium (92), including neptunium, plutonium, americium, and curium, and that are in concentrations greater than 10 nano-curies per gram, or in such other concentrations as the Nuclear Regulatory Commission may prescribe to protect the public health and safety. By definition depleted uranium cannot be transuranic waste.

Depleted uranium is not byproduct material as defined in section 11e.(2) of the Atomic Energy Act (uranium or thorium tailings and waste) which states, "the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content."

Depleted uranium is considered source material, which can be disposed of near-surface, and is radioactive waste **not classified** as high-level radioactive waste, transuranic waste, spent nuclear fuel, or byproduct material as defined in section 11e.(2) of the Atomic Energy Act (uranium or thorium tailings and waste). Therefore, consistent with the Low-Level Waste Policy Amendments Act and the 10 CFR disposal requirements for radwaste (Part 61) and radiation protection

standards (Part 20), DU is defined as low-level waste.

TOP

Where will the workshops be held? Why did NRC choose these locations?

The public workshops will be held in Bethesda, Maryland on September 2-3, 2009, and in Salt Lake City, Utah on September 23-24, 2009. NRC chose the Maryland location so that senior managers within the NRC could participate. NRC chose the Salt Lake City, Utah location to coincide with the Low-Level Waste Forum in Park City, Utah where many stakeholders will be gathered. The Salt Lake City location is also convenient for many stakeholders that have indicated a desire to participate in the workshop.

TOP

What is the timing of the rulemaking compared to the U.S. Department of Energy's and commercial enrichment facilities' plan for disposal of DU?

Staff plans to complete the technical basis document for this rulemaking by September 30, 2010; the proposed rule and draft guidance document by September 30, 2011; and the final rule by September 30, 2012. Based on current information, the Department of Energy may have shipments of DU from its deconversion facilities that require disposal in mid-2010, depending on the construction progress. Commercial enrichment facilities may have significant quantities of DU to be disposed of by 2012.

TOP

What is NRC's position regarding disposal of significant amounts of depleted uranium before the rulemaking is complete?

Because all of the low level waste disposal facilities are located in Agreement States and because no specific NRC regulations exist to impose additional requirements on the disposal of DU, the states in which the disposal facilities are located have the authority to determine the suitability of disposal during the rulemaking. Part of the decision-making process to allow disposal of any waste at a low-level radioactive waste disposal facility is to assess whether the site will continue to meet the performance objectives of 10 CFR Part 61, or the State equivalent. If a site wishes to dispose of significant amounts of depleted uranium, it would be prudent for the site operator and State regulator to review the existing performance assessment supporting the site and determine whether the issues that were raised in the technical analyses supporting the Commission decision to initiate this potential rulemaking and in the *Federal Register* Notice for the NRC public workshops are adequately addressed. If not, it would be prudent to revise the performance assessment to adequately address these issues on a site-specific basis before disposal of significant quantities of depleted uranium.

For example, the technical analysis supporting the Commission decision to initiate this potential rulemaking used a framework similar to the analysis performed for the impacts analysis described in the Environmental Impact Statement for 10 CFR Part 61. Although computational tools and methods have improved, NRC staff continue to believe the framework used in the development of 10 CFR Part 61 remains appropriate today. Specifically, the technical analysis evaluated receptors to protect the general population from releases of radioactivity and exposure scenarios to protect individuals from inadvertent intrusion that were consistent with the impact analysis performed for the development of 10 CFR Part 61. The

technical analysis also evaluated a time period of performance up to one million years. These criteria can guide a review of the current performance assessment.

TOP

Could any other materials be classified as Class A under the action taken by the Commission?

The Commission action does not change the existing definition of Class A waste as applied to DU or any other material. Nor would this action or any other NRC action affect the types of low-level waste for which the states and the federal government are assigned responsibility under the LLRWPAA. The Commission action directs staff to 1) proceed with a rulemaking to amend 10 CFR Part 61 to specify a requirement for a site-specific analysis for the disposal of unique waste streams; and 2) to develop a guidance document for public comment that outlines the parameters and assumptions to be used in conducting such site-specific analyses. This direction does not impact waste classifications currently applied to materials. However, the Commission also directed staff to perform a comprehensive revision to risk-inform the 10 CFR Part 61 waste classification framework. After this revision is performed, there is potential that other materials could be reclassified if the current tiered classification scheme continues, or it is possible an entirely different disposal system framework would be developed that might not use these classifications. The Commission cannot speculate on the results of this comprehensive revision to the waste classification framework.

TOP

How should previously disposed of depleted uranium be addressed by the disposal facility sites?

Previously disposed of volumes of DU should be addressed through each site's performance assessment. The performance assessment is meant to be a living tool for both the licensee and regulator to be able to assess future compliance of the disposal facility with the performance objectives in 10 CFR regulations protecting workers and the public and ensuring long-term stability of the disposal site after it is closed (Part 61.41-61.44). During the licensing of a disposal site, assumptions must be made about the possible final inventory of a site or a specific disposal unit within a site based on expected waste volumes and streams. As operations occur, the uncertainty in the inventory decreases as actual waste volumes, constituents, and concentrations are known. The performance assessment should be regularly updated with these actual values and any revised information of future waste to be received. The results of the performance assessment can then be used to evaluate whether there is reasonable assurance that the disposal unit or site will remain in compliance with the performance objectives.

If the result of the performance assessment is that compliance with performance objectives is uncertain or unlikely, then several options may be used depending on the specifics of the situation. Additional data collection and modeling may be performed to reduce the uncertainties in those factors driving the results. Another option is modification of the facility, such as the final cover design. A third option is to reduce future waste volumes, or specific radionuclide quantities or concentrations. The decisions on what actions to take should involve both the site operator and the appropriate regulator (s).

TOP

Exposure to depleted uranium poses both radioactive and chemical risks. How is the chemical risk integrated into the risk assessment to demonstrate compliance with 10 CFR Part 61?

The chemical risks are not integrated directly into the compliance assessment for a Part 61 license. The regulatory criteria, including concentration values and limits, in 10 CFR Part 61 have been established based on radiation risk alone. As part of requesting a license for a radioactive waste disposal facility, the applicant would also have to obtain all other required permits or licenses. These will include licenses or permits from other Federal or State agencies that have authority over the elements or compounds, in this case depleted uranium, which may pose a chemical risk. Examples of other regulatory authorities might include a general authority to protect underground sources of drinking water in the general environment or through a site's National Pollutant Elimination Discharge System permit(s).

TOP

How does the NRC ensure Agreement States provide proper oversight?

NRC is required by the Atomic Energy Act to periodically review Agreement States' regulatory programs to ensure that they are adequate to protect public health and safety and are compatible with NRC regulations. These periodic reviews of the Agreement States' radiation protection programs are performed as part of NRC's Integrated Materials Performance Evaluation Program (IMPEP). Agreement States' regulatory programs are reviewed every four years. If performance issues are identified with an Agreement State program, more frequent reviews or formal interactions are performed. In some circumstances, the State will prepare and implement a Program Improvement Program, which is reviewed by the NRC. In addition to IMPEP reviews, NRC conducts management meetings with the Agreement States between the reviews. NRC also performs detailed technical and legal reviews of all Agreement State regulations to ensure compatibility with NRC regulations. For most NRC amendments to the regulations, the Agreement States are required to adopt compatible regulations within three years. In addition to overall programmatic guidance provided by FSME, NRC Regional-based State-Agreement Officers also provide direction and guidance to the Agreement States within their Region.

TOP

Will I get a response to my comments?

Not at this time; comments submitted at this stage in the process will not receive a response from the NRC. However, the NRC will consider any comments in the development of the technical basis for the rulemaking. Written comments will be recorded in ADAMS and included into the docket, the formal public record, for the proposed rulemaking. Subsequent to the workshops, NRC will develop a technical basis document, a proposed rule, and a final rule. Comments submitted in association with the workshops will inform the technical basis document for the proposed rule, but no formal response will be provided. The public will also be invited to provide comments on the proposed rule as part of the notice-and-comment rulemaking process. These comments will be considered by the NRC in the development of the final rule, and, if a final rule is adopted, the NRC will respond to the proposed rule comments in the FRN announcing the final rule.

TOP

How can depleted uranium be stored safely in a near-surface disposal facility?

The safe disposal of depleted uranium is the responsibility of licensed waste disposal facilities. Demonstration of compliance with 10 CFR Part 61 criteria will ensure safe disposal of DU in a near-surface environment. NRC staff performed a screening analysis to evaluate whether **significant** quantities of DU can be disposed of in the near-surface. The results of the screening analysis suggest that disposal facility performance is strongly dependent upon site-specific conditions. For

instance, suitable covers and robust radon barriers may effectively limit exposures to radon gas at arid sites, while humid sites with viable water pathways are probably not appropriate for significant quantities of DU. Therefore, near-surface disposal of significant quantities of DU may be appropriate, but not under all site conditions. The analysis to assess performance of disposal of significant quantities of DU at a particular site should be supported by as much site-specific data as appropriate to demonstrate compliance with the performance objectives in 10 CFR Part 61.

TOP

How can the performance assessment account for long time periods, such as one million years, the estimated peak dose timeframe?

The performance assessment is a systematic analysis that identifies the features, events, and processes (i.e., specific conditions or attributes of the geology, biosphere (including climate), degradation, deterioration, or alteration processes of engineered barriers, and interactions between the natural and engineered barriers) that may affect the performance of the disposal facility. The applicable features, events, and processes that need to be considered for evaluation depend on the time period of analysis. Different features, events and processes may need to be included for a performance assessment for 1,000; 10,000, and 1,000,000 years. As the period of analysis is extended through time, the uncertainty in the analysis grows. At longer time periods, analyses may need to rely on stylized scenarios, based on current scientific knowledge and assumptions about features, events and processes, such as major global climatic cycles including warming cycles and ice ages, rather than discrete modeling of the evolution of the disposal site, due to the large degree of uncertainty. Arguments can be presented both for and against extended performance analysis of near-surface facilities (both for DU and any other long-lived waste constituent such as technicium-99 or chlorine-36) due to these uncertainties. This is the reason that public views on what appropriate period(s) of performance should be considered in the depleted uranium limited rulemaking was requested in NRC's recent *Federal Register* Notice.

TOP

UTAH RADIATION CONTROL BOARD
STATEMENT OF BASIS FOR ADMINISTRATIVE RULEMAKING
REGARDING DISPOSAL OF SIGNIFICANT QUANTITIES OF DEPLETED URANIUM

December 1, 2009

This Statement of Basis for Administrative Rulemaking Regarding Disposal of Significant Quantities of Depleted Uranium (Statement of Basis) has been prepared to support the proposed rule in Part VI of this Statement of Basis. If the Radiation Control Board votes to begin rulemaking on this matter, information about how and when to comment on the rule, including information about a public hearing, will be posted at http://www.radiationcontrol.utah.gov/.

I. REGULATORY AND FACTUAL BACKGROUND

Following is background information and descriptions of some of the most significant among many actions taken by the regulatory agencies discussed below regarding depleted uranium.[1]

A. What is depleted uranium and how is it similar to and different from other wastes?

> "Depleted uranium oxide contains approximately 85 percent uranium by mass. In comparison, a low-grade uranium ore common in the United States may contain 0.1 percent uranium by mass."
>
> . . .
>
> "For mill tailings, a significant portion of the total activity at the time of disposal is associated with radium, therefore disposal or management decisions can focus on the radiological inventory at the time of disposal. For example, a barrier to attenuate the emanation of radon from mill tailings can be designed based on the concentration of the material at the time of disposal. On the other hand, DU is essentially depleted in the daughter radionuclides but concentrated (compared to natural ore or mill tailings) in the parent radionuclides. Over long periods of time, the uranium parent radionuclides have the potential to produce quantities of daughter radionuclides significantly in excess of natural ores or mill tailings because the DU source has much higher concentrations of uranium. For example, mill tailings commonly have from 0.004 to 0.02 wt percent U3O8, 26 to 400 pCi/g 226Ra, and 70 to 600 pCi/g 230Th at the time of disposal (Robinson, 2004). Depleted uranium (in oxide form) would have approximately 99.9 percent uranium oxide at the time of disposal and greater than 300,000 pCi/g 226Ra and 230Th approximately 1 million years after disposal (values cited were calculated with a simple decay/in-growth calculation)."
>
> . . .
>
> "Whereas the activity in a commercial LLW facility decreases to a few percent of the initial value over a few hundred years, the activity in a facility for DU would be expected to remain relatively constant initially, but begin increasing at around 1,000 years. Peak activity, assuming no release from the source, would not be attained until after 1 million years after disposal."

U.S. Nuclear Regulatory Commission (NRC) Staff, SECY-08-0147.[2]

B. U.S. Nuclear Regulatory Commission actions

1. 1981-82: NRC developed its waste classification system and concentration limits for land disposal of radioactive waste, now found in 10 CFR Part 61*, based on modeling that informed what maximum levels of radioactivity would still allow 10 CFR Part 61 performance objectives to be met.[3] For this analysis, NRC did not evaluate environmental impacts of land disposal for significant quantities of depleted uranium. *See* Part II.B.1 of this Statement of Basis.

2. October 2000: NRC issued NUREG-1573, guidance for those conducting site-specific performance assessments for radioactive waste land disposal facilities.[4]

3. October 2005: The NRC Commission asked its staff to consider whether the signficant quantities of depleted uranium in the waste stream, which were not anticipated in 1981, warranted reclassification of depleted uranium or other amendments to NRC's regulations.[5]

4. June 2006: Louisiana Energy Services was licensed as a uranium enrichment facility. The facility will create a waste stream with substantial quantities of depleted uranium.[6] In the course of this proceeding, depleted uranium disposal at EnergySolutions was analyzed. The Commission rejected claims by an intervenor that Envirocare's performance assessment was inadequate and that NRC had previously found that depleted uranium could not be disposed of in a near-surface facility and that NRC could not therefore find that disposal at EnergySolutions was acceptable. While expressing concern that its Staff may not have fully explored the long-term impacts from the disposal of depleted uranium "whose radiological hazard gradually *increases* over time,"[7] the Commission nevertheless upheld the decision by the Atomic Safety Licensing Board. However, it noted in doing so that its decision on the adequacy of an Environmental Impact Statement was not intended to take the place of a Part 61 compliance review,[8] and that "[p]rior to a final determination on disposal, we would expect that the pertinent regulatory authority will have considered both the characteristics of the waste and the site-specific features of the disposal site to assure that all radiological dose limits and safety regulations indeed can be met."[9]

5. October 2008: NRC staff, in October 2008 (SECY-08-0147) responded to the Commission's October 2005 order.[10] The staff:
   (a) Evaluated a generic case to determine whether it was possible to meet 10 CFR Part 61 standards with near-surface disposal of depleted uranium, and concluded that it was.

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* There are Utah rules equivalent to 10 CFR Part 61 found in Utah Admin. Code R. 313. As appropriate, references to 10 CFR Part 61 should also be read as referring to the equivalent state rules. *See* endnote 1 for web access information.

(b) Prepared several regulatory options, and recommended that the Commission not change classification for depleted uranium, but add language requiring a site-specific performance assessment before significant quantities of depleted uranium are accepted for disposal.

6. October 2008: In the October 2008 SECY-08-0147 and in subsequent statements, NRC staff has also indicated that there are limitations to the generic case study described in Part I.B.5 of this Statement of Basis, and recommended that it should not be relied upon for any site-specific licensing action. *See* Part II.B.2 of this Statement of Basis.

7. March 2009: NRC agreed with the course of action recommended by the NRC staff in SECY-08-0147. The Commission made determinations:
   (a) To keep depleted uranium as Class A waste; and
   (b) To initiate rulemaking proposing enhanced performance assessment requirements for facilities proposing to dispose of significant quantities of depleted uranium.[11]

8. August 2009: NRC made a recommendation regarding any proposals to dispose of significant quantities of depleted uranium in the interim period before NRC's depleted uranium rulemaking process is completed.[12] It recommended that, prior to disposal of significant quantities of depleted uranium at a near-surface disposal facility, site-specific performance assessments should be evaluated against criteria developed in the October 2008 SECY-08-0147 staff analysis and in a Federal Register notice at 74 Fed. Reg. 30175 (June 24, 2009). See Part II.A. of this Statement of Basis.

C. Utah Division of Radiation Control actions

1. March 1991: Depleted uranium was first approved for disposal at Envirocare, but disposal was limited to volumetric bulky materials or structural debris with a concentration limit of 1.1 E5 pCi/g.[13]
2. October 1998: Envirocare's license was amended to approve an increase in the concentration limit to an average concentration per container of 3.7E5 pCi/g.
3. Approximately 1999: Envirocare submitted a performance assessment for a new proposed land disposal facility for Class A, B, and C wastes. The assessment showed that 10 CFR Part 61 performance standards would be met for very large quantities of depleted uranium based on the assumptions specified in that document. The performance assessment reported results from an analysis of 500 years.
4. October 2000: The Executive Secretary approved a license amendment for a new disposal cell for Class A waste. Disposal of depleted uranium in the new cell was not limited by concentration or quantity. Both diffuse and concentrated depleted uranium have been disposed of pursuant to this amended license; approximately 49,000 metric tons of depleted uranium have been disposed of at EnergySolutions to date.

5. September 2009: The license was changed, at EnergySolutions' request, to require that all wastes with depleted uranium concentrations greater than 5 percent (by weight) be placed a minimum of 10 feet below the top of the cover.

D. Other states' actions

1. Washington: In response to an inquiry in the course of the the NRC's Unique Waste Streams Rulemaking Worskhop held in Salt Lake City in September 2009, Washington State's representative responded as follows to this question:

> "Has the NRC or any of the agreement states that have low level waste sites been approached about reviewing the performance assessment of your particular disposal facility under this process?"
>
> "We've talked about it in good detail. I think the prudent thing we've decided is we really need to wait until this kind of works through because we could do a performance assessment that may not meet the criteria that the NRC ends up getting, and you'd end up having to do it twice. So I think from our standpoint we wait."[14]

2. Texas: In response to the same inquiry, the representative from Texas said:

> "We do not have a new performance assessment to review for the interim in Texas."[15]

Texas regulations state, regarding the licensing of radioactive waste land disposal facilities:

> "The specific technical and environmental information in the application shall also include the following analyses needed to demonstrate that the performance objectives of this subchapter, referenced in §336.723 of this title (relating to Performance Objectives), will be met:
>
> (1) Pathways analyzed in demonstrating protection of the general population from releases of radioactivity shall include air, soil, groundwater, surface water, plant uptake, and exhumation by animals. The analyses shall clearly identify and differentiate between the roles performed by the natural disposal site characteristics and design features in isolating and segregating the wastes. The analyses shall clearly demonstrate that there is reasonable assurance that the exposures to humans from the release of radioactivity will not exceed the limits specified in §336.724 of this title (relating to Protection of the General Population from Releases of Radioactivity). A minimum period of 1,000 years after closure or the period where peak dose occurs, whichever is longer, is required as the period of analysis to capture the peak dose from the more mobile long-lived radionuclides and to demonstrate the relationship of site suitability to the performance objective in this section to the performance objective in §336.724 of this title."[16]

E. Standards governing the Board's rulemaking authority

Utah Code Ann. § 19-3-104(4):

> The board may make rules:
> (a) necessary for controlling exposure to sources of radiation that constitute a significant health hazard;
> (b) to meet the requirements of federal law relating to radiation control to ensure the radiation control program under this part is qualified to maintain primacy from the federal government; (c) to establish:
> (i) board accreditation requirements and procedures for mammography facilities; and
> (ii) certification procedure and qualifications for persons who survey mammography equipment and oversee quality assurance practices at mammography facilities; and
> (d) as necessary regarding the possession, use, transfer, or delivery of source and byproduct material and the disposal of byproduct material to establish requirements for:
> (i) the licensing, operation, decontamination, and decommissioning, including financial assurances; and
> (ii) the reclamation of sites, structures, and equipment used in conjunction with the activities described in this Subsection (4).

II. SUMMARY OF PRELIMINARY BASES FOR ACTIONS

Following is a summary of information particularly pertinent to the Board's proposed rulemaking action, although all of the information provided in this Statement should be considered part of the Board's basis.

A. NRC Recommendation.

1. For this interim period before completion of NRC rulemaking, The NRC has explicitly recommended that agreement states conduct a new review of performance assessments, prior to disposal of significant quantities of depleted uranium.

> "What is NRC's position regarding disposal of significant amounts of depleted uranium before the rulemaking is complete?"
> . . .
> "If a site wishes to dispose of significant amounts of depleted uranium, it would be prudent for the site operator and State regulator to review the existing performance assessment supporting the site and determine whether the issues that were raised in the technical analyses supporting the Commission decision to initiate this potential rulemaking and in the Federal Register Notice for the NRC public workshops are adequately addressed. If not, it would be prudent to revise the performance assessment to adequately address these issues on a site-specific basis before disposal of significant quantities of depleted uranium."

NRC's Frequently Asked Questions in the Communication Plan.[17]

NRC Staff has repeated this advice in other arenas, e.g., its Unique Waste Streams Rulemaking Record.[18]

2. The NRC did not define the quantities of depleted uranium that would have to be land disposed before raising concerns, but it did define "small quantities," 1 to 10 metric tons of depleted uranium that could, it concluded, be disposed of at shallow depth.[19]

B. Past environmental analysis.

NRC has recognized that there has been no adequate analysis of the health and safety-related impacts of near-surface disposal of depleted uranium.

1. The NRC has acknowledged that at the time the initial classification system for radioactive waste was created it was not anticipated that significant quantities of depleted uranium would be disposed of in near surface facilities. It also acknowledged that environmental studies done did not address the significant quantities that are now expected.

> "At the time of development of [10 CFR] Part 61, it was envisioned that [low level radioactive waste regulated in that Part] in a disposal facility would decay, in a maximum of 500 years, to activity levels that would not pose a significant risk to an inadvertent intruder, and that there would not be significant quantities of long-lived isotopes which would pose unacceptable long-term risks to the public from releases from the facility. In developing Part 61, NRC considered longer periods of institutional control in the DEIS (NRC, 1981). Assumptions about the persistence of institutional controls in the international community were considered and a series of public meetings were conducted to get input from stakeholders. The consensus among the stakeholders was that it is not appropriate to assume institutional controls will last for more than a few hundred years. The resultant regulatory framework for commercial LLW disposal assumes material that does require institutional control for much longer than 100 years to demonstrate compliance with the performance objectives would generally be determined to not be suitable for near-surface disposal as LLW ."

NRC, SECY-08-0147.[20]

> "When NRC regulations on low-level waste disposal were developed, there were no commercial facilities generating significant quantities of depleted uranium waste. Therefore, the impacts of depleted uranium disposal were not explicitly considered."

NRC Fact Sheet on Depleted Uranium and Other Waste Disposal.[21]

> "Large quantities of uranium were not evaluated in the EIS for 10 CFR Part 61
> - 17 Ci of 238U (in 1 million m^3 of waste)
> - 3 Ci of 235U
>
> The quantity of DU [now entering the waste stream] is ~ 470,000 Ci 238U."

NRC's Unique Waste Streams Rulemaking Record, Workshop Presentations.[22]

2. NRC staff has advised against using its October 2008 analysis (SECY-08-0147), which was done to support the NRC Staff's rulemaking recommendation, for site-specific licensing purposes.

> "The model was developed to evaluate the radiological risk to potential future residents and intruders (acute or chronic exposures) near or on the land overlying a hypothetical disposal facility for DU. The model was designed to provide the user with flexibility to evaluate different waste forms, disposal configurations, performance periods, institutional control periods, pathways, and scenarios. The impact of these variables on projected radiological risk can be significant. Therefore, the model was developed as a first-order assessment tool to risk-inform decision making. Refinement of the model would be necessary if it was to be used for licensing decisions, and rigorous validation would be needed. Because site-specific waste management decisions or other variables can strongly influence whether performance objectives can be met, care should be taken not to take the model results out of the analysis context."

SECY-08-147, Enclosure 1, at page 1.[23]

3. NRC has recognized that depleted uranium is not suitable for disposal at a near-surface facility simply because it is classified as a Class A waste.

> "That the Commission has determined that DU is Class A waste merely makes that waste *eligible* for near-surface disposal. The final determination rests instead with the question of whether near-surface disposal meets the [10 CFR] Part 61, Subpart C performance objectives."

NRC's Atomic Safety and Licensing Board. [24] In addition, NRC staff concluded that it was not beneficial to change the waste classification for depleted uranium, not because it was similar to other Class A waste, but because it would not allow the same amount of disposal flexibility as the site-specific performance assessments preferred by Staff:

> "The primary disadvantage of Option 3 [reclassifying depleted uranium] is that the concentration limit developed could be so low for a reference site that it would unnecessarily constrain disposal options at sites with significantly different characteristics (e.g., humid vs. arid). As such, this approach would be prescriptive rather than a risk-informed approach, which would take into account the performance of the waste in a specific disposal environment. Another drawback to Option 3 is that it propagates the existing waste classification system, which was developed using often conservative assumptions based on the environment for LLW at the time the Part 61 FEIS was developed; some of these assumptions are not necessarily applicable in today's environment of limited disposal options and improved performance assessment capabilities."

NRC, SECY-08-0147, at page 9.[25]

C. Adequacy of current federal regulations.

1. As described elsewhere in this Statement of Basis, NRC has concluded both that its regulations should be changed, and that until its regulations are changed, additional analysis should be conducted on a site-specific basis before depleted uranium is accepted. These decisions constitute a recognition by NRC of the inadequacy of its current regulations.

2. NRC comment:

> "Why is it necessary to update the regulations?"
>
> "The licensing of new uranium enrichment facilities in the United States has raised depleted uranium to the forefront of low-level radioactive waste disposal issues. The depleted uranium waste stream is unique amongst LLRW streams; the relatively high concentrations and large quantities of depleted uranium that are generated by enrichment facilities were not considered in the Final Environmental Impact Statement (NUREG-0945) supporting the development of 10 CFR Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste." When NUREG-0945 was issued in 1982, there were no commercial facilities generating significant amounts of depleted uranium waste streams, therefore, NUREG-0945 considered only types of uranium-bearing waste streams being typically disposed of by U.S. Nuclear Regulatory Commission (NRC) licensees at that time."
>
> "With the existing U.S. Department of Energy enrichment facilities, and the recent NRC licensing of commercial enrichment facilities, more than one million metric tons of depleted uranium will require a disposition path. Existing disposal facilities such as the EnergySolutions' facility in Clive, Utah and the Waste Control Specialists' facility in Andrews County, Texas, have expressed interest to their Agreement State regulators in disposing of depleted uranium at their sites."
>
> "The NRC recognizes that the analysis supporting regulations in 10 CFR Part 61 did not address the disposal of significant quantities of depleted uranium, and that there may be a need to place additional restrictions at a specific site or deny such disposal based on unique site characteristics. Therefore, the NRC will update the regulations to specify a requirement for a site-specific analysis that demonstrates unique waste streams, including significant quantities of depleted uranium, can be disposed of safely."

NRC's Frequently Asked Questions about Land Disposal of Unique Waste Streams.[26]

3. David Esh, lead modeler for preparation of SECY-08-0147:

> "As part of that EIS developmental analyses, they developed a waste classification system, and that was developed by doing intruder and various scenario analyses and basically doing an inverse calculation.
>
> So they did the analyses. They set a dose limit that they were trying to achieve, and then they did a backwards calculation to determine what concentrations would give me those impacts. And that's what you see in the table values that are in the regulations right now.

> So where we are now, if we have a waste stream that's a lot different or could be a lot different than what was analyzed. Then you have to say, well, I don't have table values for that. So what do I need to do about it?
>
> And our opinion is we need to change the regulations and insure you could either develop new table values or you could insure that they do the analysis, but somebody has to do the analysis. You can't have an unanalyzed situation basically."[27]

D. Quantities of depleted uranium.

In the absence of action by the Board, it is very likely that significant quantities of depleted uranium will be disposed of at EnergySolutions before the performance assessment recommended by NRC (as discussed in II.A of this Statement of Basis) is reviewed and approved.

1. Texas and Washington have indicated they are not allowing disposal of significant quantities of depleted uranium until completion of new performance assessments, and those have not been initiated. *See* I.D of this Statement of Basis.

2. Only EnergySolutions and Barnwell will currently accept depleted uranium for disposal. Barnwell is only available for disposal of waste within its compact.[28]

3. The amounts of depleted uranium awaiting disposal are significant:

   > "DOE has said they will need to begin disposal shipments for the DUF6 facilities in mid 2010. More than one million metric tons of depleted uranium will need to be disposed of over the next several years."[29]

4. Louisiana Energy Services (LES), a uranium enrichment facility licensed in June 2006, has identified a "private near-surface disposal facility" as its preferred method for disposal of the significant quantities of depleted uranium it will create; LES offered an analysis of impacts at EnergySolutions (then Envirocare) in support of its NRC license application.[30]

5. Department of Energy depleted uranium

   DOE's depleted uranium management policy requires disposal of depleted uranium it owns at one of its own disposal facilities or, with a waiver, allows disposal at a non-DOE facility. DOE has issued a waiver with respect to disposal of depleted uranium at EnergySolutions.[31]

6. EnergySolutions has acknowledged before this Board that it is marketing depleted uranium disposal and that it projects receiving significant quantities.

   > "Tom Magete [*sic* - Magette, with EnergySolutions] responded that EnergySolutions did have contracts with DOE, but they did not have active task orders. EnergySolutions had

> the potential of disposing of waste from the Savannah River within the next year (about 10,000 tons). The next five years, he projected 46,000 tons coming from Portsmouth and Paducah."

Utah Radiation Control Board minutes, July 2009.[32]

E. Performance period

NRC makes the following recommendation regarding the time period for performance assessments:

> "Considering the technical aspects of the problem, the performance assessment staff recommends a performance period of 10,000 years for the analysis of DU disposal. However, analyses should be performed to peak impact, and if those impacts are significantly larger than the impacts realized within 10,000 years, then the longer term impacts should be included in the site environmental evaluation."

NRC, SECY-08-0147.[33]

III. IMPACTS OF RULEMAKING

The Utah Administrative Rulemaking Act, at Utah Code Ann. § 63G-3-301, requires an agency proposing rules to consider the potential impact of the rule on business and on government.

A. Impacts to business

If the rule is promulgated, one Utah business – EnergySolutions, L.L.C. – will be unable to dispose of depleted uranium until it has submitted a performance assessment and the performance assessment has been approved. The financial impacts on EnergySolutions are potentially substantial, but are difficult for the Board to specify because the impact depends on the following information not known to the Board at this time:

- When the requirement takes effect;
- When EnergySolutions will submit a performance assessment and when it is approved;
- When EnergySolutions would otherwise have received shipments of depleted uranium for disposal; and
- Whether receipts by EnergySolutions would simply be delayed, or whether there are competitors for depleted uranium disposal space such that EnergySolutions could lose reciepts altogether.**

** This rulemaking analysis does not consider the impact of any potential inability by EnergySolutions to demonstrate that it meets the requirements of 10 CFR Part 61 and the equivalent Utah rules, since that inability would not be by operation of this rule.

EnergySolutions will also bear the cost of preparing and submitting a performance assessment, but has indicated this is an action it was already taking.

No small business in Utah will be directly impacted. The only potential sources of substantial quantities of depleted uranium for disposal – the United States Department of Energy and privately-held uranium enrichment facilities – are not small businesses and are not located in Utah.

Any affected business is invited to submit information about potential costs of this proposed rule during the public comment period.

B. Impacts on government budget

The State of Utah receives fees from facilities that dispose of depleted uranium at a land disposal facility. Utah Code Ann. § 19-3-104. EnergySolutions has such a land disposal facility and has stated that it would, in the absence of this rule, seek to dispose of depleted uranium. The financial impacts of this on the state's budget are potentially substantial, particularly for FY 2010, but as described above are difficult to specify. The State of Utah receives $0.15/cubic foot of waste disposed of, plus $1 per curie.

IV. ADDITIONAL DOCUMENTATION

The documents cited in this Statement of Basis are incorporated in their entirety by this reference. In addition, all documents linked through the NRC's Unique Waste Streams Rulemaking website are incorporated by reference. *See*:

http://www.nrc.gov/about-nrc/regulatory/rulemaking/potential-rulemaking/uw-streams.html.

V. STATEMENT REGARDING UTAH CODE ANNOT. § 19-3-104(8) and (9).

The Board intends to issue a determination, after the public comment period, about whether there are "corresponding federal regulations that are not adequate to protect public health and the environment of the state."

The statute states:

> (8) (a) Except as provided in Subsection (9), the board may not adopt rules, for the purpose of the state assuming responsibilities from the United States Nuclear Regulatory Commission with respect to regulation of sources of ionizing radiation, that are more stringent than the corresponding federal regulations which address the same circumstances.
> (b) In adopting those rules, the board may incorporate corresponding federal regulations by reference.

(9) (a) The board may adopt rules more stringent than corresponding federal regulations for the purpose described in Subsection (8) only if it makes a written finding after public comment and hearing and based on evidence in the record that corresponding federal regulations are not adequate to protect public health and the environment of the state.
(b) Those findings shall be accompanied by an opinion referring to and evaluating the public health and environmental information and studies contained in the record which form the basis for the board's conclusion.

VI. PROPOSED RULE

R313-12-3. Definitions. [No change proposed; included only for context.]

"Depleted uranium" means the source material uranium in which the isotope uranium-235 is less than 0.711 weight percent of the total uranium present. Depleted uranium does not include special nuclear material.

R313-25-8. Technical Analyses.

(1) The specific technical information shall also include the following analyses needed to demonstrate that the performance objectives of R313-25 will be met:
~~(1)~~ (a) Analyses demonstrating that the general population will be protected from releases of radioactivity shall consider the pathways of air, soil, ground water, surface water, plant uptake, and exhumation by burrowing animals. The analyses shall clearly identify and differentiate between the roles performed by the natural disposal site characteristics and design features in isolating and segregating the wastes. The analyses shall clearly demonstrate a reasonable assurance that the exposures to humans from the release of radioactivity will not exceed the limits set forth in R313-25-19.
~~(2)~~(b) Analyses of the protection of inadvertent intruders shall demonstrate a reasonable assurance that the waste classification and segregation requirements will be met and that adequate barriers to inadvertent intrusion will be provided.
~~(3)~~(c) Analysis of the protection of individuals during operations shall include assessments of expected exposures due to routine operations and likely accidents during handling, storage, and disposal of waste. The analysis shall provide reasonable assurance that exposures will be controlled to meet the requirements of R313-15.
~~(4)~~(d) Analyses of the long-term stability of the disposal site shall be based upon analyses of active natural processes including erosion, mass wasting, slope failure, settlement of wastes and backfill, infiltration through covers over disposal areas and adjacent soils, and surface drainage of the disposal site. The analyses shall provide reasonable assurance that there will not be a need for ongoing active maintenance of the disposal site following closure.

(2)(a) Any facility that proposes to land dispose of significant quantities of depleted uranium (more than one metric ton in total accumulation) after [effective date of rule] shall submit for the Executive Secretary's review and approval a performance assessment that demonstrates that the performance standards specified in 10 CFR Part 61 and corresponding provisions of Utah rules will be met for the total quantities of depleted uranium and other wastes, including wastes already

disposed of and the quantities of depleted uranium the facility now proposes to dispose. Any such performance assessment shall be revised as needed to reflect ongoing guidance and rulemaking from NRC. For purposes of this performance assessment, the compliance period will be a minimum of 10,000 years. Additional simulations will be performed for a qualitative analysis for the period where peak dose occurs.

(b) No facility may dispose of significant quantities of depleted uranium prior to the approval by the Executive Secretary of the performance assessment required in R. 313-25-8(2)(a).

(c) For purposes of this R. 313-25-8(2) only, depleted uranium means waste with depleted uranium concentrations greater than 5 percent by weight.

ENDNOTES

1. The following frequently cited documents in this Statement of Basis may be found at the indicated web locations.

Records

NRC Communication Plan Key Messages (August 19, 2009): http://www.nrc.gov/about-nrc/regulatory/rulemaking/potential-rulemaking/uw-streams/key-messages.html

NRC Fact Sheet on Depleted Uranium and Other Waste Disposal (August 26, 2009): http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/fs-du-other-waste-disposal.html

NRC's Frequently Asked Questions about Land Disposal of Unique Waste Streams (August 4, 2009): http://www.nrc.gov/about-nrc/regulatory/rulemaking/potential-rulemaking/uw-streams/faq.html

NRC Frequently Asked Questions in the Communication Plan (August 19, 2009): http://www.nrc.gov/about-nrc/regulatory/rulemaking/potential-rulemaking/uw-streams/workshop-faq.html

NRC Staff Requirements, SECY-08-0147, Response to Commission Order CLI-05-20 Regarding Depleted Uranium (October 7, 2008) (hereinafter SECY-08-0147): http://www.nrc.gov/reading-rm/doc-collections/commission/secys/2008/secy2008-0147/2008-0147scy.pdf

NRC's Unique Waste Streams Rulemaking Record, Workshop 1, Day 1 Transcripts (September 2, 2009): http://www.nrc.gov/about-nrc/regulatory/rulemaking/potential-rulemaking/uw-streams/workshop-1-transcripts-day1.pdf

NRC's Unique Waste Streams Rulemaking Record, Workshop 2, Day 1 Transcripts (September 23, 2009): http://www.nrc.gov/about-nrc/regulatory/rulemaking/potential-rulemaking/uw-streams/workshop-2-transcripts-day1.pdf

NRC's Unique Waste Streams Rulemaking Record, Workshop Presentations (September 2009): http://www.nrc.gov/about-nrc/regulatory/rulemaking/potential-rulemaking/uw-streams/du-workshop-presentations.pdf

NRC's Unique Waste Streams Rulemaking Record Website (October 20, 2009): http://www.nrc.gov/about-nrc/regulatory/rulemaking/potential-rulemaking/uw-streams.html

Rules and Statutes

NRC Rules, 10 CFR Part 61: http://www.nrc.gov/reading-rm/doc-collections/cfr/part061/

DRC Rules, Utah Admin. Code R.313: http://www.rules.utah.gov/publicat/code/r313/r313.htm

DRC Statute, Radiation Control Act, Utah Code Ann. Title 19, Chapter 3: http://le.utah.gov/~code/TITLE19/19_03.htm

2. SECY-08-0147, Enclosure 1 at pages 2-3; see also chart at page 3.

The NRC also has descriptions of depleted uranium at a number of other web locations, *e.g.*, "NRC Fact Sheet on Depleted Uranium and Other Waste Disposal," and "NRC Frequently Asked Questions in the Communication Plan."

See also NRC's Unique Waste Streams Rulemaking Record, Workshop Presentations, Slide 78 of 115 and comment by David Esh, NRC's lead modeler for SECY-08-0147:

> "So we call it depleted uranium because it's depleted in the U-235 isotope, but chemically it's really concentrated uranium because you've made pure uranium out of the process of trying to develop fuel for reactors."

NRC's Unique Waste Streams Rulemaking Record, Workshop 2, Day 1 Transcript at page 92.

3. U.S. Nuclear Regulatory Commission (NRC). 'Draft Environmental Impact Statement on 10 CFR Part 61 Licensing Requirements for Land Disposal of Radioactive Waste.' NUREG-0782 (1981); NRC, 'Final Environmental Impact Statement on 10 CFR Part 61 Licensing Requirements for Land Disposal of Radioactive Waste,' NUREG-0945 (1982).

Note also NRC's statement that "Waste class concentrations [are] based primarily on inadvertent intruder exposure." NRC's Unique Waste Streams Rulemaking Record, Workshop Presentations, Slide 33 of 115.

4. "A Performance Assessment Methodology for Low-Level Radioactive Waste Disposal Facilities: Recommendations of NRC's Performance Assessment Working Group," NUREG-1573. Note that among the many recommendations made by the authors of this document are a recommendation for a time period of 10,000 years for analyzing performance (*Id.* at 3-13), and a recommendation for "refraining from excessive speculation about the extremely distant future, and . . . limiting evaluations of the natural site's geologic evolution to the next 10,000 years," based, for example, on the assumption that geological changes such as glaciation will result in conditions under which humans will not be living close enough to the waste to be exposed. *Id.* at 3-9 and 3-10.

Web access through: http://www.nrc.gov/reading-rm/doc-collections/nuregs/pubs/.

5. In the Matter of Louisiana Energy Services (National Enrichment Facility), 62 NRC 523, CLI-05-20, October 19, 2005.

   Web access: http://www.nrc.gov/reading-rm/doc-collections/commission/orders/2005/2005-20cli.html.

6. *See* NRC website, Louisiana Energy Services (LES) Gas Centrifuge Facility.

   Web access: http://www.nrc.gov/materials/fuel-cycle-fac/lesfacility.html.

7. In the Matter of Louisiana Energy Services (National Enrichment Facility), 63 NRC 687 at 690, CLI-06-15, June 2, 2006.

   Web access: http://www.nrc.gov/reading-rm/doc-collections/commission/orders/2006/2006-15cli.pdf

8. *Id.*

9. *Id.*,, at 699. *See also* In the Matter of Louisiana Energy Services (National Enrichment Facility), 63 NRC 241, ASLBP 04-826-01-ML, LPB-06-08, March 3, 2006; and In the Matter of Louisiana Energy Services (National Enrichment Facility), 63 NRC 687, CLI-06-15, June 2, 2006 and Environmental Impact Statement for the Proposed National Enrichment Facility in Lea County, New Mexico (NUREG-1790).

   Web access for EIS: http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1790/

10. *See* SECY-08-0147.

11. *See* Commission Order in Memorandum re: Staff Requirements – SECY-08-0147 – Response to Commission Order CLI-05-20 Regarding Depleted Uranium.

    Web access: http://www.nrc.gov/reading-rm/doc-collections/commission/srm/2008/2008-0147srm.pdf.

12. See NRC Communication Plan Key Messages, and NRC Frequently Asked Questions in the Communication Plan.

13. All references in this section are to Envirocare and EnergySolutions' license amendments and related submissions for the dates given; license amendments and related submissions are in Division of Radiation Control files. The information in numbers 1 through 3 is also described in an analysis by the U.S. Department of Energy. *See* Evaluation of the Acceptability of Potential Depleted Uranium Hexafluoride Conversion Products at the Envirocare Disposal Site, ORNL/TM-2000/355, December 2000.

Web access: http://www.ornl.gov/~webworks/cpr/rpt/109279 .pdf.

14. NRC's Unique Waste Streams Rulemaking Record, Workshop 2, Day 1 Transcript at page 55.

15. *Id.*

16. Texas Admin. Code, Rule § 336.709.

    Web access: http://info.sos.state.tx.us/pls/pub/readtac$ext.TacPage?sl=T&app=2&p_dir=N&p_rloc=106855&p_tloc=&p_ploc=1&pg=41&p_tac=106856&ti=30&pt=1&ch=336&rl=709&z_chk=1072573.

17. NRC's "Frequently Asked Questions in the Communication Plan." *See also* Communication Plan Key Messages.

18. NRC's Unique Waste Streams Rulemaking Record, Workshop 2, Day 1 Transcript at page 40.

19. *See, e.g.,* SECY-08-0147, at page 5.

20. *See* SECY-08-0147, Enclosure 1 at page 4.

    See also comment made by David Esh, NRC's lead modeler for SECY-08-0147:

    > "Basically the large quantities were not evaluated in EIS [the document supporting rulemaking for Part 61]. They did something like 17 Curies of Uranium-238 and three Curies of Uranium 235, and something like a million cubic meters of waste in the analyses, and if you look at the potential waste streams that may be anticipated, you could be looking at something like 470,000 Curies of Uranium-238. So you're really outside of the box from what was done, and we recognize that, and that's why we're here today."

    NRC's Unique Waste Streams Rulemaking Record, Workshop 2, Day 1 Transcript at page 90.

21. NRC Fact Sheet on Depleted Uranium and Other Waste Disposal. This has also been acknowledged by NRC in many other documents, e.g., NRC, SECY-08-0147, Enclosure 1 at page 1, and In the Matter of Louisiana Energy Services (National Enrichment Facility), 62 NRC 523, CLI-05-20, October 19, 2005, Part V.

    Web access for CLI-05-20: http://www.nrc.gov/reading-rm/doc-collections/commission/orders/2005/2005-20cli.html.

22. See Workshop Presentations, slide 40 of 115.

Note that risk is a function of quantity and concentration. *Id.* at Slide 58.

23. *See* SECY-08-147, Enclosure 1, at page 1.

    See also Slide 54 of 115 of the "Workshop Presentations" made by NRC at its NRC's Unique Waste Streams Rulemaking Workshop:

    "Analysis not intended to replace site-specific evaluations."

24. In the Matter of Louisiana Energy Services (National Enrichment Facility), 63 N.R.C. 591, 70-3103-ML, (ASLBP 04-826-01-ML) (May 31, 2006).

25. See SECY-08-147, at page 9.

26. NRC's Frequently Asked Questions about Land Disposal of Unique Waste Streams.

27. NRC's Unique Waste Streams Rulemaking Record, Workshop 2, Day 1 Transcript at page 82.

28. *See* NRC's Unique Waste Streams Rulemaking Record,"Workshop Presentations," Slide 12, "Commercial LLW Disposal Sites, and accompanying commentary at Workshop 1, Day 1 at page 32 and Workshop 2, Day 1 Transcript at pages 37-38.

29. NRC's Unique Waste Streams Rulemaking Record, Workshop 1, Day 1 Transcript (cited in note 1) at p. 25 and Workshop 2, Day 1 Transcript at p. 30.

30. *See* citations in notes 7 and 9.

31. *See* "U.S. Department of Energy Manual, Approval of Exemptions for Use of Non-DOE Facilities," at I-7.

    Web access: https://www.directives.doe.gov/pdfs/doe/doetext/neword/435/m4351-1c1.pdf.

    Representatives of the Board have been unable to locate a copy of DOE's exemption for disposal of depleted uranium at EnergySolutions or related documentation of DOE's decision to dispose of its depleted uranium in Utah, but the need for an exemption is also referenced in two pre-decisional documents: "Evaluation of the Acceptability of Potential Depleted Uranium Hexafluoride Conversion Products at the Envirocare Disposal Site," December 2000; and "Draft Supplement Analysis for Location(s) to Dispose of Depleted Uranium Oxide Conversion Product Generated from DOE's Inventory of Depleted Uranium Hexafluoride (DOE/EIS-0359-SA1 AND DOE/EIS-0360-SA1), March 2007."

    Web access (respectively): http://www.ornl.gov/~webworks/cpr/rpt/109279 .pdf

and http://gc.energy.gov/NEPA/nepa_documents/na/EIS-0359-SA1_EIS-0360-SA1.pdf.

32. Web access: http://www.radiationcontrol.utah.gov/Board/minagd/7142009.pdf.

33. SECY-08-0147, Enclosure 1 at page 21. *See also* SECY-08-0147, Enclosure 1 at pages 6-8 for a fuller discussion.

RESPONSE TO COMMENTS REGARDING
PROPOSED AMENDMENTS TO UTAH ADMIN. CODE R313-25-8 TO ADDRESS DEPLETED URANIUM
April 5, 2010

The Executive Secretary provides the following responses to public comments received during the public comment period (January 1, 2010 to February 2, 2010) regarding proposed changes to R313-25-8 to set forth a specific performance assessment requirement for disposal of depleted uranium. The rule is set forth as it was proposed on January 1, 2010, in Attachment 1. The rule as it now being recommended to the Board is set forth in Attachment 2. The difference between the two versions is discussed in Part B below.

A. Background – What is the Proposed Rule About and Why Has it Been Proposed?

The Statement of Basis for Administrative Rulemaking Regarding Disposal of Significant Quantities of Depleted Uranium (December 1, 2009) (Statement of Basis), as set forth in Attachment 3, describes the purpose of the Proposed Rule and the Board's authority to conduct this rulemaking. In summary, the Proposed Rule would require a licensee proposing to dispose of significant quantities of depleted uranium to submit a performance assessment and to have that performance assessment approved prior to disposal. The purpose of the performance assessment would be to demonstrate that the facility will meet the U.S. Nuclear Regulatory Commission's (NRC's) Performance Objectives for land disposal of radioactive waste if the depleted uranium is disposed of as proposed. The NRC has recommended that evaluation occur prior to the disposal of significant quantities of depleted uranium.

NRC's Performance Objectives are found at 10 CFR §§ 61.40 through 61.44. They are short narrative standards regarding the protection of the general population from releases of radioactivity, protection of individuals from inadvertent intrusion, protection of individuals during operations, and stability of the disposal site after closure. Other regulatory provisions, NRC guidance and professional judgment are used to ensure that NRC's Performance Objectives are met. The full text of NRC's Performance Objectives is set forth in Attachment 4.[1]

In order to understand why this rule has been proposed, it is necessary first to understand NRC's low-level radioactive waste classification system.[2] Although a site-specific performance assessment could have been done for every kind of radioactive waste proposed to be disposed of at every land disposal facility, the NRC elected to take a different, more efficient approach. In

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[1] Agreement states like Utah must have rules that are equivalent to NRC's Performance Objectives. Utah's rules regarding performance objectives are found at Utah Admin. Code R313-25-18 through 22.

[2] The following information is a summary of information that was already provided in the Statement of Basis, and in the documents incorporated therein. *See* Attachment 3.

the early 1980s, it did a generic performance assessment to establish the conditions under which there was reasonable assurance that its Performance Objectives would be met for different kinds and concentrations of low-level radioactive waste, and at facilities with different kinds of environmental conditions. NRC used the results of that assessment to classify different kinds and concentrations of waste into four categories, each with different disposal requirements defined by the kinds of restrictions that would be required to dispose of the waste: Class A, B, C and Greater-than-Class C. Class A is the least restrictive category, and Greater-than-Class C is the greatest. Although there are other requirements that apply to any waste being disposed, the requirements associated with the waste's classification form the foundation of the applicable requirements for nearly all low-level radioactive wastes.

Depleted uranium is different from other low-level radioactive wastes, however. Because significant quantities of depleted uranium were not anticipated at the time NRC's generic classification performance assessment was completed, that assessment did not analyze the performance of the disposal of significant quantities of depleted uranium at land disposal facilities. Nor was the appropriate classification of significant quantities of depleted uranium evaluated.[3] For these reasons, waste classification cannot serve as the regulatory foundation for disposal of depleted uranium as it does for other radioactive wastes.

After studying this matter, the NRC decided to turn instead to another of its regulatory tools, the performance assessment. It is in the process of developing a regulation that will require a facility proposing to dispose of significant quantities of depleted uranium to first conduct a performance assessment. In the interim, before that regulation is adopted, NRC has also recommended that disposal facility operators and Agreement state regulators review performance assessments to ensure that Performance Objective are being met. NRC also provided new, interim guidance about how to do a performance assessment.

This rule requiring a performance assessment for disposal of significant quantities of depleted uranium is proposed in order to ensure that NRC's Performance Objectives will be met for disposal of significant quantities of depleted uranium. In the absence of such a performance assessment, the agency cannot have reasonable assurance that performance objectives will be met.

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[3] Depleted uranium's status as a Class A waste is by operation of 10 CFR § 61.55(a)(6), which states that any wastes that are not specifically addressed in NRC's waste classification regulation will be considered Class A waste. It was not at that time a result of an affirmative decision that the restrictions for Class A waste are sufficient to ensure the safe disposal of significant quantities of depleted uranium. The NRC has since concluded that it will not change the classification of depleted uranium at this time – although it may do so in the future – but will instead require an approved performance assessment to ensure that the facility meets NRC Performance Objectives.

B. Changes in the Proposed Rule

1. In order to avoid confusion over the use of duplicate terms, the NRC has recommended that the term "depleted uranium" as defined in R313-25-8(2)(c) of the Proposed Rule and as used throughout R313-25-8(2) be changed to "concentrated depleted uranium." The Executive Secretary concurs in this recommendation and has prepared a proposed rule change for the Board's consideration.

2. Several commenters felt that this language in the Proposed Rule, R313-25-8(2)(a) was confusing:

> "Additional simulations will be performed for a qualitative analysis for the period where peak dose occurs."

They noted that simulations cannot be qualitative, so it was unclear how this analysis would proceed. The Executive Secretary agrees that it would be helpful to clarify this language and is proposing instead:

> "Additional simulations shall be performed for a qualitative analysis for the period where peak dose occurs and the results shall be analyzed qualitatively."

3. Finally, "will" has been changed to "shall" in this portion of the rule for purposes of consistency and because the latter is more commonly used in regulatory language.

C. Stringency of the Rule – Applicability

1. The Proposed Rule is not more stringent than corresponding federal regulations.

a. All licensees are already required to meet performance objectives for disposal of all wastes:

> R313-25-18. General Requirement.
> Land disposal facilities shall be sited, designed, operated, closed, and controlled after closure so that reasonable assurance exists that exposures to individuals do not exceed the limits stated in R313-25-19 and 25-22.

The Proposed Rule simply clarifies and codifies, for depleted uranium, what will be necessary to demonstrate that those standards are met. Any rule may be enforced by order under Utah Code Ann. § 19-3-108(2)(c)(iii).

Because existing rules allow the agency to require compliance before disposal where there is an unanalyzed condition, the Proposed Rule is therefore not more stringent.

b. The Proposed Rule, generally, adopts a procedure for ensuring that existing standards are met. With one exception, it does not specify any standard and so does not impose standards that are more or less stringent than federal law.

The one exception is that the rule does specify a 10,000 year minimum time period as a performance period. Because the performance period is not specified in either federal or Utah law, there is no comparable federal regulation and the stringency provisions of Utah Code Ann. § 19-3-104(8) do not apply.

The determination about the period of performance lies within the discretion of both the NRC and the Division of Radiation Control (DRC) since both are required to determine an appropriate performance period anytime they review a performance assessment. The agencies, therefore, already have authority to make this determination so, again, the requirement is not more stringent.

c. The Proposed Rule is not more stringent than federal rules because there are no "corresponding federal regulations which address the same circumstances." Utah Code Ann. § 19-3-104(8)(a). Specifically, there is no federal regulation governing how or when a performance assessment can be required generally, or specifically with respect to disposal of depleted uranium. Because there is no comparable federal regulation, the stringency provisions of Utah Code Ann. § 19-3-104(8) and (9) do not apply.

d. These analyses do not change because the Licensee is required under the Proposed Rule to comply prior to disposal. The Proposed Rule imposes the same kind of restriction that is found in countless regulatory and license requirements to which any licensee is subject: it requires that before the licensee can undertake an activity, it must demonstrate that activity is safe. This is the normal regulatory process, not a moratorium. The timing of the submission of a performance assessment is in the licensee's hands. (*See also* General Response to Comment No. 39, Comment No. 2 regarding timing of the performance assessment.)

2. In the event the rule is found to be more stringent, and specifically in the event the Division of Radiation Control is found to have the authority to require a performance assessment prior to disposal in order to assure that a licensee meets performance objectives, then the corresponding federal rules are not adequate to protect human health and the environment with respect to the disposal of depleted uranium because that disposal is an unanalyzed condition. *See* Part D.

D. Stringency of the Rule – Proposed Findings and Opinion

The Executive Secretary has submitted for the Board's consideration a draft finding and opinion, as required by Utah Code Ann. § 19-3-104(9)(b). *See* Attachment 5.

E. Discussion and Analysis Regarding Impact on Small Business

1. Applicability of Utah Code Ann. § 63G-3-301(6)

One commenter, Cavanagh Services Group, has alleged that it will be impacted by the Proposed Rule, and has quantified that impact in its comments. Cavanagh and EnergySolutions requested that the rule be sent back out for public comment with the analysis of methods of reducing the impact of the rule on small business required by Utah Code Ann. § 63G-3-301(6).

The Executive Secretary agrees that the Proposed Rule will impact Cavanagh, albeit indirectly. Because all of the analyses required by Utah Code Ann. § 63G-3-301(6) go to questions about whether direct impacts on small businesses can be reduced, however, the Executive Secretary reasonably concluded that section does not apply to indirect impacts, such as those alleged by Cavanagh. *See* analysis in Part E.3.

2. Remedy

In the event that the Executive Secretary's interpretation is in error, the remedy for failure to provide that analysis when rulemaking is proposed is provided in Utah Code Ann. § 63G-3-301(7):

> If during the public comment period an agency receives comment that the proposed rule will cost small business more than one day's annual average gross receipts, and the agency had not previously performed the analysis in Subsection (6), the agency shall perform the analysis described in Subsection (6).

The remedy, then, is to perform the analysis, not to send the rule back out to public comment. That analysis is provided in E.3.

3. Analysis

Utah Code provides:

> (6) If the agency reasonably expects that a proposed rule will have a measurable negative fiscal impact on small businesses, the agency shall consider, as allowed by federal law, each of the following methods of reducing the impact of the rule on small businesses:
> (a) establishing less stringent compliance or reporting requirements for small businesses;
> (b) establishing less stringent schedules or deadlines for compliance or reporting requirements for small businesses;
> (c) consolidating or simplifying compliance or reporting requirements for small businesses;
> (d) establishing performance standards for small businesses to replace design or

operational standards required in the proposed rule; and
(e) exempting small businesses from all or any part of the requirements contained in the proposed rule.

Utah Code Ann. § 63G-3-301(6).

(a) Would establishing less stringent compliance or reporting requirements for small businesses reduce the impact of the Proposed Rule on small business?

Response: It would not. Because there is no small business that is subject to any compliance or reporting requirements under the Proposed Rule, reducing those requirements for small business would not reduce the impact on small business.

(b) Would establishing less stringent schedules or deadlines for compliance or reporting requirements for small businesses reduce the impact of the Proposed Rule on small business?

Response: It would not. Because there is no small business that is subject to any compliance or reporting requirements under the Proposed Rule, establishing less stringent schedules or deadlines for compliance or reporting for small business would not reduce the impact on small business.

(c) Would consolidating or simplifying compliance or reporting requirements for small businesses reduce the impact of the Proposed Rule on small business?

Response: It would not. Because there is no small business that is subject to any compliance or reporting requirements under the Proposed Rule, consolidating or simplifying those requirements for small business would not reduce the impact on small business.

(d) Would establishing performance standards for small businesses to replace design or operational standards required in the proposed rule reduce the impact of the Proposed Rule on small business?

Response: It would not. Because there is no small business that is subject to any design or operational standard under the Proposed Rule, establishing alternate performance standards instead for small business would not reduce the impact on small business.

(e) Would exempting small businesses from all or any part of the requirements contained in the Proposed Rule reduce the impact of the Proposed Rule on small business?

Response: It would not. Because there is no small business that is subject to the Proposed Rule, exempting small businesses from all or any part of the requirements contained in the Proposed Rule would not reduce the impact on small business.

F. General Responses

The following general responses apply to many comments received.

1. The Proposed Rule would require completion of a performance assessment. Like many of DRC's rules, it does not provide detailed requirements but instead requires compliance with fairly broad standards. It will be the responsibility of the licensee to demonstrate that the licensee is meeting those standards.

Many comments made go to how a performance assessment should be performed and evaluated including, for example, requests to consider flooding, earthquakes, and the impact of design. We acknowledge those comments and copies will be provided to EnergySolutions and to those in DRC (including contractor support) responsible for reviewing any performance assessment that EnergySolutions submits. Those comments, however, are pertinent to that decision and not to whether the Proposed Rule requiring a performance assessment should be adopted.

2. The focus of the Utah Radiation Control Board, in line with its authority, is to protect human health and the environment. The popularity of radioactive waste disposal will therefore not be considered. The desire expressed by many commenters to keep waste out of Utah is a political question that is appropriately addressed to elected representatives.

Requests to keep depleted uranium out of Utah entirely, to the extent they are grounded in health and safety concerns, are premature. A performance assessment gives a licensee of a radioactive waste land disposal facility an opportunity to demonstrate that disposal of depleted uranium meets NRC Performance Objectives. A determination about a facility's ability to meet Performance Objectives and protect human health and safety will be made at that time, not in the context of this rulemaking.

3. Although it is beyond the scope of this rulemaking, many commenters have made requests about how the review of any performance assessment would be conducted. This general response describes the process ordinarily used.

When a significant report is received by the agency, it is reviewed by staff or staff with contractor assistance. If the staff has questions, they are compiled into "Requests for Information" (RAI) and sent to the licensee. The licensee responds to RAIs in writing and with supporting documentation. Additional RAIs may be generated during this iterative process.

If, after collecting and evaluating all relevant information, the Executive Secretary determines that it appears to be appropriate to approve the report, the staff prepares a Safety Evaluation Report and draft license amendment. A public comment period is then provided and, based on the comments received, the Executive Secretary may make necessary changes or request additional information from the licensee. Only after taking the public comments and any additional information into consideration, does the Executive Secretary make a final

determination.

In this case, the agency will follow the usual public comment format described here in making its determination on the performance assessment. There will be a public comment period on any Safety Evaluation Report and draft license amendment but not on the process leading up to that decision. However, the Executive Secretary commits to making any performance assessment, and any RAIs and responses from the licensee available on line when they are received or finalized. It is not anticipated that there will be a formal peer review process.

G. Specific Responses

Comment 1 (Utah Medical Association)

The Utah Medical Association (UMA), on behalf of the physicians in Utah, urge you to continue to push for a moratorium on the importation of Depleted Uranium into the State of Utah. We strongly believe there are probable public health risks to any importation and storage of Depleted Uranium (DU).

More than 2000 studies have examined DU toxicity. Considerable uncertainty exists regarding the safety of surface storage of DU as proposed by Energy Solutions. At best, limited modeling exists on the impact of DU inhalation or absorption that could occur following geological events (e.g. flooding, earthquakes, erosion) which could compromise DU canisters stored at the Utah site. Likewise, given an anticipated peak radioactivity in about 1,000,000 years, there is limited understanding of the impact of DU on future generations of Utahns. Clearly, there still exists uncertainty and much concern about future health impacts and toxicological outcomes of DU exposure. This uncertainty brings the strong possibility of unknown health and environmental impacts of radioactive storage.

The UMA Environmental Health Committee has carefully reviewed this issue. After careful review of the committee's conclusions and existing UMA policy, we have concluded that we must offer public comment against allowing importation of DU into the State of Utah. We ask the Utah Radiation Control Board to continue its rule-making process and quickly implement proposed rules that would prohibit the importation of DU while allowing for further study of the issues involved.

Currently, with the first shipment of DU arriving in Utah in December of 2009, Utah does not have anything in place to limit the importation of DU into the State. This must be accomplished in the rule-making process and must happen quickly.

We support the citizens of Utah who are also concerned about this issue. We remind the Board of the Salt Lake Tribune article on January 15th, 2010, which reported that the majority of Utah's citizens oppose the importation of DU. In addition, United State Representatives' Matheson and Chaffetz have proposed a bill in Congress that would ban imports of low level radioactive waste like DU. It is rare to see such bipartisan support on issues pertaining to the environment. Representative Matheson, also, opposes Energy Solutions' plan to mix DU with less radioactive atomic waste, which he and others feel may be a "sneaky way" to get hotter DU into Utah.

Given the unknown health and environmental effects of DU disposal, the Utah Medical Association urges the Radiation Control Board to enact a moratorium on the importation of DU until further study can be completed and assurances made as to the absence of any health risk. We must consider Utah's future generations, as we look back at the effects of radioactive testing on Utah citizens, when the long term effects of such testing was not appreciated. We feel this is the most prudent, wise and health conscious approach to protect the citizens of Utah.

Response

See Part F, Response No. 2.

Comment 2 (HEAL Utah)

Cover letter

Since November 6th 2009, 394 citizens have signed our online petition in support of additional regulations surrounding the disposal of depleted uranium. Please consider these as submissions as public comments for proposed changes to R313-25-8. The text of the petition and the names and addresses of the signers is included. If you need additional verification of the authenticity of the signatures, HEAL Utah can provide that.

Numerous citizens added their names to the petition in support of license condition 35, version 2. Please also consider these in regards to R313-25-8, as the signers' intentions are obvious.

A handful of citizens elected to interject their own personal comments as well, and those are singled out from the stack.

For communication purposes, you may consider all signers to have designated HEAL Utah as their representative in this matter, and please do not feel obligated to respond to these comments on an individual basis.

I would also draw your attention to a Salt Lake Tribune article dated February 2nd 2010 titled "Radioactive Waste Not Welcome Here: Poll: Overwhelming majority says Utah is not the right place for depleted uranium and foreign nuclear material." The poll referenced indicated 76% of Utahns are opposed to the disposal of depleted uranium in Utah.

Thank you in advance for your thoughtful consideration of the wishes and desires of Utahns, the vast majority of whom would prefer to see increased regulation of depleted uranium disposal.

Comments

I am pleased to submit these comments regarding proposed changes to R313-25-8 dealing with the land disposal of depleted uranium.

Within the next month or so, around 10,000 drums of depleted uranium from spent fuel reprocessing will be loaded onto trains in South Carolina and shipped to Utah for disposal. The proposed rule regarding land disposal of depleted uranium would ensure that such disposal is only allowed after a performance assessment is conducted and approved by Utah's Executive Secretary for Radiation Control that covers a minimum of 10,000 years and a "qualitative analysis" out to the time of peak dose.

Because the threat of additional large quantities of depleted uranium is imminent, I urge you to act with all haste to adopt the proposed rule as written. As is often said, we should not let perfection become the enemy of the good, and in this case, we believe the public interest is best served by swift adoption of the additional protections afforded by the proposed rule change.

However, we also believe that the rule does not sufficiently spell out how the performance assessment should be conducted, what role the public should have in the process, and what constitutes the threshold of success or failure within the context of the performance assessment.

In the world of performance assessments, the outcome is entirely dependent upon the starting assumptions and the "rules of the game" as determined by the software programmer.[FN1]

[FN1]: For example, see NRC's CLI-06–15, online at http://www.nrc.gov/reading-rm/doc-collections/commission/orders/2006/2006-15cli.pdf: "At one point, Envirocare's license contained a concentration limit on uranium isotopes, but the current license allows disposal of depleted uranium with no volume restrictions. The original radionuclide concentration limit <u>was based upon a site-specific performance assessment that assumed potential intruder exposures</u>.... Utah granted Envirocare a license amendment <u>eliminating the uranium concentration limits after concluding that the intruder scenarios assumed in the Baird Report were unrealistic</u> and therefore unnecessarily conservative" [underline added]. [end of FN1]

With this in mind HEAL, Utah recommends that the Board issue a brief policy statement by the end of calendar year 2010 setting forth how the Board intends for the performance assessment to be conducted. Please consider the following suggestions for inclusion in the policy statement:

How the Performance Assessment Should be Conducted

- *The performance assessment should model future exposures to a hypothetical on-site intruder, similar to on-site intruder scenarios that form the basis of the low-level waste classification scheme found in 10 CFR Part 61. Although the specifics of a scenario might be different in different locations, at a minimum, the intruder must be modeled to come into direct contact with the waste, in conformance to Utah rule* ***R313 -25-20. Protection of Individuals from Inadvertent Intrusion****, which requires "protection of any individuals inadvertently intruding into the disposal site and <u>occupying the site or contacting the waste</u> after active institutional controls over the*

disposal site are removed." Such a scenario represents a conservative and protective approach and also acknowledges the considerable uncertainty surrounding how the climate at a given site may change in the future, and how potential use of the site may change as a result.

- *The performance assessment must take into account large changes in climate that can occur over a one million-year period. Accordingly, the geologic record should be used as a reference point for modeling future climatic and geologic conditions.*
- *The performance assessment should calculate doses to critical organs as well as whole body dose equivalents. Utah rule R313 -25-19. Protection of the General Population from Releases of Radioactivity requires this, stating: "Concentrations of radioactive material which may be released to the general environment in ground water, surface water, air, soil, plants or animals shall not result in an annual dose exceeding an equivalent of 0.25 mSv (0.025 rem) to the whole body,0.75 mSv (0.075 rem) to the thyroid, and 0.25 mSv (0.025 rem) to any other organ of any member of the public."*

A Role for the Public

- *The details of the performance assessment should be presented in a public forum, with the opportunity for a question-and-answer session. The company contracted by the state of Utah to review the performance assessment should conduct a public workshop explaining how the model works, what assumptions were used, which exposure scenarios were included, and what the results mean.*
- *Public input should be solicited by way of public notice and comment prior to Executive Secretary approval or denial of the performance assessment.*
- *The Executive Secretary's decision on whether or not to allow depleted uranium for disposal should be publicly noticed and will be appealable to the Radiation Control Board.*
- *Contingent upon funding a multi-disciplinary peer review panel should be convened to review and render a report on the efficacy and robustness of the performance assessment. The panel should include experts in the following areas:*
  - *o Geochemistry, with specific knowledge of Uranium mineralogy and geochemistry*
  - *o Hydrology, with knowledge of near-surface and porous media flow*
  - *o Climate change, with specific knowledge of the geological past of a specific location*
  - *o Gaseous diffusion, with specific expertise on radon gas*
  - *o Health physics, with knowledge of the risk of radiation exposure to humans*
  - *o Mining*
  - *o Biology and ecology, with specific knowledge of how Uranium can affect plants, wildlife, and ecosystems*
- *The peer review panel should conduct public meetings, accept public input during the review, and make its final report publicly available. The Executive Secretary should take the final report into account before making a decision on whether or not to accept the results of the performance assessment.*
- *Local, State, and Federal elected officials from Utah should seek to fund such a peer review panel, as the issues are highly complex and the Nuclear Regulatory Commission (NRC) is similarly contemplating changes to its own regulations on depleted uranium, including potential requirements for performance assessments.*

Threshold for Success or Failure

- *If probabilistic analytical software (like GoldSim™) is used to conduct the performance assessment then a high percentage of the simulations-over 95%--must meet the applicable dose limits in order for disposal of significant quantities of depleted uranium to be deemed acceptable. Otherwise, the highest-dose scenario should be determinative.*
- *Any "disruptive event" that could reasonably lead to catastrophic failure of a disposal facility up to and including the "period where peak dose occurs" should be deemed unacceptable for depleted uranium disposal. Such a requirement is in keeping with Utah rule* ***R313 -25-23. Disposal Site Suitability Requirements for Land Disposal - Near-surface Disposal****, which states: "Areas shall be avoided where surface geologic processes such as mass wasting, erosion, slumping, landsliding, or weathering occur with sufficient such frequency and extent to significantly affect the ability of the disposal site to meet the performance objectives of R313-25, or may preclude defensible modeling and prediction of long-term impacts."*

Depleted uranium is a matter of vital public interest. Submitted with this document please find 394 comments submitted through HEAL Utah's website. For your convenience, the comments are grouped and tabulated onto spreadsheets, with the exception of five comments that were unique. Please send any correspondence on these comments to HEAL Utah rather than to the individuals listed.

Please also note that a recent poll indicates that registered Utah voters of all political stripes oppose depleted uranium disposal in the state, by a margin of 76% opposed to 16% that support, with 8% undecided. A news article detailing the poll is included with this submission for your convenience.

Furthermore, we continue to believe that a disposal depth of 10 feet for depleted uranium is insufficient to protect Utah public health and the environment and we incorporate by reference HEAL Utah's comments submitted on proposed license condition 35 to EnergySolutions' radioactive materials license, submitted December 23,2009.

We also believe existing performance assessments for the EnergySolutions' facility are not adequate to capture the hazard of depleted uranium and incorporate by reference HEAL Utah's comments on EnergySolutions' radioactive materials license renewal, submitted September 21,2007. We also incorporate by reference technical comments submitted on the proposed changes to Utah rule R313-25-8 by Doctors Nelson, Oviatt, and Rupper.

In conclusion, because of the overwhelming public concern about depleted uranium in the state and the inadequacy of current assessments and approaches to the issue, we strongly urge you to adopt proposed changes to Utah rule R313-25-8 requiring a performance assessment. We also urge that the Board issue a policy statement that sets forth Board expectations for how that performance assessment will be conducted, including relevant assumptions and scenarios, a significantly enhanced public participation component and thresholds of acceptability of the performance assessment.

Response

The Executive Secretary notes the comment supporting the rule change to require a performance assessment. As to the burial depth of depleted uranium, how a performance assessment should be conducted and evaluated, and a Board policy statement on these issues, *see* Part A, Background; Part F, General Response Nos. 1, 2, and 3; and Response to Comment No. 39.21. It is not anticipated that there will be a formal peer review process. *See* Part F, General Response No. 3.

Response to comments incorporated by reference:
Three of the five comments submitted via the HEAL website contain the statement: "I also urge you to include provision which fully take into account levels of peak dosage and geomorphologic impacts of erosion on the Clive facility." Such issues relate to how the performance assessment will be performed and not to the rule itself. *See* Part A, Background, and Part F, General Response No. 1. The remaining issues in the five comments raise general concerns about disposal of depleted uranium, including the potential for an unintended live ordnance drop or aircraft accident from activities on Utah Test and Training Range, and are not specific to this rulemaking. *See* Part F, General Response No. 2.

The Executive Secretary has previously responded to HEAL's comments on license condition 35 and license renewal. Response to Nelson *et al* comments are set forth in Response 27.

Comment 3 (Riley Parker)

My Plea is please keep depleted Uranium out of Utah. The cost of sending it here should be used to take care of it where it already is. I have thanked ... Utah our Governor and our U.S. Representative Jim Matheson for their help in keeping it out.

Money is nothing in comparison to good health. I can't attend the meetings I am 87 years old- but I am concerned about the future.

Response

See Part F, Response No. 2.

Comment 4 (Gary and Mary Thorne)

Please no more depleted Uranium or any other trash. Utah should not be a toxic waste dump. What do the citizens of Utah get out of it, nothing but a lower quality of life?

Think of future generations not just the bottom line of Energy Solutions.

Response

See Part F, Response No. 2.

Comment 5 (Utah Manufacturers Association)

Comment 5.1

Utah Manufacturers Association, the "voice of industry", representing more than 800 member companies in Utah, has grave concerns about the process the Radiation Control Board is proposing to promulgate rules regarding the disposal of depleted uranium in Utah.

The existing NRC Regulations are adequate to protect public health and the environment of the State. The NRC recently reviewed its regulations and confirmed that depleted uranium is Class A waste and may be suitable for near-surface disposal. The NRC has initiated a limited rulemaking to specify a requirement for site-specific analyses to ensure the continued safe disposal of DU; however, they have explicitly stated that uranium is properly classified as Class A waste as part of this process.

Response

As described in the Statement of Basis and in this Comment Response document, NRC has acknowledged that disposal of significant quantities of depleted uranium was not analyzed at the time NRC created its waste classification scheme, and that the classification scheme alone is therefore insufficient to ensure that NRC Performance Objectives will be met. NRC has recommended, and is developing a rule to require that performance assessments be reviewed and, if necessary, revised before disposal of significant quantities of depleted uranium in order to ensure that NRC Performance Objectives will be met.

Comment 5.2

The NRC found no need for any immediate action while its limited rulemaking proceeds. The NRC has concluded there is no immediate health and safety issue regarding the disposal of DU. In determining how to proceed with its limited rulemaking, it explicitly considered and rejected the need for an expedited rulemaking or Order regarding the ongoing disposal of DU.

Response

See Response to Comment 39.20

Comment 5.3

Existing technical analyses demonstrate that a moratorium on DU disposal pending the NRC rulemaking is not necessary to protect public health and the environment of the State. EnergySolutions has conducted technical analyses that clearly demonstrate that there is no near term threat from continuing disposal while the NRC rulemaking proceeds, and furthermore that the site is safe for the continued disposal of large quantities of depleted uranium. These studies consist of current performance assessment, analyses by NRC staff in SECY-08-0147, an assessment of the site-specific conditions at Clive and their impact on exposure scenarios, and comparison with the concentration considered by the NRC in the 1981 rulemaking (0.05 uCi/gm).

Response

See General Response to Comment 39, Nos. 4 and 5, and Response to Comment No. 39.8.

Comment 5.4

In fact, the current performance assessment, which EnergySolutions is in the process of updating, is itself adequate to demonstrate the absence of any near-term impact. The existing license provisions are more than adequate to protect public health and the environment of the State during the NRC rulemaking and for thousands of years.

Response

A licensee may, if it chooses, rely on existing performance assessments to comply with the Proposed Rule. *See* General Response to Comment No. 39, Response No. 2, regarding timing.

Comment 5.5

EnergySolutions already has agreed to modifications to its license that include, among other things, ensuring that DU is disposed of a minimum of 10 feet from the top of the cover on the site. This additional depth will specifically serve to retard the emission of radon at that point in the future when it begins to be generated. Radon is the principal source of the potential dose resulting from the decay of uranium.

Response

Please *see* Response to Comment 39.21.

Comment 5.6

The proposed rule is in conflict with State law. Utah Annotated Code (§19-3-104(8)) prohibits the Radiation Control Board from adopting rules "...that are more stringent than the corresponding federal regulations which address the same circumstances." The proposed rule is clearly more stringent than NRC rules that govern the disposal of depleted uranium as Class A waste (10 CFR 61).

The Radiation Control Board has not made the finding necessary that would allow it to promulgate rules no more stringent than" NRC regulations. Utah Annotated Code (§19-3- 104(9) allows the Radiation Control Board to adopt rules "more stringent than corresponding federal regulations for the purpose described in Subsection (8) only if it makes a written finding after public comment and hearing and based on evidence in the record that corresponding federal regulations are not adequate to protect public health and the environment of the state." The

Board has not initiated a process, including holding hearings to take evidence. Without such evidence, the Board cannot make any such finding.

Furthermore, the Radiation Control Board has not identified which standard or part of a standard is inadequate. To make the finding necessary that would allow it to promulgate rules no more stringent than" NRC regulations the RCB would have to be explicit about the inadequacy of the subject standard and no such identification has been made.

The proposed rule places the State of Utah in direct conflict with the NRC's Agreement State Program. The rules under which the State of Utah is delegated the authority to oversee compliance with the Atomic Energy Act, the Agreement State program, imposes certain limitations on the state. Among those are designations regarding the compatibility of state regulations with NRC regulations. The NRC requires that State regulations governing the disposal of low level radioactive waste be essentially identical" to those of the NRC. The proposed rule fails to satisfy that requirement.

Response

Please *see* Parts C and D above and Response to Comment 39.11 (need for an evidentiary hearing). In the event that it is determined that the Proposed Rule is more stringent under Utah Code Ann. § 19-3-104(8) and (9), the findings necessary to support this rulemaking are found in Attachment 5.

The NRC has determined that the Proposed Rule is not in conflict with NRC's Agreement State Program. *See* Comment No. 36.

Comment 5.7

UMA was intimately involved in the passage of the legislation restricting Utah State regulatory agencies from adopting rules and regulations "more stringent than corresponding federal regulations" unless after a public hearing and based on evidence in the record that corresponding federal regulations are not adequate to protect public health and the environment of the state. It has served us well and has fostered a healthy business climate in Utah. Predictability is crucial to Utah businesses and failure to comply with state statute upsets that principle. We therefore, respectfully request the Radiation Control Board follow Utah statute. If state agencies ignore this law Utah businesses will experience damage to there business climate. It is our understanding that the Radiation Control Board members have been informed of the law but have chosen to ignore it. UMA representing manufacturers across the state will not tolerate violation of this law.

For the reasons stated above Utah Manufacturers Association opposes the process underway by the Radiation Control Board and requests they withdraw the proposed regulations until they can make a finding that would support promulgating rules more stringent than corresponding federal rules.

Response

As described in Parts C and D, above, and in Response to Comment 39.6, the Executive Secretary does not believe the Proposed Rule is more stringent that corresponding federal rules.

The Executive Secretary acknowledges the importance of providing a positive and predictable regulatory environment for business. That is among the reasons that the stringency provisions of DEQ statutes have been used so infrequently. In this case, however, as described in the Statement of Basis and in this Comment Response document, the Proposed Rule is warranted, even if it is found to be more stringent than corresponding federal regulations, and must be used.

Comment 6 (Steven and Maridee Haycock)

We write in support of the Board's determination to create a new rule to ensure that no depleted uranium enters Utah before completion of detailed and thorough public health studies and performance assessments. We believe this rule must consider levels of peak dosage and must study the impact of all foreseeable geological processes. We believe additional safeguards are imperative.

It is imperative that our state work to protect its people from exposure to radiation and contamination. Decisions concerning waste of this nature will impact our descendants forever; these decisions must be made methodically and with the utmost scientific integrity, free of the short-term thinking that dominates the political process.

Response

The commenters' support for the rule is noted. With respect to the request to consider peak dosage, please note that the Proposed Rule requires a qualitative review of simulations for peak dosage. With respect to the request for consideration of geological processes, please *see* Part F, Response No. 1.

Comment 7 (Peter Corroon, Mayor, Salt Lake County)

I believe more research and data must be collected to determine the safest methods of the disposal of depleted uranium (DU) in Utah. This data must include possible consequences of disruptive future events such as earthquakes, flooding, and changes in climate. All potential public health consequences must be analyzed before current shipments of DU are buried and the state of Utah considers importing more DU. We are especially concerned that high-level radioactive waste will be transported through Salt Lake County.

Despite repeated public concerns to the Governor's office about this issue it is incredibly unfortunate that over 5,000 drums of DU have recently been shipped to Utah before necessary studies have been completed.

It is clear that DU presents possible hazards to the safety of Utahns today and into the future. We must create high standards for the disposal of DU and the proposed new rule is a step in that direction. Future generations should not be forced to accept the potentially harmful consequence of our lack of due diligence and research on this important issue.

Response

The request for additional research and data is consistent with the goals of the Proposed Rule. With respect to the requests for analyses of events such as earthquakes, flooding and climate changes, please *see* Part F, Response No. 1. The Board does not have jurisdiction over waste transportation matters; those comments are beyond the scope of this rulemaking.

Comment 8 (NEI/Ralph Andersen)

On behalf of the nuclear industry, the Nuclear Energy Institute (NEI) submits the following comments in response to Utah's proposed rule regarding the land disposal of depleted uranium (DU) within the state of Utah. We trust you will find these comments useful, and we appreciate the stakeholder comment opportunity provided by the state.

We share your goal of ensuring that licensed nuclear energy activities protect public health and safety and the environment, and recognize your role as an agreement state in this regard. As such, we support Utah's expectation that low-level radioactive waste disposal practices within Utah will conform to the applicable requirements in 10 CFR Part 61 and the corresponding provisions of the Utah regulations. To this end, it is our understanding that

Energy Solutions plans to submit additional site specific information on its Clive facility to Utah for review and approval by year's end.

We support this continued site-specific work and believe that Utah's proposed rule is premature and unnecessary at this time. NEI believes that: 1) Utah can fulfill its regulatory role to ensure safety without promulgating a proposed rule at this time; 2) NRC is currently developing a proposed rule addressing the disposal of large quantities of DU; 3) Utah will need to promulgate a compatible rule once the NRC's rulemaking is complete; and 4) NRC has stated that, as currently written, the Utah proposed rule would create a conflict with the current 10 CFR Part 40 definition of DU and must be modified to be found compatible with existing NRC rules.

Response

The commenter's opposition to the rule is noted. Please note that the Proposed Rule has been changed to resolve the potential conflict identified by NRC. *See* Part B.1, above.

<u>Comment 9</u> (David Moir)

As a paralegal and a citizen of the State of Utah I am concerned that the Division of Radiation Control {DRC) is now willing to skirt established law in favor of becoming politically popular.

Opposing EnergySolutions has become increasingly politically popular. We have seen big name political figures jump on the hate EnergySolutions bandwagon, joining the chorus of antagonist fanatics who pitch outright lies in the attempt to generate fear, which spends just like cash. They use it to buy votes, elected officials, press coverage, funds and to press their own political agenda.

The one voice of reason in this whole debate has been the DRC. As those who regulate EnergySolutions, the DRC has always known the truth and thus could sift through the mountain of lies and threat them with the contempt they deserve - ignore them. But the Division, is so doing, has received much criticism from EnergySolutions antagonist, accused of receiving brides, kickbacks and turning a blind eye to the dangerous and polluting Energy Solutions.

The Division to their credit, has discarded such attacks and continued with their business. But it seems that all that is about to change. The Division has been under pressure from Heal Utah and other antagonists, to enact rules regarding the disposal of Depleted Uranium (DU) that are more stringent than federal regulations.

May I remind the Division that Utah Annotated Code (§19-3-104(8) prohibits the Radiation Control Board from adopting rules "...that are more stringent than the corresponding federal regulations which address the same circumstances." The proposed rule is clearly more stringent than NRC rules that govern the disposal of depleted uranium as Class A waste (10 CFR 61).

The Board has not made the finding necessary that would allow it to promulgate rules more stringent than NRC regulations. Utah Annotated Code (§19-3-104(9)) allows the Radiation Control Board to adopt rules "more stringent than corresponding federal regulations for the purpose described in Subsection (8) only if it makes a written finding after public comment and hearing and based on evidence in the record that corresponding federal regulations are not adequate to protect public health and the environment of the state."

The Board has not initiated a process, including holding hearings to take evidence. Without such evidence, the Board cannot make any such finding. Furthermore the Board has not identified which standard or part of a standard is inadequate. To make the finding necessary that would allow it to promulgate rules "more stringent than" NRC regulations the RCB would have to be explicit about the inadequacy of the subject standard and no such identification has ben made. The NRC recently reviewed its regulations and confirmed that depleted uranium is Class A waste and may be suitable for near-surface disposal. The NRC has initiated a limited rulemaking to specify a requirement for site-specific analyses to ensure the continued safe disposal of DU; however, they have explicitly stated that uranium is properly classified as Class A waste as part of this process.

The NRC found no need for any immediate action while its limited rulemaking proceeds. The NRC has concluded there is no immediate health and safety issues regarding the disposal of DU. In determining how to proceed with its limited rulemaking, it explicitly considered and rejected the need for an expedited rulemaking or Order regarding the ongoing disposal of DU.

Existing technical analyses demonstrate that a moratorium on DU disposal pending the NRC rulemaking is not

necessary to protect public health and the environment of the State. EnergySolutions has conducted technical analyses that clearly demonstrate that there is no near term threat from continuing disposal while the NRC rulemaking proceeds, and furthermore that the site is safe for the continued disposal of large quantities of depleted uranium. These studies consist of current performance assessment, analyses by NRC staff in SECY-08-014, an assessment of the site-specific conditions at Clive and their impact on exposure scenarios, and comparison with the concentration considered by the NRC in the 1981 rulemaking (0.05 uCi/gm). In fact, the current performance assessment, which EnergySolutions is in the process of updating; is itself adequate to demonstrate the absence of any near-term impact.

The existing license provisions are more than adequate to protect public health and the environment of the State during the NRC rulemaking and for thousands of years. EnergySolutions already has agreed to modifications to its license that include, among other things ensuing that DU is disposed of a minimum of 10 feet from the top of the cover on the site. This additional depth will specifically serve to retard the emission of radon at that point in the future when it begins to be generated. Radon is the principal source of the potential dose resulting from the decay of uranium.

Independent of the NRC rulemaking, EnergySolutions already has commenced preparation of technical analyses. The updated technical analyses will explicitly address the longer performance period that arises from the decay of uranium and its progeny. Any findings from the updated technical analyses can be addressed before any health and safety issues arise. The disposal of depleted uranium during the interim period while the NRC conducts its rulemaking results in no irreversible harm. Steps necessary to provide additional mitigation, if necessary, for example providing additional depth, can be taken long before there is any threat from the disposal of depleted uranium. The proposed rule places the State of Utah in direct conflict with the NRC's Agreement State Program. The rules under which the State of Utah is delegated the authority to oversee compliance with the Atomic Energy Act, the Agreement State program, imposes certain limitations on the state. Among those are designations regarding the compatibility of state regulations with NRC regulations.

I encourage compliance with establish law and the discarding of those with funds enough to buy the loudest voices. Has anyone ever asked the antagonist, where are the facts necessary to support their arguments? Based on what do they make their allegations? Or are the voices of those who continue to yell - help us defeat EnergySolutions - all we need is your check or credit card number, just accepted without ever being questioned?

You must make decisions based on facts, not fiction. In so doing, you cannot ignore established law in favor of those who say - trust us, we're cute and we make Dutch apple pie (it is terrific) While ignoring law that prohibits the passing of regulations more stringent than federal rules may make you popular with such people, it does not make it right. The correct thing to do is obvious.

Response

The commenter's opposition to the Proposed Rule is acknowledged.

Please *see* the following responses to comments, which are responsive to the comments raised:

- Parts C, D and Responses to Comments Nos. 5.6 and 39.6, with respect to the comments regarding stringency of the Proposed Rule;
- Response to Comment No. 39.11 regarding the requirements for rulemaking and the need for an evidentiary hearing;
- General response to Comment No. 39, No. 3 and Response to Comment No. 39.20 regarding NRC's rejection of the need for expedited rulemaking;
- General response to Comment No. 39, No. 3 with respect to the near term threat from continuing disposal;
- General response to Comment No. 39, Nos. 4 and 5, and Response to Comment No. 39.8 with respect to reliance on the study in the SECY-08-0147 and on expert studies that have not been submitted to or approved by the agency;

- Response to Comment No. 5.4 regarding relying on existing performance assessments;
- Response to Comment No. 39.21 regarding the adequacy of the 10 foot barrier; and
- General response to Comment No. 39, No. 7 regarding the possibility of mitigating concerns.

With respect to the basis for the rule generally and the inappropriateness of relying on the waste classification for depleted uranium in the absence of a performance assessment, please *see* the Statement of Basis generally and Part A, above.

Comment 10 (Karen F. Watson)

This letter is to offer adamant support to a company in the west desert, EnergySolutions, located at Clive, Utah. As you can see from my letterhead, I live in Grantsville, Utah the nearest community to EnergySolutions, Dugway, EG&G, MagCorp, Hill Air Force Base Test Range, landfills and other operations located in the west desert. Of all the industries, EnergySolutions is by far the safest and well managed. EnergySolutions is a highly regulated, self reporting company, as you well know, and has a good reputation with the Utah Department of Environmental Quality. My opinion of this company is that if the State of Utah would ignore the detractors, mainly HEAL Utah and competitive companies trying to curtail business in Utah, and come to the conclusion that our state is blessed with a natural geological phenomenon located in the west desert which is ideally suited for the disposal of low-level radioactive waste. All of the natural resources, clay, gravel, rock, etc. exist naturally on or near the site, as well as the added plus of poor, contaminated ground water. Should we have a legislative body and Governor who could turn this mentality around " the state of Utah could be totally out of debt and provide outstanding education to its future, the children of Utah. Years ago, several Utah business associations and business lobbyists united to successfully achieve passage of legislation restricting Utah State regulatory agencies from adopting rules and regulations "more stringent than corresponding federal regulations" unless after a public hearing and based on evidence in the record that corresponding federal regulations are not adequate to protect public health and the environment of the state. That law is found in Utah Annotated Code (19-3-104(8)).

Recently, at the urging of HEAL Utah, the Utah Radiation Control Board has proposed a rule which is clearly more stringent than corresponding U.S. Nuclear Regulatory rules that govern the disposal of depleted uranium as Class A waste. The Board has not initiated a process, including holding a public hearing to take evidence that the federal regulations are not adequate. The Board has not even attempted to identify which specific standards, rule or regulation is not adequate. Yet, the Board has initiated a rulemaking process to promulgate more stringent regulations at the urging of HEAL Utah, a disappointment to intelligent citizens of the state.

Over the years the Utah "no more stringent regulation" law has served the state very well and has fostered a healthy business climate in Utah. If state agencies ignore this law, Utah business will experience damage to its business climate, i.e. other companies in the state that HEAL Utah may wish to challenge. You as a body have been informed of the law and obviously have chosen to ignore it. Be aware, Utah business will not tolerate violation of this law. As a citizen of Tooele County, state of Utah, I expect that the Radiation Control Board will conduct its duties in accordance with the law, and allow EnergySolutions, a Utah Company to conduct its business within the law.

Response

The commenter's opposition to the Proposed Rule is acknowledged. Please *see* Parts C, D and Responses to Comments Nos. 5.6 and 39.6 and 39.11, with respect to the comments regarding stringency of the Proposed Rule and the need for an evidentiary hearing.

With respect to the basis for the rule generally, please *see* the Statement of Basis generally and Part A, above. Other comments raised are beyond the scope of this rulemaking.

Comment 11 (Paulette McGhie)

"As a citizen of Utah, I firmly believe that our state should work to protect future generations from radiological exposure and contamination. I therefore stand behind and support the Board's course of action to devise a new rule to ensure that no depleted uranium comes to our state in advance of the completion of thorough public health studies and performance assessments. A new rule should also take into account when levels of peak dosage occur as well as likely geological processes such as flooding and erosion."

Response

The commenter's support for the rule is noted. The request for a rule to ensure that no depleted uranium comes to Utah is beyond the scope of this rulemaking. Please *see* Part F, Response No. 2. With respect to the request to consider peak dosage, please note that the Proposed Rule requires a qualitative review of simulations for peak dosage. With respect to the request for consideration of geological processes, please *see* Part F, Response No. 1.

Comment 12 (Evelyn M. Reeliarde)

Utah Department of Environmental Quality, please see that Depleted Uranium only comes to our state after the completion of thorough health studies. The increase in radiation could affect my grandchildren and great grandchildren.

Also a new rule should take into account when levels of peak dosage occur, as well as likely geological processors ... flooding and erosion.

Response

The commenter's support for the rule is noted. With respect to the request to consider peak dosage, please note that the Proposed Rule requires a qualitative review of simulations for peak dosage. With respect to the request for consideration of geological processes, please *see* Part F, Response No. 1.

Comment 13 (Sandra Hays)

I believe that our state should work to protect future generations from radiological exposure and contamination. I therefore stand behind and support the Boards course of action to devise a new rule to ensure that No Depleted Uranium comes to our state in advance of completion of thorough public health studies and performance assessments. A new rule should also take into account when levels of peak dosage occur as well as likely geological processes such as flooding and erosion.

Response

The commenter's support for the rule is noted. The request for a rule to ensure that no depleted uranium comes to Utah is beyond the scope of this rulemaking. Please *see* Part F, Response No. 2. With respect to the request to consider peak dosage, please note that the Proposed Rule requires a qualitative review of simulations for peak dosage. With respect to the request for consideration of geological processes, please *see* Part F, Response No. 1.

Comment 14 (Tanya Andrew)

As a citizen of Utah, I firmly believe that our state should work to protect future generations from radiological exposure and contamination. I therefore stand behind and support the Board's course of action to devise a new rule to ensure that no depleted uranium comes to our state in advance of the completion of thorough public health studies and performance assessments. A new rule should also take into account when levels of peak dosage occur as well as likely geological processes such as flooding and erosion.

Response

The commenter's support for the rule is noted. With respect to the request to consider peak dosage, please note that the Proposed Rule requires a qualitative review of simulations for peak dosage. With respect to the request for consideration of geological processes, please *see* Part F, Response No. 1.

Comment 15 (Mary Ellen Navas)

Sadly, I will not be able to attend the meeting of the RCB tomorrow afternoon, so I want to convey my comments about DU to you. My point of view is simple. I do not think the Utah site at Clive is the right place for this highly dangerous byproduct of uranium enrichment or re-processing. I believe the RCB has an opportunity to put teeth into the protection of Utah and the people ahead of us by instituting a new rule that would require ANY storage or disposal to be sufficiently effective to protect future generations from radiological exposure or damage. The Texas model of utilizing "peak dose" is a conservative position. Please be VERY conservative as you design a rule to protect Utah.

Response

The commenter's support for the rule is noted. The request for a rule to ensure that no depleted uranium comes to Utah is beyond the scope of this rulemaking. Please *see* Part F, Response No. 2. With respect to the request to consider peak dosage, please note that the Proposed Rule requires a qualitative review of simulations for peak dosage. The request for a "conservative" rule is unclear and therefore the Executive Secretary cannot respond. To the extent the commenter is requesting conservative application of the Rule, please *see* Part F, Response No. 1.

Comment 16 (M. Horner and Robert W. Orton)

As citizens of Utah, we firmly believe that our state should work to protect future generations from radiological exposure and contamination. We therefore stand behind and support the Board's course of action to devise a new rule to ensure that no depleted uranium comes to our state in advance of the completion sf thorough public health studies and performance assessments. A new rule should also take into account when levels of peak dosage occur as well as likely geological processes such as flooding and erosion." It has never been our intention nor is it our desire to make Utah the national or world dumping ground for nuclear waste.

Response

The commenters' support for the rule is noted. With respect to the request to consider peak dosage, please note that the Proposed Rule requires a qualitative review of simulations for peak

dosage. With respect to the request for consideration of geological processes, please *see* Part F, Response No. 1.

Comment 17 (Lisa Rutherford)

As a Utah resident, I am strongly (!) opposed to bringing in more depleted uranium to our state. What a travesty that this has been allowed at all. Now is the time for the Board to pursue establishing tough, new standards before more DU is brought to Utah. The potential harm from exposure to DU should take into account when levels of peak dosage occur and consider the effects of flooding and erosion.

I've written before and often feel that my pleas and those of many others fall on deaf ears. Do you not have loved ones who live in this state and are also affected by these decisions? I find it difficult to believe that anyone would want their family exposed to these materials. We've been told before (remember the 50s?) that radioactive material was not harmful only to find out later that was a ruse, and we were the stooges.

Response

The commenter's support for the rule is noted. The request for a rule to ensure that no depleted uranium comes to Utah is beyond the scope of this rulemaking. Please *see* Part F, Response No. 2. With respect to the request to consider peak dosage, please note that the Proposed Rule requires a qualitative review of simulations for peak dosage. With respect to the request for consideration of geological processes, please *see* Part F, Response No. 1.

Comment 18 (Susan F. Fleming)

I have been a resident of Utah for over thirty years and am deeply concerned about shipments of radioactive waste, specifically Depleted Uranium, to Utah. Today we need to work hard to protect our citizens and future generation from exposure to radiation and contamination. Therefore, I stand behind and support the Board's course of action to devise a new rule to ensure that no depleted uranium comes to our state in advance of the completion of very thorough public health studies and performance assessments. A new rule should also take into account when the levels of peak dosage occur. The fact that there are underground streams and aquifers, and that our state is prone to earthquakes and earth movement on a regular basis should be taken into amount. Since we have other ongoing geological processes, such as erosion and flooding, these should be calculated as well.

In summary, I am opposed to having one or more companies jeopardize the residents of Utah by bringing toxic and radioactive wastes into our state. Depleted Uranium only gets hotter as the years go by, and there is no way to prevent this escalation of radioactivity. Please pass rules and regulations to protect our citizens and our future children from this serious problem. Your prescient and protective regulatory actions today may prevent serious disaster in the future, so please think very carefully about this issue.

Response

The commenter's support for the rule is noted. The request for a rule to ensure that no depleted uranium comes to Utah is beyond the scope of this rulemaking. Please *see* Part F, Response No. 2. With respect to the request to consider peak dosage, please note that the Proposed Rule requires a qualitative review of simulations for peak dosage. With respect to the request for consideration of geological processes, please *see* Part F, Response No. 1.

Comment 19 (Marcia Tendick)

As a citizen of Utah, I firmly believe that our state should work to protect future generations from radiological exposure and contamination. I therefore stand behind and support the Board's course of action to devise a new rule to ensure that no depleted uranium comes to our state in advance of the completion of thorough public health studies and performance assessments. A new rule should also take into account when levels of peak dosage occur as well as likely geological processes such as flooding and erosion.

This is an extremely important issue to me, as I would think it would be for anyone considering the health and welfare of future generations in Utah. Please put the future of all humans ahead of any consideration of monetary gain.

Response

The commenter's support for the rule is noted. With respect to the request to consider peak dosage, please note that the Proposed Rule requires a qualitative review of simulations for peak dosage. With respect to the request for consideration of geological processes, please *see* Part F, Response No. 1.

Comment 20 (Cavanagh Services Group)

The subject Notice of Proposed Rule was published in the Utah State Bulletin Number 2010-1 Dated January 01,2010. The Notice provides for public review of the Proposed Rule through February 2, 2010. The proposed rule would require facilities that wish to land dispose of DU to complete and have approved a site-specific performance assessment that demonstrates that the performance standards specified in 10 CFR Part 61 and corresponding provisions of Utah rules will be met. Therefore, the Utah Radiation Control Board, at its 12/08/2009 meeting, voted to amend Section R313-25-8 that requires EnergySolutions or any facility that land disposes significant quantities of DU to submit for review and approval a site specific performance assessment prior to disposal of significant quantities of DU.

The subject Notice of Proposed Rule contains a statement and data which is inaccurate and as such the Notice of Proposed Rule as published failed to provide to the public all necessary data and information in order to effectively permit comment. Specifically, the Notice of Proposed Rule under the heading "Small Businesses" states: "No small business in Utah will be directly impacted. The only potential sources of substantial quantities of DU for disposal--the United States Department of Energy and privately-held uranium enrichment facilities-- are not small businesses and are not located in Utah."

While it is true that the only potential source of substantial quantities DU for disposal is the United Stated Department of Energy (US DOE), it is not true that such a rule will not impact Small Business in Utah.

Cavanagh Services Group, Inc, is a Utah based, Small Business Administration Certified 8(a), Small Disadvantaged Woman Owned, Small Business. Cavanagh Services Group is currently under contract with the US DOE for the transportation of DU from the DOE's Savannah River to Clive, Utah. This contract is a significant percentage of the Cavanagh Services business plan for 2010. Cavanagh has increased its staff by over 80% from 2008 to 2009. Delays of transporting DU will have a significant financial and personnel impact on Cavanagh. Cavanagh feels that the Notice of Proposed Rule is in error in misrepresenting the facts and as such does not accurately inform the citizens of Utah in order that they may provide related comments.

In light of the errors associated with the Notice of Proposed Rule, Cavanagh feels that the Division of Environment Quality must correct the Notice by changing the Small Business statement to include that Small Businesses in the State of Utah will be significantly impacted by this rule. Further Cavanagh requested that the Notice of Proposed Rule then be republished in the Utah State Bulletin and that the public be given additional time to consider the Proposed Rule with all of the available facts.

Response

Please *see* Part E of this Response to Comment document.

Comment 21 (Patty Herndon)

I am truly disappointed by the extent that the handling of Depleted Uranium has become a huge political debate. I have seen a lot of comments, facts and 'experts' presenting their views on both sides. I am afraid that the environmentalist groups are making a very large effort to prey on the general citizen's innate 'fear' of things that 'could' be dangerous. I think that they are pushing their own political and possibly personal agenda's by attacking and demonizing the process of handling and properly disposing of Depleted Uranium in the EnergySolutions Clive Facility in the West Desert.

I have lived in Utah for the past 17 years. My years before that were spent in Idaho. In Idaho I lived in different cities that have been very closely associated with the now known Idaho National Laboratory, whether municipally or through jobs created. The research and advancements accomplished by that facility have been incredible. The benefits of nuclear power in general have been innumerable, and have improved my life personally. I also remember learning about radioactivity and what it is and its benefits, as well as its hazards, as a young child in school. As an adult I have had many opportunities to work in and around radioactive materials.

I have a bachelor's degree in Biology with a minor in Chemistry. Before I graduated, I began working in the environmental testing industry as a Laboratory Technician. My job was in a Third Party Environmental Laboratory that did certified analytical testing for different companies. I handled various types of material - soil, groundwater, even potentially contaminated protective equipment, etc. and performed analytical procedures and tests on them. The Environmental Protection Agency (EPA), the Division of Radiation Control (DRC) and/or the Nuclear Regulatory Commission (NRC) each played some role in 'why' a customer had to have a material analyzed and verify or confirm that there was a deemed hazard involved with the material. My supervisors all the way up to the owner of the company took the time to help me understand the potential hazards of the things I would and did handle on a daily basis. I used the protective equipment and monitoring devices provided for my safety and I did my job ... Safely. And in doing so, I help provide customers with the information they needed, and often regulators also, to properly handle and manage potentially hazardous materials properly.

I currently have an opportunity to work for EnergySolutions at their Clive Facility. I work very hard everyday to do my job to the best of my abilities to help EnergySolutions handle low level radioactive waste materials safely and properly dispose of them in such a way that the material will be less of a hazard to the general populous. There are many regulations associated with this process.

I feel very confident that EnergySolutions is very vigilant in adhering to these regulations, as well as keeping me and everyone else safe in the process. I would not be working here if it wasn't important. I feel that the recent proposal to adjust the rules and regulations for the handling of Depleted Uranium is completely unfounded and ridiculous. The U.S. Nuclear Regulatory rules have addressed the potential hazards and provide appropriate expectations for the proper handling of Depleted Uranium. Uranium processing facilities, nuclear facilities and disposal facilities have been handling uranium in all forms with employee and community safety in mind for many years under these regulations, what has changed now? Uranium itself hasn't changed, the hazards associated with it haven't changed, the people handling it are still concerned about working with it safely, so what has changed to warrant changes to the rules and regulations. I am afraid that the environmental group Heal Utah that is spurring these changes are doing it because they hope for some kind of political and maybe personal gain. They are ignoring the years of experience and science and playing on the fear of the general public that may not know enough about radioactive material to see through their unfounded claims. If you do not know a lot about radioactivity, it can seem very scary and dangerous based on the major catastrophes that have occurred in human history. It is however these same catastrophes that helped the U.S. Nuclear Regulatory Commission establish the rules and regulations in the first place. Please do not allow them to prey on the general public's ignorance to suit their political or personal desires. I have great confidence in the great people that worked long and hard to establish the rules and continue to work to improve them when necessary. So since nothing has changed with Depleted Uranium itself, as far as I am aware, I feel that the Utah Radiation Control Board has no reason to listen to the unfounded urging of Heal Utah.

Response

The commenter's opposition to the Proposed Rule is acknowledged.

With respect to the basis for the rule generally, please *see* the Statement of Basis generally and Part A, above. Other comments raised are beyond the scope of this rulemaking.

Comment 22 (Carolyn Potter)

Utah is a wonderful place to live and we need to do everything to keep it as safe as possible, especially from nuclear waste being sent which is not within a few hundred miles or another country's. There needs to be a limit on waste as to what Energy Solutions or any company wants to bring to Utah. Yes, EnergySolutions is in business to make money but allowing them to take waste from remote areas is greedy on their part. They only want to line their pockets with money at the expense of polluting Utah more. E. S. doesn't care about the quality or safety of Utah's land or its people. They care about their monetary gain. E. S. and other nuclear companies need to establish storage sites (close in proximity) in their areas of the U. S. or in foreign countries (e.g. Italy, UK, Germany, etc.) to take care of their nuclear waste. (e.g. sending waste from the government cleanup of the Savannah River atomic-bomb site in South Carolina to Utah is not a good idea.) Utah or any other state doesn't need to take on the world's problems by disposing their waste here.

Stop these ideas of bringing nuclear waste across the oceans or many hundreds or thousands of miles across the U.S. to any one place in the America . It is unsafe and not practical. (See enclosed article--"Company cited for duct-tape incident") There are probably more of these kinds of things happening that is covered up. E.S.'s philosophy on this is who cares what we store in the ground here or if we pollute with our shipments on the way to Utah!!! Well, I care and a lot of other people care.

E.S. is unprofessional, deceitful (trying to circumvent the law by blending waste-blending should be reclassified to a hotter waste if there is one speck of Classes B and C waste in it) and they're money mongers. That's their one concern--$$$$$!

Please keep a rein on E.S. and other pollutant companies who want to take advantage of Utah. This is our state not the world's nuclear dumping ground.

Oh, by the way Energy Solutions should be taxed more for Utah putting up with all this underhandedness that they continue to dish out.

Response

These comments are beyond the scope of this rulemaking. Please *see* Part F, Response No. 2.

Comment 23 (Dr. Lou Borgenicht)

I am a pediatrician and I have worked as such for many years, having obtained my Doctor of Medicine (MD) degree from Case Western Reserve University School of Medicine in 1970. I am aware of the unique and synergistic impacts that depleted uranium's radioactivity and toxicity can have on the human body. Children and infants are especially susceptible to the ill effects caused by depleted uranium exposure.

According to latest report from the National Academies of Science titled "Bier VII: Health Risks from Exposure to Low Levels of Ionizing Radiation," there is a linear dose-response relationship between exposure to ionizing radiation and the development of solid cancers in humans. The report also makes the following points:

1. It is unlikely that there is a threshold below which cancers are not induced. Thus, the smallest dose of radiation has the potential to cause a small increase in health risks to humans.

2. Ionizing radiation has sufficient energy to change the structure of molecules, including DNA, within the cells of the body. Some of these molecular changes are so complex that it may be difficult for the body's repair mechanisms to mend them correctly.

3. An important finding from the studies was that the occurrence of solid cancers increases in proportion to radiation dose. More than 60% of exposed survivors received a dose of radiation of less than 100 mSv (millisievert).
4. Evidence suggests excess cancers can be detected as low as 10 mSv in utero. Depleted uranium is a known nephrotoxin (toxic to the kidney), and there is a growing body of evidence demonstrating that depleted uranium may also be genotoxic, mutagenic, tumorigenic and neurotoxic. Children as well as the embryo/fetus are likely at a higher risk from the mutagenic and carcinogenic nature of depleted uranium. As a neurotoxin, uranium isotopes are similar to lead. The primary form that uranium isotopes take in the body is the uranyl cation (U_{22+}) and may act in an analogous fashion to the lead cation (Pb2+.). This lead cation has a well known and tragic history as a neurotoxin, especially in children.

I am aware that EnergySolutions has accepted large amounts of depleted uranium for disposal in Utah in the absence of regulations which would require studies as to health effects and safeguards against inadvertent exposure.

In conclusion, I strongly urge the Utah State Radiation Control Board to adopt measures which would preclude acceptance of any additional depleted uranium into our state until these issues are fully investigated and substantial protections exist to protect human health and the environment for the duration of depleted uranium's hazard life.

Response

The commenter's support for the rule is noted. With respect to the request to consider specific impacts from depleted uranium, please *see* Part F, Response No. 1.

Comment 24 (Judy M. McCowey)

I totally oppose nuclear waste disposal in Utah. Here are just a few reasons: it becomes more hazardous over time; it's dangerous to humans, animals and to the environment and has long-term effects. As responsible people we need to consider all of Utah present and future lesser immediate greed and selfishness of a few. Please don't waste Utah.

Do the research.

Response

The opposition to nuclear waste disposal in beyond the scope of this rulemaking. Please *see* Part F, Response No. 2.

Comment 25 (Naomi Franklin)

Depleted uranium ("DU") is the 'waste' from enrichment of Uranium 235. U235 is enriched for producing electricity in nuclear energy plants --- and for nuclear weapons. The amount of DU waste is thus a measure of the amount. of U235 enrichment proceeding in the United States. Judging from existing and projected DU amounts, a great deal of U235 enrichment is anticipated. On what basis?

DU waste is radioactive as delivered to Utah, and will become more radioactive over time in storage. It is also toxic, and has been connected to 'Gulf War syndrome'. It is shipped to Utah in casks and buried as such. I have heard no information about the lifetime of these casks. Doubtless that will depend upon conditions at the deposition site, which has been known to become flooded with salt water within historic time.

Radioactivity at any level is not healthful for biological systems. Increased rates of cancer in humans of all ages is attributed, in part, to radioactivity. Uranium has proved to be a cancer generator at all stages of its life cycle: mining, enrichment, nuclear plants, nuclear waste---and nuclear explosions.

The U.S. NRC classified DU as low level, Class A. But they now admit that DU is a special material requiring further study. A few years of more study. Perhaps enough time to allow the transfer of the whole pile DU waste pile to be transferred to Utah BEFORE their conclusions are reached.

I am grateful that the Utah Radiation Control Board has understood the need for Utah to look at this scenario

and understand that it is the RCB which must impose its own conditions for the receipt of DU. The EnergySolutions waste site at Clive needs careful reconsideration as a repository for DU.

Response

The commenter's support for the rule is noted. With respect to the specific technical concerns raised, please *see* Part F, Response No. 1.

Comment 26 (Cindy King)

Comment 26.1

(Special note: I am requesting written response to these comments as regulations and statutes require).

GENERAL COMMENTS: Technical analysis needs to be transparent, scientifically defendable, peer reviewed like all scientific data, and proven without any reasonable doubt. The public must be allowed to review and comment on any performance analysis. Any consultants used must be independent of EngerySolutions and the State of Utah and this must be able to be confirmed by the public. The assumption of a ban on depleted uranium needs to included. The 1,000 year limit is too short and needs to be at least a million years. Chemical properties other than radioactive isotopes must be analyzed. All daughter products must be analyzed. Methodology for threshold limits must be clearly defined. Uncertainties must be defined. Long and short-term effects addressed to human health and environment issues, as well as geological and climate changes issues, including freezing and thawing, but not limited to. There should be no exclusions of other animals that might be affected, and should be named. All assumptions must be analyzed as if it will occur. There needs to be a cost and benefit analysis for long and short-term risks. There needs to be a risk/benefit ratio analysis. Contingence and mediation analysis is needed. The deadline of March 1, 2010 needs to be removed, such that a proper and thorough analysis can be done. Analysis of how future generations are going to know that this is hazardous and toxic site, since there is no known language and/or symbols that are currently known from past generations longer than 5,000 years to warn us today. Current data has to establish "[t]he disposal of depleted uranium poses similar long-term radiological hazards to disposal of some types of transuranic wastes, and will likely require the development of a repository comparable to the Waste Isolation Pilot Plant in New Mexico." [footnote omitted]. With that said, analysis is needed to demonstrate that EngerySolutions is comparable to that of the Waste Isolation Pilot Plant in New Mexico and will become similar. Various Nuclear Regulatory Commission studies have stated that depleted uranium needs to be disposed in deep earth repositories, similar to the New Mexico facility; analysis is needed to demonstrate why and how depleted uranium should be stored in a shallow earth disposal site, such as EnergySolutions?

SPECIFIC COMMENTS: (Section (1) (a)): "... and exhumation by burrowing animals... " This needs to be removed, since other animals that are not considered burrowing animals but feed off burrowing animals could cause problems. Therefore the phase should read "and exhumation by any animal."

(Vide Section): "The analyses shall clearly identify and differentiate between the roles performed by the natural disposal site characteristics and design features in isolating and segregating the wastes." This statement assumes that there will be differentiated performance roles between natural disposal site characteristics to design features in the segregating of the waste. This might not always be the case over time for following reasons: human error is a known factor that has occurred at the site over its life span today. To date there has not been any data to establish that materials design features will be able to withstand the amount of depleted uranium over the necessary time period required for protection to prevent contamination into nature resources. Ergo it is not clear how isolation will occur or can occur; a distinction is needed.

(Vide Section): "The analyses shall clearly demonstrate a reasonable assurance that the exposures to humans from the release of radioactivity will not exceed the limits set forth in R313-25-19." This statement makes the assumption that harmful effects from radiation exposure are linear, while it is now known that low doses of radiation may have a disproportionately greater effect than would be expected from a linear model. Analysis needs to occur with materials that are not radioactive. The Statement makes the assumption that the radioactive material will not be "mixed" with other materials. There needs to be cumulative and synergetic analysis included. The term

"reasonable assurance" is a loaded statement without any regulatory or judicial clarification, and is a political statement. Ergo, the word "reasonable" needs to be removed, or clearly defined such that it is enforceable regulatory and judicially.

(Section (1) (b)): "Analyses of the protection of inadvertent intruders shall demonstrate a reasonable assurance that the waste classification and segregation requirements will be met and that adequate barriers to inadvertent intrusion will be provided." This statement assumes that there will be a time limit and ownership will be maintained to assure protection, and that segregation of waste will not occur over time. The facility has had notices of violation dealing with segregation requirements in the past; there is no assurance that this type of violation will not occur in the future. There have been media reports that the facility is looking into "mixing/blending" other materials in hopes of decreasing concentration of the radioactive isotopes. Again the phase "reasonable assurance" needs to be clarified. Inadvertent intruders need to include rogue employees as well. Who will be responsible for intruders after the facility has completed closure? This needs to be addressed.

(Section (1) (c)): "Analysis of the protection of individuals during operations shall include assessments of expected exposures due to routine operations and likely accidents during handling, storage, and disposal of waste. The analysis shall provide reasonable assurance that exposures will be controlled to meet the requirements of R313-15." This statement makes the assumption that harmful effects from radiation exposure are linear, while now it is known that low doses of radiation may have a disproportionately greater effect than would be expected from a linear model. Ergo analysis is needed for a non-linear exposure effects.

(Section (1) (d)): "Analyses of the long-term stability of the disposal site shall be based upon analyses of active natural processes including erosion, mass wasting, slope failure, settlement of wastes and backfill, infiltration through covers over disposal areas and adjacent soils, and surface drainage of the disposal site. The analyses shall provide reasonable assurance that there will not be a need for ongoing active maintenance of the disposal site following closure." The analysis needs to include natural geologic changes, climate changes, changes in water table and surface water due to geological and climate change. Maintenance needs to occur long after closure due to the radioactivity increasing as the depleted uranium decays. If not, then analysis is needed on the cost of maintenance after the facility is long gone. There needs to be analysis of "mixing/blending," as been reported in the media, from the facility.

Response

Thank you for your comments. However, the rule under consideration is R313-25-8(2), not R313-25-8(1). *See* Part A, Background, Part F, General Response No. 1, and Responses to Comments Nos. 27.2 and 31.2. It is not anticipated that there will be a formal peer review process. *See* Part F, General Response No. 2.

Comment 26.2

(Section (2)(a)): "Any facility that proposes to land dispose of significant quantities of depleted uranium, more than one metric ton in total accumulation, after [effective date of rule] shall Submit for the Executive Secretary's review and approval a performance assessment that demonstrates that the performance standards specified in 10 CFR Part 61 and corresponding Provisions of Utah rules will be met for the total quantities of depleted uranium and other wastes, including wastes already disposed of and the quantities of depleted uranium the facility now proposes to dispose. Any such performance assessment shall be revised as needed to reflect ongoing guidance and rulemaking from NRC. For purposes of this performance assessment, the compliance period will be a minimum of 10,000 years. Additional simulations will be performed for a qualitative analysis for the period where peak dose occurs." All performance evaluation needs to have public input and transparency. There should be a set limit on the amount allowed with no exceptions. The performance assessment of 10,000 years is too short and needs to be expanded. The qualitative analysis for peak dose makes the assumption that harmful effects from radiation exposure are linear, while now it is known that low doses of radiation may have a disproportionately greater effect than would be expected from a linear model. Ergo qualitative analysis for peak doses needs to include non-linear exposures.

(Section (2)(b)): "No facility may dispose of significant quantities of depleted uranium prior to the approval by the Executive Secretary of the performance assessment required in R313-25-8 (2)(a). " This statement assumes that

there will be significant quantities of depleted uranium disposed of at the facility; a limit on the amount is needed, such that a performance assessment can be made. All performance assessment must include public input and transparency.

In précis, the proposed regulation is reactionary and lacks foresight. It is to protect profits over human health and the environment. Technical analysis needs to be transparent and have peer review. Any and all consultants that are used need to be independent of EnergySolutions and the State of Utah, and must be able to be confirmed by the public. Performance assessments need to have public oversight and input. Uncertainties need to be analyzed. Geological and climate changes need to be analyzed. Long and short-term costs need to be analyzed for storage and disposal. There needs be a limit placed on quantity as well as the concentration of depleted uranium. There needs be analysis of why there is change in using shallow disposal versus deep inject disposal. All assumptions must be treated as actuaries. There needs to be analysis on who will be responsible after closure.

Response

Many of the comments address how a performance assessment should be performed and evaluated and public or peer reviewed. *See* Part A, Background, and Part F, General Response Nos. 1, 2 and 3.

The performance period provided by the rule is a minimum of 10,000 years. The Executive Secretary will evaluate the licensee's proposed compliance period, as well as any limits that may be placed on the disposal of depleted uranium during the course of the performance assessment process. Please note that there is no limitation on the length of time performance objectives must be met. Establishing a compliance period is part of the modeling process and, like the rest of the modeling process, is designed to represent expected conditions as closely as reasonably possible.

Comment 27 (Stephen Nelson, Charles Oviatt, Summer Rupper)

Note: Attachments to these comments are not included due to their length and, for the same reason, the entirety of this comment is not reproduced below, but are available for review at the Division of Radiation Control. The Executive Secretary responds to the entirety of these comments as follows.

Comment 27.1

Introduction:

The proposed revision to rule R313-25-8 is inadequate because it is insufficiently protective of the natural environment. In particular, the quantitative performance period in part (2) (a): i) is too short, and ii) a qualitative analysis to the time of peak dose (peak activity), is, by definition, insufficient to demonstrate performance of the system and relies on faulty logic.

We deal with ii) briefly here and in the remainder of this document the problems with i) are addressed. However, in addressing i), we demonstrate that, properly worded, ii) can and should be met with a quantitative analysis. We do this through two "contentions" that are followed with supporting analysis.

The problem with a "qualitative analysis for the period where peak dose occurs" is that "peak dose," both in its timing and magnitude, cannot be estimated without a quantitative model. Dose refers to human exposure. This may or may not occur when DU has reached maximum activity. If the Board means "peak activity," then the solution is simple. The rule must extend to 1 million years, which is not a new figure in the regulation of radioactive wastes (See Nelson et al.,2009; attached).

Before proceeding with our analysis, we note the language of parts of rule R313-25-8 that have not been

modified (except for numbering), but inform what the licensee must "demonstrate." (l) (a) includes exposure pathways in ground and surface water, including natural and engineered features of the site. (1) (d) includes "erosion, mass wasting, slope failure, settlement of wastes and backfill, infiltration through covers over disposal areas and adjacent soils, and surface drainage of the disposal site." These criteria must be met within the context of the additional challenges posed by the disposal of large quantities of depleted uranium (DU).

Response

The Proposed Rule has been modified to clarify the intent that quantitative simulations must be performed for the period where peak dose occurs but the results are to be analyzed qualitatively. See Part B.3, above.

The term "peak dose" is retained, rather than use of the commenters' suggested term, "peak activity." Total activity cannot be directly translated into dose because different elements (daughter products) can have different mobility and radiotoxicity. *See, e.g.,* SECY 08-0147 at 2, 3. Therefore, an inadvertent intruder would be at greater risk of exposure at peak dose than at peak activity.

Comment 27.2

Contention 1: There is a high probability the site will flood, and that probability is so high such that rigorous, quantitative analysis is required.
[NOT reproduced are commenters multiple pages of technical discussion and figures, relying, in part, on the NRC technical review plan for Yucca Mountain, NUREG 1804; the potential for a disruptive flooding event at Clive; and the effect of climate change. Reproduced immediately below is the commenters' conclusion to Contention 1.]

Despite DRC staff statements, the site will flood in the future and the consequences cannot be ignored or subjected to "qualitative" analysis. The rule clearly calls for the consideration of natural processes in system performance, including ground and surface water effects on erosion and compaction of the piles. The rule, as previously written, was probably sufficient for short-lived conventional waste streams, but given the quantity of material and long-lived nature of DU, the revised rule is inadequate in terms of reasonable assurance of environmental protection.

Response

Most of the comments in Contention 1 are not pertinent to this rulemaking because they address the portion of the rule that was not proposed to be changed, *i.e.*, R313-25-8(1)(d) (as renumbered). The rule under consideration is R313-25-8(2). In any event, the specificity the commenters suggest may not be necessary to incorporate into a rule because the agency has discretion to ensure that any unanalyzed condition at Clive will be evaluated to determine whether it is protective of human health and the environment. Comments relating to a disruptive flooding event and the effect of climate change relate to how a performance assessment should be conducted. *See* Part A, Background, and General Response No. 1, above. *See also* General Response to Comment No. 39, No. 5; just as it is not appropriate for the agency to consider expert opinion that a standard will be met during the rulemaking process, it is inappropriate for the agency to consider expert opinion that a standard will not be met.

Comment 27.3

Contention 2: The consequences of flooding are unacceptable

***Erosion**: We are aware from the audio of the Dec. 3, 2009 Board Meeting that EnergySolutions intends to include flooding of the site in its performance evaluation. We do not contend that they will do so, but isn't the very notion of a submerged landfill, or a landfill at the shoreline of a large lake absurd at face value? Isn't the mere fact that this has to be accounted for in their evaluation an implicit admission that this is the wrong place for DU? As noted above: "the site must remain above the water table for the effective duration of the repository (USGS, 1989)."*

That said, we recognize that at least three factors related to flooding that must be accounted for. First, is enhanced seepage and complete saturation of the landfill interior. Second, the lake has the potential to reach the elevation of the Provo shoreline (4740 feet), where it will spill into the Snake River drainage. Thus, the performance evaluation

must also consider compaction, and compaction-induced failure of the liner and cap systems due to ~460 feet of overlying water.

The most serious issue is erosion of the piles. We consider their breach very likely. A lake at the elevation of Clive will have a large fetch (i.e., stretch of open water for waves to accumulate by blowing winds). For example, from the northwest there would be on the order of 50 miles of open water.

[Two pages of technical discussion and figures are not reproduced here.]

***DU Releases**: Now we consider the effects of the releases of DU into the lake system. For some of this discussion, we rely on a calculation by Prof. Gary Sandquist. Dr. Sandquist is a retired nuclear engineering professor from the U of U. The calculation was forwarded to one of us (Nelson) with his permission and we assume it is correct:*

- *Assuming 60,000 tons of DU are emplaced at Clive (49,000 tons that may be there already plus 11,000 tons from South Carolina), the concentration of uranium in the lake would be 0.25 ppm*
  - *This calculation assumes the lake reaches the elevation of Clive and that all uranium is dissolved in the lake.*

We believe this is a reasonable calculation, but it raises the question as to the ability of the lake to carry uranium concentrations this high.

UO_3 contains uranium in the 6+ oxidation state, which is relatively soluble. We understand that the South Carolina material is in powder form, which increases its reactivity due to a high surface area, and also increases its ability to be physically dispersed. We could perform solubility calculations for uranium using thermodynamically-based computer codes, but for simplicity we rely on a report from the Idaho National Engineering and Environmental Laboratory (INEEL, 2000). This report determined that in natural waters, the concentration of uranium in water passing through a 20 micron filter rapidly exceed 70 ppm and reached a steady-state of nearly 100 ppm after l-2 months. These experiments were conducted with U_3O_8. The conclusion is that an expanded lake would have a large capacity to dissolve uranium.

Sandquist's figure of 0.25 ppm is a lower bound based on may be already at the site, plus what is expected to arrive shortly. However, the Board is aware that the stockpile of DU requiring disposal may be as much as 1,400,000 tons by the middle of this century. Assuming the Clive site eventually contains 1,000,000 tons of DU, lake concentrations could reach4.2 ppm.

These may not sound like high concentrations. However, we compare them to the EPA limit for uranium in water of 0.03 ppm found at:

(http : //www. epa. gov/fedfac/documents/uranium_drinking_water_standards. htm)

At 0.25 ppm, the current inventory of DU at Clive could exceed safe levels in the lake by a factor of 8. At 4.2 ppm, the concentration could exceed safe levels by a factor of 140. Furthermore, the same EPA standard acknowledges that the toxicity of uranium as a heavy metal may exceed its radiological hazard.

We cannot answer the full range of questions surrounding the potential impacts on the ecosystem, such as bio-accumulation up the food chain, etc. But we can identify some processes that need to be considered. For instance, uranium in solution is probably its most bio-available form. and recession of the lake may leave soluble uranium salts in surface sediments.

Although there may be secondary processes that would attenuate uranium concentrations in the lake with time such as adsorption and burial on the lake bottom, or co-precipitation with calcite, our current understanding of these processes is very limited. However, there are a whole host of DU daughter products, some with long half-lives (^{230}Th 75,000 years; ^{234}U 245,000 years; ^{226}Ra 1600) years that may be present. Their mobility and fate must be considered as well and if significant time has passed between burial and release, their activities could approach that

of pure ^{238}U.

Finally, Figure 5 is fairly sobering. It illustrates the relative radioactivity of various waste products (y-axis) from the nuclear fuel cycle over time (x-axis). After 100,000 years the activity of DU is not much less than spent fuel and at 1,000,000 years they are nearly the same. There is a very good reason that the NRC is revisiting DU disposal and is taking its time to do so. [Figure 5 (mislabeled as Fig 4) is not reproduced here].

Response

Dr. Sandquist's calculation is reproduced under Comment No. 34 (Sandquist). The Executive Secretary acknowledges the above comments and notes he will await the outcome of the site specific performance assessment before making a decision on the suitability of the site for the disposal of depleted uranium. As to the technical discussion relating to erosion and DU releases, *see* Response to Comment 27.2 (Contention No. 1).

Comment 27.4

[Comments titled "Other Observations" and "Conclusion" are not reproduced here.]
Recommendations:

- *We recommend that the disposal of DU be prohibited at the EnergySolutions facility in Clive. However, if the Board proceeds to approve a rule, it must be strengthened, carefully considering comments provided.*
- *If the Board is concerned with the ability of any entity to conduct quantitative models in excess of 10,000 years, there is away around this problem:*
  o Assume that at the time of emplacement the entire inventory of DU is at its maximum activity.
  o Assume that at the time of emplacement concrete and steel containment has corroded.
  o Assume that the piles are impacted by waves for an extended period of time (500 yr.) at their midpoints between their tops and the surrounding grade.
  o Assume the piles are flooded to a depth of 460 feet (the elevation difference between Clive and the Provo shoreline) to evaluate enhanced seepage and release, as well as differential compaction and containment failure due to the hydrostatic load.
- *Since the Board wrote this rule, the Board directly should read and respond to public comment to ensure that the concerns of citizens providing input are heard.*
- *Empanel an independent group of experts to review the performance evaluation. This panel should include a diverse group of technical expertse and institutional affiliations. The large inventory and long-lived nature of DU make this issue too important to leave solely to DRC staff and contractors.*

Response

Thank you for your comments. The Executive Secretary acknowledges the above recommendations. *See* Response to Comment 27.2 (Contention No. 1). In response to bullet three, the Board has access to all public comments and this Comment Response document will be provided to all Board members in advance of the April Board meeting. *See* Part F, General Response No. 3 relating to the public comment process.

Comment 28 (Julie Harper)

I am a concerned citizen and an Environmental Studies major at the University of Utah. would like to state my disgust on the approval of storing nuclear waste in our beautiful state of Utah.

First of all I feel that we should not be the garbage dump for other states and countries just because we happen to have a lot of "empty" land. There isn't enough empty land on this planet to safely store this sort of waste and I

certainly do not want it in my backyard. Let South Carolina or Italy figure out where to store their own cancerous waste!

Secondly, I don't feel its safe to store this kind of waste in our desert....or anywhere for that matter. What happens if there is a big earthquake which is predicted? Or if the Great Salt Lake rises again? The areas where its planned they will be stored really are not that far from the millions of people along the Wasatch Front, especially if you consider the wind will blow it right to us! YOU LIVE HERE TOO!

Thirdly, I am so tired of everything being about money! What's more important, your family's health or money? Personally, I would take the health of my children and their children over a dollar any day! I didn't grow up here, but I have friends who did and many of them have had cancer before the age of 30! I can't help but wonder if it is the effects of nuclear tests in the West Desert, even this many years later.

Please don't let Utah become the world's nuclear waste dump! We are better than that!

Response

The request for a rule to ensure that no nuclear waste be stored or disposed of in Utah is beyond the scope of this rulemaking. Please *see* Part F, Response No. 2. With respect to the concern expressed about cancer and earthquakes, please *see* Part F, Response No. 1.

Comment 29 (Tim Wood)

I strongly oppose the importation and burial of depleted uranium in Utah. Utah should not become the nation's dumping ground for hazardous radiological waste and other toxic materials. Burying depleted uranium in Utah's west desert in an area that has historically been a flooded lake bed, makes little sense given that: (1) the waste will remain hazardous for thousands of years; and (2) it will convert slowly to a soluble oxide form over time.

What in the world is our state government thinking? Clearly, it is not thinking about future generations of Utahns who will have to deal with this problem. The proposed project is an outrageous example of the short-term thinking that is crippling our society. That burying depleted uranium in our west desert represents a workable solution to the radiological waste issue because "we'll be gone before it becomes a problem" is an irresponsible cop-out that smacks of back room deals between our state government and Energy Solutions. Energy Solutions may make a bundle in the short-term. But Utah's citizens will lose in both the short- and the long-terms.

Utahns, specifically Utah's Down Winders, have suffered in the recent past from irresponsible radiological "experiments" condoned and conducted by our government. It's time to remember the past and think hard and long-term about our future. If depleted uranium waste can be handled and stored safely, then it can be handled and stored elsewhere. There is nothing in this deal for Utahns in general. I strongly urge you to ban toxic and radiological waste from being imported and stockpiled in Utah.

Response

The commenter's request to ban toxic and radiological waste from Utah is beyond the scope of this rulemaking. Please *see* Part F, Response No. 2.

Comment 30 (Peter C. Burns)

I am writing to provide comment concerning the proposed rulemaking related to disposal of depleted uranium and aspects of the proposed performance assessment requirements. I am the Henry Massman Professor of Civil Engineering and Geological Sciences at the University of Notre Dame, and have been employed as a faculty member of the university for 13 years. I earned a B.S. (1988), M.S. (1990) and PhD, (1994) in geology prior to two years of post-doctoral research experience and one year on faculty at the University of Illinois. I have published more than 250 scientific papers, the majority of which deal with the mineralogy, geochemistry or structural chemistry of uranium. I have been the principle investigator on several Department of Energy and National Science Foundation

projects concerning uranium, and am currently Director of the Energy Frontier Research Center Materials Science of Actinides. My past research efforts included studies related to the proposed repository at Yucca Mountain and contamination of the subsurface with radionuclides at former weapons production facilities. I served as an expert panel member on two recent (fall, 2009) NRC round-table discussions on a proposed rulemaking concerning disposal of depleted uranium, and am currently a member of a National Academy of Sciences study panel examining nuclear waste forms. Full details of my background and scientific accomplishments/credentials can be found at petercburns.com

The safe disposal of depleted uranium (DU) is a unique challenge. Unlike class A wastes, it becomes more dangerous (radioactive) with time, with a peak radioactivity occurring after about 1,000,000 years (due to the ingrowth of daughter products). Uranium is also a toxic heavy metal, which presents a risk in addition to that associated with its radioactivity. Shallow landfill disposal presents numerous pathways for release of radioactivity into the environment. I consider it unwise to dispose of DU in landfills, but will restrict my comments to the specific rulemaking you contemplate.

With the details depending on the specific form of uranium, it is rather soluble in oxygenated (above the water table) groundwater, and transport of uranium through the vadose zone into the groundwater table can be rapid under some geologic conditions. The rate of transport through the natural environment depends on several factors that are difficult to quantify and that vary through time. Although much of the performance assessment modeling associated with disposal of DU tends to emphasize the radon risk, leakage of uranium into groundwater and surface water poses a considerably larger and longer-term risk to the biosphere and humanity. It is easier to focus on the radon risk, which is only relevant for individuals located near the emplaced waste due to the short half life of the isotope. I contend that the much larger risk is contamination of groundwater and surface water with dissolved uranium, as this can impact an entire watershed.

The maximum peak risk (dose) associated with disposal of DU will occur in the distant future, on the order of 1,000,000 years. The proposed regulatory time frame of 10,000 years does not capture this expected peak dose, but may be defensible relative to the viability of the calculations and models, and the defensibility of models that extend beyond that time frame. I applaud the proposed wording that requires at least a qualitative assessment of risk to peak dose, as this will necessarily address such factors as climate change.

Performance assessment models can be substantially flawed by incorrect assumptions, omissions, errors in fact, lack of understanding of the operative processes, or even intentional biasing. As such, my primary recommendation to the Board is that a robust system of peer review be established for the examination of any performance assessment intended to support the disposal of DU. Specifically, I am recommending that upon receipt of an application for a disposal license with the supporting documentation and performance assessment models, the government of Utah seek a review of the performance assessment models. This review should be conducted by a team of scientists/engineers who are independent of the company seeking license, the government of Utah, the NRC, and the various other stakeholders.

I propose that the peer review be conducted by a panel of about six individuals spanning the disciplines of geochemistry, hydrology, climate change, geomorphology, geotechnical, and health physics. The panel should be specifically charged with the detailed review of the model with an emphasis on at least the following:

- *the validity of models of physical and chemical processes*
- *the validity of bounding assumptions*
- *errors and/or omissions*
- *areas of uncertainty that exceed the model's claims*
- *the details of implementation of the model (computer code, etc.)*

I suggest the peer review panel be given six months to provide a report that would be submitted to the government and that would be a public document. The company could then respond to any issues with a revised performance assessment if they deemed it appropriate, and the government could proceed to a decision on the issue of licensing. The six-month delay this peer review would cause seems warranted when it is weighed against the potential consequences of poor decisions relative to the environment and public trust.

Response 30. The Executive Secretary notes your support for a qualitative assessment of risk to peak dose. *See also* Response 27.1. Comments relating to how a performance assessment should be conducted and evaluated, *see* Part A, Background, and Part F, General Response No. 1

and 3. It is not anticipated that there will be a formal peer review process. *See* Part F, General Response No. 3.

Comment 31 (David C. Kocher)

Comment 31.1

I am hereby submitting comments on the proposed amendments to Section R313-25-8, Technical Analyses, in the State of Utah's License Requirements for Land Disposal of Radioactive Waste -- General Provisions. To provide some background information, I served as an invited expert at the U.S. Nuclear Regulatory Commission's Public Workshop on Unique Waste Streams Including Depleted Uranium that was held in Salt Lake City on September 23-24, 2009. For many years, I served on teams of technical experts that prepared performance assessments for disposal of low-level radioactive waste at two U.S. Department of Energy (DOE) sites (Oak Ridge and Savannah River), and I also served on a panel of DOE contractors that provided advice to DOE on matters of conduct of performance assessment and development of appropriate regulatory requirements. Important elements of that panel's advice are incorporated in DOE's current waste management order as it applies to disposal of low-level waste. Although I am not a resident of the State of Utah, I have been encouraged by a resident who was also an invited expert at the workshop last September to submit comments on the proposed amendments to regulations that would apply to disposal of depleted uranium. My comments, which are concerned with the proposed paragraph (2)(a), are as follows.

[1] The new provision in paragraph (2)(a) should include a statement about "reasonable assurance" of compliance with applicable performance standards, similar to statements about "reasonable assurance" in existing regulations in paragraph (1) and its subparagraphs.

Response

A licensee required to perform a performance assessment must also comply with paragraph 1 of the existing rule, which requires "reasonable assurance" that the performance objectives will meet. R313-25-8(1)(a-d). A change to add "reasonable assurance" to paragraph 2(a) is not necessary.

Comment 31.2

[2] The proposed requirement that a performance assessment shall demonstrate compliance with performance standards in 10 CFR 61 and corresponding provisions of Utah rules when all disposed waste is taken into account, including waste already disposed of and proposed disposals of depleted uranium, raises an important question about the required scope of a performance assessment.

I am not familiar with Utah rules. However, as I'm sure the State understands, the numerical performance standards for waste disposal in 10 CFR 61 are concerned only with limiting potential radiation doses to off-site members of the public. Therefore, site-specific performance assessments basically need to be concerned only with potential releases of radionuclides beyond the boundary of the disposal facility. There is no requirement in 10 CFR 61 to assess potential impacts on inadvertent intruders who might come onto the disposal site at some time after an assumed loss of institutional control. Rather, protection of inadvertent intruders is handled in 10 CFR 61 by means of the generally applicable waste classification system, which includes limits on concentrations of specific radionuclides in Class A, B, and C wastes and technical requirements for disposal of waste in each class that apply at any licensed disposal facility. The concentration limits for the different waste classes were based on analyses of scenarios for inadvertent intrusion, with a scenario for a resident homesteader generally providing the basis for the limits for longer-lived radionuclides.

The generally applicable waste classification system in 10 CFR 61 has important implications for disposal of depleted uranium. Uranium is not included in the list of radionuclides for which concentration limits on Class A and

C wastes are specified. Therefore, depleted uranium in any concentrations and quantities is included in Class A waste, which has the least stringent disposal requirements. This approach to classifying depleted uranium (and other forms of uranium) was taken because the U.S. Nuclear Regulatory Commission (NRC) believed that there would be little uranium in low-level waste intended for disposal in licensed facilities. However, NRC did include concentration limits for depleted uranium in its proposed 10 CFR 61. The proposed rule specified a Class C limit for depleted uranium of 0.05 microcuries per cubic centimeter. This concentration limit is roughly 60 times less than the concentration of undiluted depleted uranium.

It is evident (at least to me) from the proposed concentration limit for depleted uranium in 10 CFR 61 that large quantities of depleted uranium would not qualify as Class A waste if a intruder dose assessment were required and may not even qualify as Class C waste. Whether or not depleted uranium would be Class C waste probably depends on the kinds of scenarios for inadvertent intrusion into disposed waste that would be considered reasonable for the purpose of setting a concentration limit. For example, if only drilling through the waste, but not excavation into a large volume of waste, were considered credible, which would be reasonable if disposal well below the ground surface were required, and the disposal limit for Class C waste were allowed to be 10 times higher than the limit for Class A waste based on consideration of the likelihood of occurrence of an assumed intrusion scenario, as is the case in 10 CFR 61 as promulgated, it is possible that depleted uranium could be classified as Class C waste.

The point of these remarks is that the State of Utah should carefully consider whether there needs to be a requirement for disposal of depleted uranium that a performance assessment shall also consider potential exposures of future inadvertent intruders and whether there should be a numerical performance standard for protection of inadvertent intruders (a limit on effective dose equivalent of 500 mrem per year, for example). Such requirements would go beyond what is required in 10 CFR 61. If such a requirement were instituted, the State would need to consider the important issues of disposal requirements for depleted uranium, an appropriate numerical performance standard, and definition of credible intrusion scenarios. Not to address protection of inadvertent intruders in some way would seem to me to be irresponsible, given that large volumes of depleted uranium most certainly would not qualify as Class A waste on the basis of analyses used to establish the waste classification system in 10 CFR 61 and may not even qualify as Class C waste.

Response

The Executive Secretary acknowledges that the rules do not provide a numeric performance standard for protection of the inadvertent intruder. *But see* Response 27.2. As to the suggested 500 mrem per year effective dose for inadvertent intrusion into Class C disposed waste, the Executive Secretary notes where there is no available rule, it is common for the agency to look to rules that apply in analogous situations. Comments relating to how a performance assessment should be conducted and evaluated, *see* Part A, Background and Part F, General Response No. 1.

Comment 31.3

[3] Finally, I would like to comment on the last two sentences in paragraph (2)(a), which address the compliance period and the need for an analysis that extends to the time of peak projected dose. These provisions are of critical importance for disposal of depleted uranium because, as everyone is aware, the radiological hazard of uranium increases with increasing time to about 1 million years, due to ingrowth of Ra-226 and its short-lived decay products, especially Rn-222. The increase in hazard amounts to orders of magnitude compared with the hazard from depleted uranium today.

First, I am concerned about the wording that the compliance period "will be a minimum of 10,000 years." The use of "minimum" here leads to a vague specification of the performance period. In my view, the performance period needs to be clearly and unambiguously stated in the regulation, although a less satisfactory approach would be to include guidance with the regulation to indicate how the compliance period might be determined. But, in general, licensees need specific requirements, not vague and ambiguous statements. This would also benefit decision makers.

Response 31.3.

Please *see* Response to Comment No. 26.2.

Comment 31.4

Second, I do not understand how simulations beyond the performance period "will be performed for a qualitative analysis for the period where peak dose occurs" ("qualitative" is the problem). Simulations would produce quantitative results (whether they are credible is another matter entirely). Perhaps what is intended here is that quantitative simulations would be used to render some kind of qualitative judgment about performance at far future times. Regardless of the intent, however, I do not believe that the meaning of this statement is clear.

Third, related to the previous point is the following issue: How will the State use results of an analysis beyond the compliance period (whether it is qualitative or quantitative) in making a judgment about whether disposal of depleted uranium is acceptable? It seems to me that the regulations, or perhaps an accompanying guidance document, need to give some indication of how results of such an analysis will be used in deciding on the acceptability of disposal of depleted uranium.

Response

Comments by Nelson *et al.* raise a similar point. *See* Response to Comment 27.1 above.

Comment 31.5

[4] I would say in closing that depleted uranium poses special problems in regard to protection of inadvertent intruders and the time frame for compliance with regulations that NRC clearly will need to deal with in revising its regulations to accommodate disposal of this material. There are no obvious precedents for dealing with this kind of waste.

Response

Thank you for your comments.

Comment 32 (Dobres M Johnson)

The focus of your Board as to the protection of our citizens and future generations concerning radiological exposure and contamination is critical. I therefore support the Board's efforts to establish a new ruling, which would ensure that no depleted uranium shipments arrive in our state prior to the completion of exhaustive public health studies and performance assessments.

A new rule should include the provision for the disclosure of level of peak dosage, as will as potential geological processes, i.e. flooring and erosion.

Response

The commenter's support for the rule is noted. With respect to the request to consider peak dosage, please note that the Proposed Rule requires a qualitative review of simulations for peak dosage. With respect to the request for consideration of geological processes, please *see* Part F, Response No. 1.

Comment 33 [reserved]

Comment 34 (Gary M. Sandquist)

I have responded to Stephen Nelson (BYU Geochemist) recent statement concerning the impact of a dramatic rise of the Great Salt Lake (circa 50,000 years) upon the integrity and dissolution of depleted uranium (DU) in encroaching waters impacting the Clive Disposal Site.
Attached is a calculation entitled "Analysis -Uranium in expanding GSL that intercepts Clive Site"
The conclusion of the analysis utilizing USGS and Utah Geological Survey Data and References [is presented in the analysis below]
ANALYSIS. URANIUM IN EXPANDING GSL THAT INTERCEPTS CLIVE SITE (Gary Sandquist)
About 49,000 tons of DU are stored in Clive and an additional 11,000 tons of DU are awaiting storage for a total inventory of 60,000 of DU.
This material is disposed of at Clive at a minimum depth of 10 feet below top of cell,
The current elevation of GSL is 4194 ft above sea level and has a water volume of about 11 million acre feet within an area of 969 square miles. (UT Geological Survey Data)
The elevation of Clive site is 4288 feet or 94 feet above current level of GSL.
(Data source: U.S. Geological Survey Maps, GSL and Clive-Aragonite.
If GSL is inundated and a return of Lake Bonneville occurred then water level at 4288 feet would provide a surface area of about 4500 sq miles (UT Geological Survey Data Topographical Maps)
So total area for expanded lake = 4500 sq miles + 969 sq miles = 5400 sq miles
Total water volume for this = 1.7 E8 acre-ft (added water) +11E6 acre-ft (present GSL) = 1.8 E8 acre-ft
1.8 EB acre feet x 43,560 cubic feet/acre-feet = 7.8 E 12 cubic feet
Water has a density of 0.031 tons/cu ft
So water mass in this expanded GSL = 7.8 E 12 cubic feet x 0.031 tons/cu ft = 2.4 E11 tones
Clive disposal of DU is 60,000 tons so = 60,000 (tons DU)/2 .4 E11 (tons H2O) = 0.25 ppm U in water.

If GSL expands to reach Clive Site total possible dissolved U in water is 0.25 ppm DU in water.
Average Utah soil contains 2.8 ppm of natural U or 11 times more U than water from rising GSL that reaches Clive Site. (Note: DU has about 60% radioactivity of natural U)
Even if entire US inventory of DU (estimated at ~600,000 MT) were disposed at Clive then maximum possible U content in this expanded GSL would be 2.5 ppm or still less than UT soil average.
Worldwide average uranium content is 3 ppm in soils, deep sea clays, and stream sediments.
However. DU metal is insoluble in water as are oxidized products of DU, viz. UO2 & U3O8.
U normally exists as deposits of insoluble sediments in water bodies.

Physical Characteristics of Uranium Compounds (CRC Handbook Chemistry & Physics)

Compound	*Melting Point (°C)*	*Crystal Particle (Density (g/cm^3))*	*Bulk (Density (g/cm^3))*	*Solubility in Water at Ambient Temperature*
U_3O_8	*Decomposes to UO2 at 1,300*	*8.30*	*1.5 - 4.0*	*Insoluble*
UO_2	*2,878 ± 20*	*10.96*	*2.0 - 5.0*	*Insoluble*
Uranium metal	*1,132*	*19.05*	*19*	*Insoluble*

Counter to popular belief, main risk of exposure to DU (or natural U) is chemical hazard from uranium oxide rather than radioactivity. A microgram of U in body has an alpha activity of less than 1 disintegration per minute (uranium is a very weak alpha emitter).

Response

The calculation presented in this comment is the one referred to in Comment No. 27.3 from Nelson *et al.* Both sets of commenters arrive at different conclusions as to the effect of depleted uranium disposal on the Great Salt Lake. However, the comments relate to the evaluation of a performance assessment and are not specific to the Proposed Rule. *See* Part A, Background, and Part F, General Response No. 1.

Comment 35 (Kira Kilmer)

My comments address responsibility of policy makers to anticipate all aspects of your decisions regarding the importation of uranium materials..

1. Energy Solutions may not last as long as the problems they create. Lehman Brothers and Enron would not have anticipated their own demise. The responsibility for mitigation of problems could fall to Utah, or to all taxpaying US citizens if Superfund Clean-up funds are necessary – do we want bigger or smaller government? Is it fair to gloss over problems and expect taxpayers to bail you out? Would "clean-up" even be possible? What if an aquifer were contaminated?

2. Energy Solutions is not going to advertise their own shortcomings just as the tobacco or sophisticated industry told us cigarettes tasted good and were either masculine or sophisticated but did not admit the cigarettes were addictive and that use exposed smokers to carcinogens.

3. Storage is only one of several concerns. What about transportation? Carrying containers across the country exposes all those along the route to potential contamination, either by intentional spilling or accidental hazard. In Salt Lake the train route goes through the heart of the city. Can you afford an accident or terrorist incident in our metropolitan center? Would you want an incident in any other city or rural farmland?

4. What about worker exposure to toxic materials? The Energy Solutions executives will sit at their desks, but the so called jobs they create may come with the inherent risk of deadly exposure should any containers fail or should there be workplace errors in handling the containers.

5. And finally, should not you, the legislature, the governor and all of us as the society who support you, be thinking of the final results. To meet our growing energy needs, should we agree to working with poisons or look to sources that are sustainable and non-toxic? Do we want mercury in our air, uranium in our dust and possibly in our water, or should we push ahead with solar, wind, geothermal energy sources, and conservation, while our research teams try to solve the known negative consequences of nuclear materials and coal.

We ask the coca growers in Colombia to give up a chance for income, we ask the opium growers in Afghanistan to grow grain at much lower profits, surely we can ask ourselves: are a few jobs worth the risk of accident, risks to employee and citizen health and potential damage to our environment?

Response

The commenter appears to be requesting an end to the disposal of radioactive waste in Utah, which is beyond the scope of this rulemaking. Please *see* Part F, Response No. 2. The Board does not have jurisdiction over transportation matters; those comments are also beyond the scope of this rulemaking. The comments regarding environmental concerns generally are relevant to the performance assessment. Please *see* Part F, Response No. 1.

Comment 36 (U.S. Nuclear Regulatory Commission)

Comment 36.1

We have reviewed the proposed changes to the Utah regulations R313-25-8, received by our office on January 6, 2010. These regulations were reviewed by comparison to the equivalent Nuclear Regulatory Commission (NRC) rules in 10 CFR Part 61. We discussed our review of the regulations with you on January 21, 2010.

As a result of our review, we have three comments that have been identified in the enclosure. Please note that we have limited our review to regulations required for compatibility and/or health and safety and the identification of program elements that create conflicts, duplications or gaps in the orderly pattern of regulations on a nationwide basis (See the 1997 Policy Statement on Adequacy and Compatibility of Agreement State Programs).

Under our current procedure, a finding that the Utah's regulations meet the compatibility and health and safety categories of the equivalent NRC regulation may only be made based on a review of the final Utah regulations. However, we have determined that if your proposed regulations were adopted, incorporating our comments and without other significant change, they would meet the compatibility and health and safety categories established in the Office of Federal and State Materials and Environmental Management Programs (FSME) Procedure SA-200.

We request that when the proposed regulations are adopted and published as final regulations, a copy of the "as published" regulations be provided to us for review. As requested in FSME Procedure SA-201, "Review of State Regulatory Requirements," please highlight the final changes, and provide a copy to Division of Materials Safety and State Agreements, FSME. The SRS Data Sheet summarizes our knowledge of the status of other Utah regulations, as indicated. Please let us know if you note any inaccuracies, or have any comments on the information contained in the SRS Data Sheet. This letter, including the SRS Data Sheet, is posted on the FSME website: http://nrc-stp. ornl.gov/rulemaking.html.

Response

Thank you for your comment.

Comment 36.2

The NRC would also like respond to the Statement of Basis for Administrative Rulemaking, dated December 1, 2009 which is part of the December 8, 2009 Radiation Control Board Information Packet as posted on your website and e-mailed to Duncan White on December 10, 2009. The Statement notes that the Utah Radiation Control Board "intends to issue a determination . . . about whether there are 'corresponding federal regulations that are not adequate to protect public health and the environment of the state." Statement of Basis at 11.

The Statement of Basis also concludes that NRC has recognized "the inadequacy of its current regulations." Statement of Basis at 8. Your characterization of NRC's regulations and conclusions regarding their adequacy is in error. Although the current regulations did not consider the disposal of significant quantities of depleted uranium, they are adequate to ensure the protection of the public health and safety. The requirements in 10 CFR Part 61 Subpart C provide the performance objectives that all disposal facility licensees must comply with before disposing of any low-level radioactive waste. The NRC's recommendation to update a site's performance assessment prior to disposal of significant quantities of depleted uranium would ensure that the licensee continues to comply with these requirements; a recommendation to ensure compliance with the existing regulations does not indicate that the regulations are inadequate.

The NRC's rulemaking effort will clarify these requirements and provide additional guidance to licensees and the Agreement States that are dealing with the disposal of unique waste streams, but engaging in a rulemaking to update the NRC's regulations does not mean that the current regulations are inadequate to protect the public health and safety while rulemaking is pursued to improve the regulations.

Response

The Executive Secretary agrees that, given the requirements in 10 CFR Part 61 Subpart C that all disposal facility licensees must comply with NRC Performance Objectives before disposing of any low-level radioactive waste, NRC's regulations and Utah's equivalent rules are adequate to protect public health and the environment of the state. *See* Part C and D, above.

Comment 37 (Douglas A. Barnes)

As a Utah native, I expect our state officials to protect citizens and future generations from the threat of radioactive waste, exposure and contamination. I support the Board's commitment to create strong policies and laws that guarantee citizens that no depleted uranium comes into our state - without first completing rigorous public health studies, along with thorough assessments of all entities involved. A bulletproof new rule is essential to protect citizens and future generations from the future hazards posed by depleted uranium. This new rule must include projections for peak exposure timelines, and the threats to our population posed by statistically significant seismic activity and flood scenarios.

Response

The commenter's support for the rule is noted. With respect to the request to consider peak dosage, please note that the Proposed Rule requires a qualitative review of simulations for peak dosage. With respect to the request for consideration of geological processes, please *see* Part F, Response No. 1.

Comment 38 (Colleen K. Barnes)

As a Utah resident and business owner, I expect the DEQ to protect the people of Utah, business development, tourism, and future generations from the threat of radioactive waste, exposure and contamination.

I support the Board's commitment to create strong policies and laws to guarantee the people of Utah that no depleted uranium comes into our state - without first completing rigorous public health studies, along with thorough assessments of all entities involved in the storage transaction. A new rule is urgently needed; and it must include projections for exposure timelines, as well as the threats to our population and enterprises posed by statistically significant seismic activity and flood scenarios. Please take a strong stance in favor of rigorous hearings, scientific assessment, and new legal guidelines regarding depleted uranium. Please also move forward quickly with a thorough review of ALL parties engaged in the approval process, transfer, and storage of radioactive and hazardous waste in Utah. It's shocking that no rule currently exists to protect tax-payers, businesses, and generations-to-come from all present and future hazards posed by the ultimate storage of 700,000 tons of depleted uranium. In a down economy, do we really want state business development shackled to the "radioactive Utah" brand?

Response

The commenter's support for the rule is noted. With respect to the request to consider peak dosage, please note that the Proposed Rule requires a qualitative review of simulations for peak dosage. With respect to the request for consideration of geological processes, please *see* Part F, Response No. 1.

Comment 39 (EnergySolutions)

Note: Some of these comments have been excerpted due to their length. The Executive Secretary responds to the entirety of these comments as follows.

General Response to Comment No. 39

Because there is a core group of comments and assumptions that are interspersed several times throughout EnergySolutions' comments, an initial general response is appropriate.

1. The Executive Secretary agrees that NRC Performance Objectives, if met, are protective of public health and safety. The purpose of the Proposed Rule is to require a licensee to demonstrate that the facility will meet NRC Performance Objectives.

2. EnergySolutions has urged that the Proposed Rule is not necessary because a licensee is required to demonstrate at licensing that it will meet NRC Performance Objectives. Implicit in this comment is an assumption that it is inappropriate to require a current demonstration. The Executive Secretary does not agree with that assumption in light of:

- New guidance from NRC, associated with SECY-08-0147 and NRC's depleted uranium rulemaking process about how to conduct a meaningful performance assessment.[4]
- A clearer understanding of the critical role played by the performance assessment for disposal of depleted uranium since NRC has acknowledged that, in the absence of a performance assessment, disposal of depleted uranium is an unanalyzed condition. This is so because the waste classification alone is not sufficient protection for disposal of significant quantities of depleted uranium. (*See* Statement of Basis and Part A, above.)
- Specific recommendations from NRC that the current performance assessments be reviewed. (*See* General Response to Comment 39, No. 3.)

3. The NRC and its staff have recommended that any performance assessment be reviewed before disposal of significant quantities of depleted uranium. For example, in NRC SECY-08-0147 (Oct. 7, 2008) (hereinafter "SECY-08-0147"), "Staff recommends conducting a limited rulemaking to revise Part 61 to specify the <u>need for a disposal facility licensee or applicant to conduct a site-specific analysis</u> that addresses the unique characteristics of the waste and the additional considerations required for its disposal <u>prior to disposal of large quantities of DU</u> and other unique waste streams such as reprocessing waste." (*emphasis added*). The SECY-08-0147 was adopted by Nuclear Regulatory Commission by Order dated March 18, 2009.[5]

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[4] The commenter also acknowledges that approval of a new performance assessment that meets current guidance will be a significant undertaking. *See* EnergySolutions' Comment No. 39.6.

[5] *See also* Comments of Larry Camper at NRC's Unique Waste Streams Rulemaking Record, Workshop 1, Day 1 (Sept. 2, 2009), tr. at 45, <u>http://www.nrc.gov/about-nrc/</u>

4. The disposal of depleted uranium is an important question that should be subject to a renewed demonstration at this time, as described above. The studies the commenter wants considered for this rulemaking have not been provided to the Executive Secretary for review and approval and have not been made available to the public for public comment. It is not appropriate to rely on them in a rulemaking action or to use the rulemaking process as a short-cut for agency and public review of the performance assessment process. Careful review of a performance assessment will take time, as EnergySolutions' own experts have recognized in Comment No. 39.6.

5. The Executive Secretary does not agree with EnergySolutions' suggestion that the Board consider, as appropriate evidence of compliance, the opinions of experts that future submissions will demonstrate that NRC's Performance Objectives will be met.

In addition, the assertion that the performance assessment will demonstrate compliance assigns a role to the performance assessment that that study cannot play. As NRC's lead performance assessment model for the SECY-0147 has stated:

> [A performance assessment] can provide a lot of insights to decision makers, but performance assessments do not make your decision for you. Decision makers make your decision.[6]

A decision that is informed by a performance or other kind of risk assessment involves an interplay between information provided in the assessment about how much risk and uncertainty there is, and determinations made about how much risk and uncertainty are acceptable. That interplay becomes more complex as the uncertainty in a technical analysis becomes greater.

There are many decisions that EnergySolutions will make as it writes a performance assessment: whether the period selected for a quantitative assessment is sufficient to understand the long-term trends for the site; what assumptions to make about human use of the area far into the future; what assumptions to make about the area's climate in the future; and what assumptions should be made about geomorphological changes. All of these matters and many more were the subject of four days of discussion before the NRC during its Unique Waste Streams Workshop, initiated in support of its rulemaking process. Very little consensus was reached about how to approach any of them. Because the Executive Secretary will be making his decision in advance of NRC's rulemaking process, he will face many of the same difficulties. These decision points, and many more, are complex and it should not be assumed that the outcomes will be the same choices that EnergySolutions has made.

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regulatory/rulemaking/potential-rulemaking/uw-streams/workshop-1-transcripts-day1.pdf. and *id*, Workshop 2, Day 1 (Sept. 23, 2009), tr. at 40.

[6] NRC's Unique Waste Streams Rulemaking Record, Workshop 1, Day 1, *supra* n. 5, tr. at 77 (September 2, 2009).

Finally, one important purpose of the performance assessment is to inform the waste disposal process. If the performance assessment identifies specific conditions under which disposal should occur (e.g., grouting or not grouting the waste, need to treat waste before disposal) that information should be available when the waste is disposed. *See* EnergySolutions Comment No. 39.29: "Site-specific analyses are very useful not only for understanding site performance, but enhancing site performance."[7]

6. The Proposed Rule imposes the same kind of restriction that is found in countless regulatory and license requirements to which any licensee is subject: it requires that before the licensee can undertake an activity, it must demonstrate that activity is safe. This is the normal regulatory process, not a moratorium. The timing of the submission of a performance assessment is in the licensee's hands. *See also* General Response to Comment No. 39, Comment No. 2 regarding timing of the performance assessment.

7. The Executive Secretary does not believe it is appropriate to rely on a licensee's ability to mitigate disposal in order to approve disposal before it has been adequately studied. Allowing an activity to occur before approval, even if it at the licensee's risk, is not appropriate since changing the status quo could prejudice the outcome of an agency's determination. This is recognized in many other rules that prohibit construction before approval of a facility. See, for example, R313-24-3(2), which provides "[c]ommencement of construction prior to issuance of the license or amendment shall be grounds for denial of the license or amendment."

In addition, one of the purposes of a performance assessment is to establish appropriate disposal conditions. Those conditions should be established prior to disposal. See General Response to Comment 39, No. 5.

Finally, it is not a foregone conclusion that the agency will approve a performance assessment. That decision and the conditions under which depleted uranium disposal may occur (*e.g.*, disposal depth, quantity limits, etc.) will be made after the agency has received and evaluated the totality of the submissions from a licensee.

8. The Executive Secretary does not agree that the agency should only consider near-term risk from disposal of depleted uranium. A licensee has an obligation to demonstrate that NRC Performance Objectives will be met generally, not just for the short term.

9. It is not appropriate for the agency to presume that specific conditions that a licensee agrees to meet – a 10 foot disposal depth, for example – will be sufficient absent an approved performance assessment. An approved performance assessment may also include additional

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[7] *See also* SECY-08-0147, Encl. 1 at 10 ("Because site-specific waste management decisions or other variables can strongly influence whether performance objectives can be met, care should be taken not to take the model results out of the analysis context.").

restrictions. The agency also cannot presuppose that the performance assessment will demonstrate that NRC Performance Objectives will be able to be met at the site. *See* General Response to Comment No. 39, No. 7.

Comment 39.1

EnergySolutions has reviewed the proposed rule regarding depleted uranium ("DU") published for comment by the Radiation Control Board (the "Board") on January 1, 2010 (the "Proposed Rule"). EnergySolutions opposes adoption of the Proposed Rule for the following reasons:

1. *The Board has failed to recognize and acknowledge that there are existing federal regulatory requirements that ensure the safe disposal of DU at EnergySolutions' LLRW facility at Clive, Utah (the "Clive Facility").*
2. *In failing to do so, the Board has violated the "no more stringent" statute of the Utah Radiation Control Act.*
3. *The location of the Clive Facility and the DU disposal methods used there are suitable and protective of public health and the environment.*
4. *In the highly unlikely event that DU disposal at the Clive Facility is shown to pose risks to public health and the environment, mitigation measures are available to eliminate such risks.*
5. *There are legal arguments and public policy considerations to demonstrate that the Proposed Rule violates applicable law, exceeds the Board's authority, and contravenes sound public policy.*
6. *Therefore, the Board has failed to demonstrate that the Proposed Rule is needed to protect public health and the environment of the State of Utah.*

In the following sections of its comments, EnergySolutions elaborates on the technical, legal, and public policy objections identified above. In so doing, EnergySolutions relies upon the judgment of several widely acknowledged experts. Each of these experts brings particular expertise to questions raised by the Proposed Rule.

The first point raised as an objection deserves special emphasis because it most clearly illustrates the shortcomings of the Proposed Rule. Under Utah law, the Board "may not adopt rules" that are "more stringent than the corresponding federal regulations which address the same circumstances" unless "it makes a written finding after public comment and hearing and based on evidence in the record that corresponding federal regulations are not adequate to protect public health and the environment of the state." The Board does not base the Proposed Rule on any independent judgment or analysis showing that the current regulations of the Nuclear Regulatory Commission ("NRC") are inadequate to protect public health and the environment. Instead, the Board attempts to justify the Proposed Rule by suggesting that there are no comparable federal rules in place and that the NRC has recognized "the inadequacy of its current regulations."

This clearly is not the case. The NRC has unequivocally declared to this Board that

> *Your characterization of NRC's regulations and conclusions regarding their adequacy is in error. Although the current regulations did not consider the disposal of significant quantities of depleted uranium, they are adequate to ensure the protection of the public health and safety.*

Letter from Terence Reis, Deputy Director, Division of Materials Safety and State Agreements, Office of Federal and State Materials and Environmental Management Programs, Nuclear Regulatory Commission, to Dane L. Finerfrock, Utah Division of Radiation Control ("DRC"), dated January 21,2010 ("These regulations were reviewed by comparison to the equivalent Nuclear Regulatory Commission rules in 10 CFR Part 61."), attached as Exhibit A.

This clear and unambiguous declaration by the NRC - the federal agency with jurisdiction over the regulation of radioactive waste - on its own demonstrates that there is no legal basis for the Proposed Rule. As such, the Proposed Rule should not be adopted by the Board.

Additionally, EnergySolutions believes that the Board has failed to support the Proposed Rule with a legally sufficient "reason for the change." The Board has also failed to produce "public health and environmental information and studies" that provide justification for the Proposed Rule.

BACKGROUND

Interest of EnergySolutions. EnergySolutions operates the Clive Facility, a LLRW disposal facility, pursuant to a license issued by the DRC and in accordance with applicable statutes and rules (the "License"). The License authorizes EnergySolutions to "receive, store, and dispose by land burial, radioactive material as naturally occurring and accelerator-produced material (NARM) and low-level radioactive waste." License Condition 9.A.

DU is within the universe of materials authorized for disposal by the License. DU also meets the criteria for Class A LLRW under the existing rules of the DRC. UAC R313-15-1008.

Proposed Rule. EnergySolutions hereby submits its comments on the Proposed Rule and the accompanying "Statement of Basis for Administrative Rulemaking Regarding Disposal of Significant Quantities of Depleted Uranium" ("Statement of Basis"). The Notice of Proposed Rulemaking (Amendment), DAR File No. 33267, dated December 14, 2009 (the "Notice"), was published in the Utah State Bulletin on January l, 2010, attached as Exhibit B.

Omission of Statement of Basis from the Notice. The Statement of Basis was not published in the Utah State Bulletin. Rather, the Notice stated that the Statement of Basis was posted on the DRC's website, but a search of the website did not show it. EnergySolutions was able to obtain a copy of the Statement of Basis directly from the DRC. Other interested parties and members of the public who may want to submit public comments have not been able to obtain and review the Statement of Basis. As a result, the opportunity afforded interested parties and members of the public to submit public comments has been inadequate and the scope and quality of the comments on the Proposed Rule will be diminished.

Public Comments Submitted bv EnergySolutions. EnergySolutions has assembled a technical team to prepare technical reviews which are summarized below (collectively, the "Technical Reviews"). The Technical Reviews support the conclusion that existing NRC regulations are sufficient to protect public health and the environment, with the result that the Proposed Rule is not needed and does not satisfy the criteria in Utah Code Ann. § 19-3-104(8) and (9). The experts whose reports and analyses comprise the Technical Reviews are:

- *Talisman. Talisman International, Inc. ("Talisman") is an international nuclear engineering firm located in Washington, D.C. Talisman advises commercial nuclear power reactors, fuel cycle facilities, and high-level and low-level radioactive waste generators and disposal facilities regarding all aspects of licensing and operations. Most of the employees of Talisman are former senior managers at NRC, the U.S. Department of Energy ("DOE"), and utility companies. Talisman's technical review is attached as Exhibit C.*
- *Neptune. Neptune and Company, Inc. ("Neptune") is an environmental consulting firm headquartered in Los Alamos, New Mexico. Neptune specializes in planning, design, and analysis of environmental data in support of decision making and risk assessments involving the management and disposal of high-level and low-level radioactive waste. Neptune has extensive experience with preparing performance assessments at a variety of facilities, including the Nevada Test Site, Los Alamos National Laboratory, and Savannah River Site. Neptune has been engaged by EnergySolutions to prepare the performance assessment ("PA") for the Clive Facility. Neptune's technical review is attached as Exhibit D.*
- *Enchemica. Enchemica, LLC's ("Enchemica") chief scientist, Dr. Janet Schramke, PhD, located in Loveland, Colorado, has over 26 years of professional experience in the fields of geochemistry and environmental chemistry, and is a former Senior Research Scientist at the DOE's Pacific Northwest National Laboratory. Dr. Schramke has considerable experience evaluating issues related to low-level, high-level and transuranic radioactive waste disposal, and has been engaged by EPA's Office of Radiation and the New Mexico Environment Department to provide numerous technical evaluations of the Waste Isolation Pilot Plant. She also served as part of the Yucca Mountain Project License Application Review Team for Sandia National Laboratory, providing senior-level reviews of portions of the Safety and Analysis Report submitted to the NRC. Enchemica's technical review is attached as Exhibit E.*

Response

With one exception, each of these comments is more fully stated in the remainder of EnergySolutions' comments and is responded to through those comments.

The exception is the comment regarding the availability of the Statement of Basis. The Executive Secretary does not agree that the Statement of Basis was not available. In addition, there is no basis for asserting that publication of the Statement of Basis was required. The Utah Rulemaking Act requires (in pertinent part):

(8) The rule analysis shall contain:
(a) a summary of the rule or change;
(b) the purpose of the rule or reason for the change . . . .
Utah Code Ann. § 63G-3-301.

The Rulemaking Notice met both of these requirements, and also provided the name of a person to contact for more information. Any person who used that information to request a copy of the Statement of Basis received one.

Finally, EnergySolutions' attorney received a copy of the Statement of Basis on December 2, 2009, in advance of the official notice through the Utah Bulletin on January 1, 2010. *See* Attachment 6.

Comment 39.2

I. THE PROPOSED RULE IS NOT NEEDED TO PROTECT PUBLIC HEALTH AND THE ENVIRONMENT

A. Applicable Legal Standard

The Utah "no more stringent" statute in the Utah Radiation Control Act sets forth the governing legal standard, required findings, and basis for findings.

Legal Standard

- *Utah Code Ann. § 19-3-104(8)(a): "Except as provided in Subsection (9), the board may not adopt rules, for the purpose of the state assuming responsibilities from the United States Nuclear Regulatory Commission with respect to regulation of sources of ionizing radiation, that are more stringent than the corresponding federal regulations which address the same circumstances."*
- *Id. § 19-3-104(9): "The board may adopt rules more stringent than corresponding federal regulations for the purpose described in Subsection (8) only if it makes a written finding after public comment and hearing and based on evidence in the record that corresponding federal regulations are not adequate to protect public health and the environment of the state."*

Response

The Executive Secretary agrees that EnergySolutions has correctly cited the statute. He does not agree that standard applies, or, if the standard is found to apply, the Executive Secretary believes the standard has been met. *See* Parts C and D, above, and Response to Comment No. 39.6.

Comment 39.3

Required Findings. The Board may not promulgate the Proposed Rule, unless the Board makes the following two findings:

1. The on-going receipt and disposal of DU (above 1 metric ton) - during the period from the effective date of the Proposed Rule until approval by the Executive Secretary of the DRC of the PA - will constitute a threat to "public health and the environment of the state."

2. During the period from the effective date of the Proposed Rule until approval by the Executive Secretary of the PA, "corresponding federal regulations are not adequate to protect public health and the environment of the state." Obviously, if the Board cannot make the first finding, it cannot make the second finding.

Response

As discussed in Part C, above, the Executive Secretary does not believe the stringency provisions of the Utah Radiation Control Act apply.

Even if it is found that the Proposed Rule is more stringent that federal regulations, however, the Executive Secretary disagrees with both of EnergySolutions' interpretations. The standard for promulgating a more stringent rule under Utah Code Ann. § 19-3-104(9) is that "federal regulations are not adequate to protect public health and the environment of the state," not that disposal of waste will constitute a threat to public health and the environment of the state, as the commenter states.

Protection of public health and the environment requires that potential risks be examined before action is taken. If current law does not allow the agency to require that examination – and, again, the Executive Secretary does not believe that is the case – then that law is "not adequate to protect public health and the environment of the state."

Comment 39.4

Basis for Findings. The above findings must be based on "evidence in the record" after public notice and comment and a rulemaking hearing. Such evidence must specifically address whether "corresponding federal regulations are not adequate to protect public health and the environment of the state."

Response

The Executive Secretary agrees that, in the event a finding under the stringency provisions of the Radiation Control Act is required, this is the correct statement of the requirements for that finding.

Comment 39.5

Before addressing the evidence offered by EnergySolutions that demonstrates that no risks to public health and the environment exist from on-going DU disposal, EnergySolutions first addresses whether the Board has applied the correct legal standard. This discussion is necessary because the Statement of Basis does not apply the correct legal standard. Under the heading "Standards Governing the Board's Rulemaking Authority," the Statement of Basis merely references the general authority under Utah Code Ann. § 19-3-104(4) but ignores the requirements under Utah Code Ann. § 19-3-104(8)-(9). Statement of Basis at 5. Oddly, the Statement of Basis then states:

> *The Board intends to issue a determination, after the public comment period, about whether there are "corresponding federal regulations that are not adequate to protect public health and the environment of the state."*

Id. at 11. This would seem to indicate that at the time the Proposed Rule was issued, the Board was not sure which legal standard applies. To assist the Board, EnergySolutions respectfully requests that the Board consider the following points.

Response

The Executive Secretary does not agree that the Statement of Basis applies an incorrect legal

standard. *See* Response to Comment 39.6, and Parts C and D, above.

Comment 39.6

1. There are "corresponding federal regulations which address the same circumstances"

The NRC characterized the Proposed Rule as "equivalent" to NRC rules 10 C.F.R. Part 61 for compatibility purposes. As NRC further notes, however, the characterization in the Statement of Basis that the NRC regulations are inadequate to protect public health and the environment is "in error." Ex. A at 1.

The Talisman technical review explains in detail how 10 C.F.R. Part 61 covers disposal sites that manage DU, and how the performance objectives and other requirements found in those regulations ensure the protection of public health and the environment (including the inadvertent intruder). Ex. C at 3-5, and 7. The NRC itself summarized in a recent adjudicatory proceeding how Part 61 ensures the protection of public health and the environment:

[T]he 'bottom line for disposal' of low-level radioactive waste are the performance objectives of 10 CFR subpart C [of Part 61], which set forth the ultimate standard and radiation limits for (1) protection of the general population from releases of radioactivity; (2) protection of the individuals from inadvertent intrusion; (3) protection of individuals during operations; and (4) stability of the disposal site after closure.

In the Matter of Louisiana Energy Services (National Enrichment Services) CLI-05-05, slip opinion at 11, dated January 18, 2005. Attached as Exhibit F.

2. The Proposed Rule is More Stringent than its Federal Counterpart

The Proposed Rule is more stringent than its federal counterpart because it prohibits the disposal of significant quantities of DU unless and until the NRC completes its rulemaking. That prohibition is not reflected in the counterpart regulation in 10 C.F.R. Part 61, which allows disposal of DU as Class A LLRW. A state rule prohibiting disposal of DU at the same time that the corresponding federal rule allows such disposal is per se more stringent than the federal rule.

The Talisman technical review also identified the practical consequence of the moratorium proposed by the Board:

The period of time necessary to gain approval of the performance assessment is unknown, which means in effect that the Radiation Control Board is proposing by rule to ban the disposal of DU for an indeterminate period of time. Consequently, the rule will result in a moratorium lasting at least two years in light of the time it will take to develop a robust performance assessment and the time it will take the State to review it.

Ex. C at 8. The Statement of Basis and rulemaking record provide no support whatsoever for such a moratorium.

3. The Current Regulatory Requirements are Adequate to Ensure the Safety and Suitability of DU Disposal at the Clive Facility

Talisman provides a detailed analysis of the current NRC regulatory requirements in 10 C.F.R. Part 61 that apply to the Clive Facility to ensure the continued safe disposal of DU and other waste. See Ex. C at 3-5. Specifically, Part 61 provides that disposal sites must be sited, designed, operated, closed, and controlled so that reasonable assurance exists that exposures to humans are within the limits of the performance objectives.

The performance objectives include: (1) protection of the general population from releases of radioactivity to the general environment as set forth in 10 C.F.R. § 61.41; (2) protection of individuals from inadvertent intrusion into the disposal site after site closure as set forth in 10 C.F.R. § 61.42; (3) protection of individuals during operations of the disposal site as set forth in 10 C.F.R. § 61.43; and (4) the site must achieve long-term stability as set forth in 10 C.F.R. § 61.44.

It is significant that the NRC regulations in Part 61 have been demonstrated to provide adequate protection of public health and the environment for many years, and continue to be relied upon. Notably, Utah has adopted these performance objectives in the Radiation Control Rules, Utah Admin. Code R313-25, and has relied upon the protections provided by Part 61 since 1982. In addition, other states with operating low-level waste disposal sites, e.g., Washington and South Carolina, have also relied on Part 61 for many years. Texas, which is currently in the process of licensing a radioactive disposal site, has also adopted Part 61.

Talisman also observed that Congress has recognized the protective value of the Part 61 performance objectives. Congress recently enacted legislation adopting the Part 61 strategy of demonstrating that radioactive waste disposal meets the performance objectives of Part 61. Specifically, in section 3116 of the National Defense

Authorization Act of 2005 (50 U.S.C. § 2601), Congress required DOE in consultation with the NRC to comply with the existing Part 61 performance objectives for disposing waste incidental to reprocessing. In addition, the DOE has adopted the current Part 61 performance objectives in its Waste Management Order 435.1 to implement its health and safety responsibilities under the Atomic Energy Act. Ex. C at 7.

4. The NRC Has Affirmed the Adequacy of its Regulations Adequate to Protect Public Health and the Environment of the State of Utah

In its comments to the Executive Secretary on the Proposed Rule, the NRC explicitly addressed this fourth issue as follows:

The Statement of Basis also concludes that NRC has recognized "the inadequacy of its current regulations." Statement of Basis at 8. Your characterization of NRC's regulations and conclusions regarding their adequacy is in error. Although the current regulations did not consider the disposal of significant quantities of depleted uranium, they are adequate to ensure the protection of the public health and safety. The requirements in 10 C.F.R. Part 61 Subpart C provide the performance objectives that all disposal facility licensees must comply with before disposing of any low-level radioactive waste. The NRC's recommendation to update a site's performance assessment prior to disposal of significant quantities of depleted uranium would ensure that the licensee continues to comply with these requirements; a recommendation to ensure compliance with the existing regulations does not indicate that the regulations are inadequate. The NRC's rulemaking effort will clarify these requirements and provide additional guidance to licensees and the Agreement States that are dealing with the disposal of unique waste streams, but engaging in a rulemaking to update the NRC's regulations does not mean that the current regulations are inadequate to protect the public health and safety while rulemaking is pursued to improve the regulations.
Ex. A at 1-2 (emphasis added).

The fact that a regulation is under review and is amended does not mean that the original regulation is no longer protective of public health and the environment. As circumstances change and more information becomes available, an administrative agency will reevaluate and modify its rules. Importantly, in this circumstance, the NRC has explicitly stated that the current regulations are adequate to protect public health and the environment while rulemaking is pursued to improve the regulations.

Talisman also addressed this point in its technical review, observing that had the NRC concluded that the current NRC requirements were not protective of health and the environment, the NRC would have taken action to prevent the disposal of DU until the rulemaking was completed. See generally Ex. C. Such action could have included issuing immediately effective orders under 10 C.F.R. § 2.202 to NRC licensees prohibiting disposal of DU until the rulemaking was completed. The NRC could also have issued orders to EnergySolutions and/or other disposal site licensees in Agreement States to prohibit disposal of DU pursuant to the provisions of 10 C.F.R. § 150.15(a)(5) and (b). The fact that the NRC has taken no formal or informal action further confirms that no immediate health and safety concern exists pending the rulemaking.

The technical review prepared by Talisman describes the limited purpose of the NRC rulemaking and why it should not be construed as an admission that 10 C.F.R. Part 61 is inadequate to protect public health and the environment:

While the rulemaking will clarify the need for a site-specific analysis, it does not indicate that the existing system is flawed or otherwise inadequately protective of public health and safety. Sections 61.12 and 61.13 already require a demonstration that the site and design of the disposal system meet the performance objectives and, therefore, the NRC rules are protective of public health and safety.
Ex. C at 5.

Response

Please *see* Parts C and D, above, which include a general discussion of the applicability of Utah Code Ann. § 19-3-104(8) and (9). *See also* the responses to comments by others that are incorporated in this comment.

The Executive Secretary does not agree with EnergySolutions' characterization of the Proposed Rule as a moratorium. *See* General Response to Comment No. 39, No. 6. The Executive

Secretary also does not agree that the federal regulations allow disposal of depleted uranium in the absence of a performance assessment that shows NRC Performance Objectives will be met.

The Statement that "it prohibits the disposal of significant quantities of DU unless and until the NRC completes its rulemaking" is in error, both because it characterizes the Proposed Rule as a prohibition and because it assumes that a licensee will not be able to have a performance assessment approved until NRC acts. The Proposed Rule allows a licensee to submit a performance assessment at any time. It does not anticipate waiting for NRC to complete rulemaking before making a determination about the adequacy of a performance assessment.

Comment 39.7

It is important to note that Section 274 (c)(4) of the Atomic Energy Act of 1974 (42 U.S.C. § 2021), and Article II, paragraph C of the Agreement between NRC and Utah give the NRC primacy in Utah regarding the disposal of "byproduct, source, or special nuclear material as the Commission from time to time determines by regulation or order should, because of the hazards or potential hazards thereof, not be so disposed of without a license from the Commission." Thus, the Proposed Rule and moratorium, if enacted, likely violates the preemptive effect of NRC's regulations.

Response

The Executive Secretary does not agree. Where the NRC has determined that the Proposed Rule is compatible with its program, and where the Proposed Rule is consistent with a recommendation made by the NRC, the Proposed Rule is not preempted by federal law.

Comment 39.8

The Technical Reviews demonstrate that a moratorium on DU disposal pending the NRC rulemaking is not needed to protect public health and the environment.

1. *The Location of the Clive Facility and the DU Disposal Methods are Suitable and Protective of Public Health and the Environment*

Neptune offered the following expert opinion based on its knowledge of the location of the Clive Facility and disposal methods used: "[t]he remoteness of the Clive Facility site and hostile environment for both humans and ecological systems, make it particularly well suited for disposal of large quantities of DU." Ex. D at 4. Neptune also observed that the existing NRC guidance supports the safe disposal of DU at the Clive Facility and provides a level of confidence that the full site-specific PA will confirm the same:

> *In October 2008, the Nuclear Regulatory Commission (NRC) prepared "Analysis of Depleted Uranium Disposal" as Enclosure 1 to the SECY-08-0147 [4], which concluded that near surface disposal of large quantities of depleted uranium may be appropriate at disposal depths of at least three meters. Although the NRC has acknowledged that this generic radiological performance assessment should not be relied upon as the sole basis for making site-specific licensing decisions, it does provide useful context for assessing site-suitability. In fact, the NRC relied on just such an approach for development of the classification tables in 10 CFR 61.55, which are based on a generic analysis of potential impacts at a reference site.*

Id. at 4.

[Note that this comment was moved from elsewhere in EnergySolutions' comments.] *Reliance on the work done by the NRC is in keeping with the historical practice of using generic analyses as a component of demonstrating compliance. Again, as pointed out by Neptune in their technical review, Part 61 is based in part on generic analyses that rely on a reference site. Indeed, the reference relied upon is less suitable than the Clive Facility for the disposal of LLRW.*

Response

As acknowledged in this comment, NRC's analysis in the SECY-08-0147 should not be relied on as a site-specific performance assessment. The NRC has cautioned in many places that the generic performance assessment described in this paper cannot be relied on for site-specific licensing purposes. *See, e.g., See also* SECY-08-0147, Encl. 1 at 10:[8]

> The model was designed to provide the user with flexibility to evaluate different waste forms, disposal configurations, performance periods, institutional control periods, pathways, and scenarios. The impact of these variables on projected radiological risk can be significant. Therefore, the model was developed as a first-order assessment tool to risk-inform decision making. Refinement of the model would be necessary if it was to be used for licensing decisions, and rigorous validation would be needed.

Moreover, David Esh, the lead modeler for the SECY-08-0147 has acknowledged that there are limitations in that work that would need to be carefully studied on a site-specific basis. For example, he acknowledged that neither erosion nor above-grade construction was considered.[9] He also acknowledged that the assumption made for the study that climate conditions would remain steady were too simplistic.

Finally, it should be noted that the SECY-08-0147 has also not been subject to the rigorous public notice and comment process that NRC believes is appropriate.

Comment 39.9

[Quoting Neptune]

> *Based on the 2008 NRC analysis, Neptune's preparation of PAs at other sites, and Neptune's knowledge of site conditions and disposal configurations at the Clive facility, Neptune's collective professional judgment is that a fully quantitative PA can be developed that will demonstrate compliance with applicable standards*

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[8] *See also* Workshop Presentation at 54 ("Depleted Uranium NRC Analysis: SECY-08-0147 provides basic description of assessment and assumptions; Analysis not intended to replace site-specific evaluations."), http://www.nrc.gov/about-nrc/regulatory/rulemaking/ potential-rulemaking/uw-streams/du-workshop-presentations.pdf; Workshop 2, Day 1, *supra* n.5, tr. at 107 (David Esh) ("You have to basically do the site specific analysis and determine whether it can at a particular site. I think if our conclusions were interpreted that because you have an arid site, therefore you can do it, that's not correct."); and Workshop 2, Day 1, tr. at 120 (Mr. Esh, described as "spot on" a statement by another workshop participant that "This is not a risk assessment. This doesn't tell you anything about the ability of any specific facility or site to meet or not meet performance objectives under any conditions.").

[9] *See* exchange between modeler David Esh and a workshop participant, Workshop 1, Day 1, *supra* n. 5, tr. at 93-94 (erosion not considered for SECY-08-0147); and Workshop 2, Day 1, tr. at 114, lines 16-19 (above grade disposal not considered for SECY-08-0147).

within a 10,000-year time period for disposal of some quantity of DU.

Neptune also confirmed that the future PA it is now preparing for the Clive Facility will adequately address the peak radon concentration:

> *Because peak radon activity will occur following about 1,000,000 years into the future, a more qualitative model will also be developed to evaluate ultra-long term performance. This is in keeping both with NRC guidance and our experience at other [LLRW] sites. This approach will be used rather than relying on quantitative dose projections because of the uncertainty associated with evaluating human receptor scenarios that far into the future. This uncertainty is associated both with projecting human behavior and environmental conditions. For example, several ice ages might occur, and recurrences of Lake Bonneville can be expected.*

Id. at 5.

Similarly, Enchemica's technical review describes other prior technical analyses of DU disposal at the Clive Facility that confirm Neptune's opinion set forth above:

> *EnergySolutions has carried out a site-specific analysis applicable to the disposal of large quantities of depleted uranium (DU) at their facility in Clive, Utah (Whetstone 2009). This groundwater transport evaluation was carried out in a manner consistent with previously approved site-specific assessments (Whetstone 2000, 2007), except for the modeling of additional uranium decay chains and extension of the time period to more than 10,000 years after cell closure (Whetstone 2009). Potential environmental effects of DU disposal were addressed by modeling the groundwater transport of radionuclides from the disposal cell to a compliance well at the site. The site-specific analyses included many conservative assumptions that resulted in the overestimation of leaching and transport of DU constituents from the disposal cell to a compliance well. This report reviews the characteristics of DU and summarizes the conservative assumptions and results of the site-specific modeling calculations of groundwater transport that demonstrate large-quantity DU disposal can be safely carried out at the Clive facility.*

Ex. E at 1-2.

Enchemica also provided a detailed analysis of conservative assumptions underlying the site-specific groundwater transport assessments for the Clive Facility that support past and future DU disposal. Id. at 3-4. This analysis also took into consideration the engineered cover and other cell design features and site specific information to confirm the integrity and geotechnical stability of the current disposal methods. Id. at 5. Enchemica concluded:

> *Site-specific groundwater transport modeling for waste disposal at the EnergySolutions Clive facility has demonstrated that uranium can be safely placed in the disposal cells, even when the waste is assumed to contain uranium isotopic concentrations that greatly exceed plausible concentrations, along with significant concentrations of uranium progeny (Whetstone 2000, 2007, 2009).*
>
> *The results of these site-specific performance assessments demonstrate that large quantities of DU can be safely placed in the Clive facility, because significant radionuclide transport through the groundwater will not occur. The low rainfall, lack of potable water and saline soils make the site unsuitable for present-day or future habitation. The radon barrier and the intrusion protection function of the engineered cover would provide protection to receptors exposed through a non-resident exposure scenario.*

Id. at 6-7.

Accordingly, the best available science and technical analyses demonstrate that large quantities of DU can be safely disposed at the Clive Facility. Moreover, EnergySolutions has voluntarily and probatively commenced preparation of an additional PA to demonstrate the same even before the NRC rulemaking concludes.

Response

See General Response to Comment 39, Nos. 4 and 5.

Comment 39.10

2. *The Existing Technical Analyses Satisfy Current Regulatory Requirements and Ensure the Safety and Suitability of DU disposal at the Clive Facility*

The technical review prepared by Talisman appropriately notes the emphasis in 10 C.F.R. Part 61 on technical analyses. Indeed, as it points out, the term performance assessment does not even appear in the regulations. The requirement to perform technical analyses appears in 10 CFR §§ 61.12 and 61.13:

> *Sections 61.12 and 61.13 already require a demonstration that the site and design of the disposal system meet the performance objectives and, therefore, the NRC rules are protective of public health and safety.*

The technical analyses that have been prepared by EnergySolutions and its contractors, as supplemented by the analyses prepared by the NRC in SECY-08-0147, demonstrate the suitability of the Clive Facility for the disposal of DU.

EnergySolutions has initiated preparation of a new formal PA both to satisfy the anticipated outcome of the NRC's limited rulemaking and to provide assurance that the disposal of DU at the Clive Facility historically, currently, and in the future has been done in a manner that satisfies the performance objectives of Subpart C. Nonetheless, there exist significant, robust technical analyses that, taken in the aggregate, satisfy 61.12 and 61.13. These analyses are comprised of the studies described above: the Enchemica technical review (Whetstone 2009) and the NRC analyses contained in the SECY, "Analysis of Depleted Uranium Disposal." These technical analyses demonstrate not only the absence of any near-term risk, but the high likelihood that the Clive Facility will be found suitable for the continued disposal of large quantities of DU.

3. While Highly Unlikely, in the Event the DU Disposed of at the Clive Facility is Determined to Pose a Risk to Public Health and the Environment in the Future, Mitigation Measures are Available to Eliminate Any Risks

Neptune observed in its technical review that

> *one erroneous assumption implicit in the Proposed Rule is that a moratorium is needed because once DU is disposed of at the Clive Facility, no mitigation will be possible in the event that a future PA fails to demonstrate compliance. This assumption is incorrect because performance can be successfully enhanced by various forms of mitigation.*

Ex. D at 1. Neptune found that mitigating measures that could eliminate risk - in the highly unlikely event that DU disposal posed a risk to public health and the environment - include constructing a thicker cap to reduce radon emissions or removal and relocation of the DU. Id. Thus, the Proposed Rule offers no plausible justification for the Proposed Rule.

Response

See all General Responses to Comment 39 (Nos. 1 through 9).

Comment 39.11

C. The Board Failed to Satisfy the Procedural Requirement of Receiving Evidence at a Public Hearing

Utah law requires that when adopting rules that are more stringent than corresponding federal regulations, the Board must make "a written finding after public comment and hearing and based on evidence in the record . . . ." Id. at § 19-6-104(9)(a) (emphasis added). No Utah case law exists interpreting this provision or the analogous provision limiting the rulemaking authority of the other DEQ boards. However, from the plain language it appears that commentors must be able to offer both written and oral arguments to the Board in the setting of a formal hearing. Such an approach makes sense for complex rulemakings involving "public health and environmental information and studies." Commentors should be afforded the opportunity to submit detailed technical information represented by the testimony of technical information represented by the testimony of technical experts who would be subject to further questioning from the Board.

The purpose of a public rulemaking hearing is "to afford interested persons an opportunity to submit written data, views, and arguments regarding why the proposed regulation should or should not be adopted." Utah Restaurant Assoc. v. Salt Lake City-County Board of Health, 771 P.2d 671, 674 (Utah Ct. App. 1989) (citation omitted). Thus, commentors for rulemaking under Utah Code Ann. § 19-6-104(9)(a) must be able to present written comments and comments at a public hearing.

The Board held what it referred to as a "public hearing" on January 26, 2010. This event is more properly referred to as a public meeting, given that the Board provided no opportunity for commentors to explain their

comments, submit expert testimony to support their comments, or to entertain questions from the Board. Indeed, the hearing was not even open to commentors who intended to present written comments, as explained by the Executive Secretary during the January Board meeting:

Peter, I need to clarify something for the Board. The January 26 meeting, it's an opportunity for the public to provide [tape cuts out] orally rather than in writing. It is not a meeting where there's going to be dialogue expect to acknowled recorded by a court reporter and the transcript will be made available and those comments are treated the same as comments that have been received in writing. So let's make this clear, this isn't going to be a period for debating the merits of what's being discussed. It's an opportunity for oral comments for those people who don't take the time to write them to us. Write and send them to us.

Transcript of January 12, 2010 Radiation Control Board meeting, attached as Exhibit G. Accordingly, the Proposed Rule violated the procedural requirement to hold a meaningful public hearing. The value of the public meeting was further diminished because the majority of the Board was not even present at the meeting to hear comments - only two members attended.

The reference to "record" "evidence" also suggests that the Legislature intended that the public hearing be through a more formal process which could include sworn testimony and cross examination as occurs with some federal agencies which undertake rulemaking through formal adjudication. This point is less clear from the language of the statute.

Although Utah Code Ann. § 19-3-104(9) requires additional findings, there is nothing in the provision to suggest that a different procedure is required. The terms "hearing," "evidence" and "record" are all used in the Utah Rulemaking Act, and have not been interpreted to require the kinds of extraordinary procedures proposed by EnergySolutions.

The rulemaking hearing was open to any person, whether or not they submitted written comments. The comments of the Executive Secretary simply reflected the likelihood that the opportunity was more likely to be used by those who were not planning to file written comments. Several of those commenting at the meeting did also submit written comments. Written comments and oral comments carry the same weight.

It is common practice for rulemaking hearings to be conducted by hearing officers who are not the same person(s) as the final decisionmaker. We acknowledge the commenter's preference, but no authority is cited for the suggested requirement that the final decisionmaker attend the hearing.

Comment 39.12

D. The Board Failed to Consider the Impact of the Proposed Rule on Small Businesses.

Nowhere in the Statement of Basis is there any analysis of the impact of the Proposed Rule on small businesses. The Utah Administrative Rulemaking Act requires that the rulemaking agency consider the fiscal impacts of a proposed rule on business and, if there is an expected negative fiscal impact on small business, the agency is required to take certain steps to mitigate that impact. Utah Code Ann. § 63G-3-301(5) and (6).

Cavanagh Services Group ("Cavanagh") is a Utah woman-owned small business in Utah that has contracts with EnergySolutions for the loading and transloading of DU for rail shipment to the Clive Facility. The Statement of Basis does not even identify Cavanagh, much less assess the impacts of the Proposed Rule to Cavanagh's business. This omission means that the Statement of Basis is legally defective. Accordingly, the Statement of Basis and the Proposed Rule should be withdrawn and the proper analysis performed under Utah Code Ann. § 63G-3-301(6).

Response

See Part E, above.

Comment 39.13

Conclusion

As shown above, the Proposed Rule is fatally flawed because (1) the Board has failed to recognize and acknowledge that there are existing federal regulatory requirements that ensure the safe disposal of the Clive Facility, (2) the Board has violated the "no more stringent" statute of the Utah Radiation Control Act, (3) the location of the Clive Facility and the DU disposal methods used there are suitable and protective of public health and the environment, (4) even in the highly unlikely event that DU disposal at the Clive Facility is shown to pose a risk to public health and the environment, mitigation measures are available to eliminate such risks, and (5) the Proposed Rule violates applicable law, exceeds the Board's authority, and contravenes sound public policy. In sum, the Proposed Rule is not needed to protect public health and the environment of the State of Utah. Accordingly, EnergySolutions respectfully requests that the Board vacate the Proposed Rule.

Response

This statement summarizes comments made more fully elsewhere in EnergySolutions' comments. Please *see* those comments for responses.

Comment 39.14 (Talisman)

Regulatory Background. Regulations promulgated by the U.S. Nuclear Regulatory Commission (NRC) specifically address the disposal of depleted uranium. The applicable federal regulation, found at 10 C.F.R. Part 61, Licensing Requirements for Land Disposal of Radioactive Waste, promulgated by the NRC establish the requirements for land disposal of radioactive waste and the procedures, criteria, and terms and conditions for licenses for the disposal of LLRW containing byproduct, source, and special nuclear material. 10 C.F.R. § 61.3. Depleted uranium (DU), which is the subject of this rulemaking, is source material and is regulated under Part 61. As explained in NRC's comments, no room for disagreement exists that DU is regulated. In fact DU was specifically considered in the development of Part 61. As recently affirmed by the NRC, DU is Class A waste subject to 10 CFR Part 61.

Response

The Executive Secretary agrees with the statement regarding applicable law and the statement that DU is regulated under Part 61, and that DU is a Class A waste. *See* General Response to Comment 39, No. 1. The Executive Secretary also agrees that DU was considered in the development of Part 61, specifically the proposed waste classification provisions. The final waste classification regulation, however, is not based on NRC's analysis of the disposal of significant quantities of depleted uranium.

Although NRC recently affirmed that the classification for depleted uranium will not change, it did acknowledge that, because significant quantities of depleted uranium were not analyzed in the development of Part 61, it was not appropriate to rely on that waste classification without an adequate performance assessment. *See* Statement of Basis and documents cited therein.

Comment 39.15

Performance Objectives. Part 61,which the State of Utah has adopted in its Utah Administrative Code at R313-25, is protective of the public health and the environment of Utah. A key part of Part 61 are the four performance objectives in Subpart C of Part 61 that when met ensure the safe disposal of LLRW. Applicants for disposal site licenses and license renewals must demonstrate by technical analyses that these performance objectives have been met. These analyses, which include performance assessments, are reviewed by the licensing authority as part of the licensing process.

Part 61 provides in section 61.40 that disposal sites must be sited, designed, operated, closed, and controlled so that reasonable assurance exists that exposures to humans are within the limits of the performance objectives. The performance objectives are:

1. *Protection of the general population from releases of radioactivity to the general environment as set forth in 10 C.F.R. § 61.41.*
2. *Protection of individuals from inadvertent intrusion into the disposal site after site closure as set forth in 10 C.F.R. § 61.42.*
3. *Protection of individuals during operations of the disposal site as set forth in 10 C.F.R. § 61.43.*
4. *The site must achieve long-term stability as set forth in 10 C.F.R. § 61.44.*

Response

The Executive Secretary agrees with this characterization of some of the requirements of Part 61.

Comment 39.16

Adequacy of Part 61. The existing Part 61 is adequate because the regulations require that performance objectives of Subpart C be met and these performance objectives are protective for both the public and a site intruder. The State of Utah has adopted these performance objectives in Utah Administrative Code. The NRC regulations as codified in Part 61 have been demonstrated to provide adequate protection of public health and safety for disposing of LLRW for many years. NRC and the various states have relied upon the protections provided by Part 61 since 1982. Not only has Utah adopted Part 61, the other states with operating LLRW disposal sites, Washington and South Carolina, also have done so. Texas, which is currently in the process of licensing a radioactive disposal site, also has adopted Part 61. All states that license LLRW disposal sites have adopted Part 61.

The NRC summarized the significance of the performance objectives during a recent adjudicatory proceeding as follows:

> *the 'bottom line for disposal' of low-level radioactive waste are the performance objectives of 10 CFR subpart C [of Part 61], which set forth the ultimate standard and radiation limits for (1) protection of the general population from releases of radioactivity; (2) protection of the individuals from inadvertent intrusion; (3) protection of individuals during operations; and (a) stability of the disposal site after closure.*

Further evidence that the performance objectives of Part 61, Subpart C, are adequate is demonstrated by the fact that the Proposed Rule references and relies on them.

Response

The Executive Secretary agrees that, if met, NRC Performance Objectives are protective of public health and safety. *See* General Response to Comment 39, Nos. 1 and 2.

Comment 39.17

Specific Technical Requirements. In addition to meeting the above performance objectives, Part 61 has numerous specific technical requirements addressing waste disposal that also must be met, e.g., 61.50, 61.51, 61.52, 61.53, 61.55, 61.56, and 61.57. These technical requirements address siting suitability, disposal design, operational and closure provisions, environmental monitoring, and waste classification and characteristics. These provisions provide for a comprehensive regulatory envelope that together with the performance objectives provides protection to the public health and safety. An important element of these technical requirements is the classification of the radioactive waste. There are three classes: A, B, and C. As noted above, DU is Class A waste. The classification process is described in 10 C.F.R. § 61.55. Depending on the class of waste different requirements of Part 61 apply.

In sum, 10 C.F.R. Part 61 is a comprehensive federal regulation that governs the disposal of LLRW including DU. Utah, as an Agreement State, must adopt requirements that the NRC finds to be adequate for protection of the public health and safety and to be compatible with the NRC requirements as provided for under section 274 (d) and (j) of the Atomic Energy Act of 1974 (42 U.S.C. § 2021), which Utah has done by its establishment of Utah Administrative Code at R313-25. While performance assessments, which are the subject of the Proposed Rule, are important tools to predict sufficient protection of public health and the environment, the governing regulations including implementation of the performance objectives and specific technical requirements together impose rigorous controls, giving the Board, workers, and public stakeholders confidence that Clive's operations remain safe.

Response

The Executive Secretary agrees that, if met, NRC Performance Objectives are protective of public health and safety. He does not agree that the other provisions cited are sufficient in the absence of a performance assessment, particularly with respect to the disposal of significant quantities of depleted uranium. *See* Statement of Basis and documents cited therein, and General Response to Comment 39, No. 2.

Comment 39.18

PURPOSE AND SCOPE OF NRC RULEMAKING

Clarification of Part 61 Implementation. Part 61 does not use the term "performance assessment." Rather it requires "technical analyses," which include analyses other than performance assessments. Existing NRC guidance in NUREG-1573 provides that performance assessments are needed to demonstrate that the public is protected from radioactive releases post closure to meet the standards of the performance objective in 10 C.F.R. § 61.41. As noted above, Part 61 requires in sections 61.12 and 61.13 that technical analyses demonstrate that these objectives be met. As a result, to ensure that the technical analyses contain performance assessments, the NRC intends to codify a requirement for conducting a site specific performance assessment. It is doing this by embarking on a limited rulemaking effort to clarify Part 61 implementation for DU. While providing specifically for performance assessments will clarify the need for a site-specific analysis, it does not indicate that the existing system is flawed. 10 C.F.R. § 61.12 and 13 already require the demonstration that the site and design meet the performance objectives and, therefore, are protective of the public health and safety.

Response

See Response to Comment 39.17.

Comment 39.19

In fact, the NRC recently informed Utah that NRC does not consider its regulations to be flawed. As to Utah characterization of the adequacy of the NRC regulations in Part 61 in Utah's Statement of Basis for Administrative Rulemaking, dated December 1, 2009, NRC said:

> *Your characterization of NRC's regulations and conclusions regarding their adequacy is in error. Although the current regulations did not consider the disposal of significant quantities of depleted uranium, they are adequate to ensure the protection of the public health and safety. The requirements in 10 CFR Part 61 Subpart C provide the performance objectives that all disposal facility licensees must comply with before disposing of any low level radioactive waste. The NRC's recommendation to update a site's performance assessment prior to disposal of significant quantities of depleted uranium would ensure that the licensee continues to comply with these requirements; a recommendation to ensure compliance with the existing regulations does not indicate that the regulations are inadequate. The NRC's rulemaking effort will clarify these requirements and provide additional guidance to licensees and the Agreement States that are dealing with the disposal of unique waste streams, but engaging in a rulemaking to update the NRC's regulations does not mean that the current regulations are inadequate to protect the public health and safety while rulemaking is pursued to improve the regulations.*

(Emphasis added). Thus, it is clear that the State cannot rely on the actions of the NRC to base its conclusions that the NRC rule is inadequate. NRC has made it clear that the fact that it is clarifying its rule does not mean the existing rule is inadequate to protect the public health and safety.

Response

See Response to Comment No. 39.6.

Comment 39.20

NRC Did Not Choose to Impose a DU Disposal Moratorium. The fact that the NRC chose to clarify Part 61 implementation does not in any way suggest that the NRC has concluded that there is an immediate health and safety issue regarding the disposal of depleted uranium. As evidenced by NRC's comments on the Proposed Rules noted above at footnote 6, there is not a current safety issue with the NRC requirements. Nowhere has NRC said that Part 61 is inadequate to protect the public health and safety. If that were the case, NRC would have taken immediate action to prevent the disposal of DU until the rulemaking was completed. Such action could have included issuing immediately effective orders under 10 C.F.R. § 2.202 to NRC licensees prohibiting disposal of DU until the rulemaking was completed. The NRC could also have issued orders to EnergySolutions and other disposal site licensees in Agreement States to prohibit disposal of DU pursuant to the provisions of 10 CFR 150.15 (a)(5) and (b). This would be consistent with section 274 (c)(4) of the Atomic Energy Act of 1974 (42 U.S.C. § 2021), and with Article II, paragraphs C of the Agreement between NRC and Utah that provides that the NRC authority in Utah continues as to the disposal of:

> *. . . byproduct, source, or special nuclear material as the Commission from time to time determines by regulation or order should, because of the hazards or potential hazards thereof, not be so disposed of without a license from the Commission.*

Quite to the contrary, the NRC has taken no formal or informal action suggesting an immediate health and safety concern.

Moreover, NRC has not used its informal actions such as Information Notices, Bulletins, or Regulatory Issuance Summaries to provide regulatory directives to discourage DU disposal pending the NRC rulemaking. Rather, it has made clear that no immediate action is necessary. In public meetings in Salt Lake City, Utah, Staff specifically addressed this point by noting that they considered and rejected the need to take some near-term action specifically because there is no near-term threat to health and safety. David Esh stated at the September 22, 2009 meeting of the Utah Radiation Control Board that "there isn't an immediate public health and safety concern surrounding this material."

Response

See General Response to Comment 39, No. 3, regarding the statements from NRC recommending that a performance assessment be conducted prior to disposal of significant quantities of depleted uranium.

It is several Agreement states, not NRC, that regulate the facilities for which a performance assessment review is suggested. NRC relied on them to take appropriate action, as it demonstrated in the following statement:

> In addition, as we stated earlier in this proceeding, an NRC environmental impacts analysis of depleted uranium disposal impacts does not require a full-scale site-specific review, an inquiry in the purview of the responsible licensing agency. The NRC does not regulate any of the five near-surface waste disposal facilities identified in the FEIS as potential locations for disposal of the depleted uranium. These potential disposal sites are either regulated by state authorities under the NRC's Agreement State program, or by the Department of Energy. If LES ultimately chooses one of these waste disposal facilities, it will fall within the purview of one of these authorities - not the NRC - to approve and regulate the disposal. We would expect the appropriate regulatory authority to conduct any site-specific evaluations necessary to confirm that radiological dose limits and standards can be met at the disposal facility, in light of the quantities of depleted uranium envisioned. In short, our NEPA analysis today considers estimated disposal impacts, but does not purport to assess whether all regulatory requirements would be satisfied at any particular site.

Louisiana Energy Services, L.P. (National Enrichment Facility), CLI-06-15, 63 NRC 687, 690-91 (2006) (*internal quotations and footnotes omitted*).

With respect to the quote by David Esh, it is helpful to put the quote in context:

> Although I believe they could change the waste classification, they felt regarding this situation that it is important they follow this deliberative process with their stakeholders, get all the input and let the process precede as it may. And this is partly because there isn't an immediate public health and safety problem surrounding this material. It's unlikely that large quantities of Depleted Uranium can be disposed of as Class A waste without additional requirements. It would be a challenge if you took hundreds of thousands of metric tons and put it in ground and put a meter of soil on top of it that you could meet the performance objectives. That would be a very big challenge, technically.

It is apparent that in making that statement, Mr. Esh was relying on the fact that the facility will be required to demonstrate through a performance assessment that it will meet NRC Performance Objectives before disposing of waste, as the Proposed Rule requires.

Comment 39.21

Prudential Site-Specific Evaluation. Rather than prohibit disposal of DU until the rulemaking is completed or direct that performance assessments be re-reviewed, NRC stated in a "communication document," which is not a regulatory document (either formal or informal), that it would be "prudent" for the site operator and state regulator to review the existing site-specific performance assessment documentation and existing control measures. Utah DRC and EnergySolutions have agreed to amend the license resulting in the implementation of revised License Condition 35. This condition includes burial of DU with a minimum of 10 feet below the top of the cover. It also requires submittal of a performance assessment, in general conformance with the approach used by the NRC in SECY-08-0147 be submitted for review and approval no later than December 31, 2010.

Response

See General Responses to Comment 39 (Nos. 1 through 9).

Comment 39.22

Suggesting that it would be prudent to review existing performance assessments is well within the purview of the regulator under the existing Part 61. NRC further stated that the performance assessment should minimally be reviewed against the initial parameters staff identified in SECY-08-0147. In that regard, it is noted that in SECY-08-0147 the NRC staff concluded after performing a generic performance assessment that for arid sites disposal of large quantities of DU may be appropriate. It recommended burial depths at a minimum of 3 meters which is consistent with the current license conditions for the Clive site, an arid site. As noted above, License Condition 35 already satisfies this requirement. However, as also noted above, nowhere, including in their memorandum to the Commission, has Staff suggested that Part 61 in its current form, is not adequate to protect health and safety.

Response

See Response to Comment No. 39.8 and General Response to Comment 39, Nos. 1, 2 and 9.

Comment 39.23

Congress Has Recognized the Protective Value of Part 61. Congress also has recognized the protective value of the Part 61 performance objectives. Recently, Congress enacted legislation that adopted the Part 61 strategy of demonstrating that radioactive waste meets the performance objectives of Part 61. Specifically in section 3116 of the National Defense Authorization Act of 2005 (50 U.S.C. § 2601), Congress required the U.S. Department of Energy (DOE) in consultation with the NRC to comply with the existing Part 61 performance objectives for disposing waste incidental to reprocessing. In addition, DOE has adopted the current Part 61 performance objectives in its waste management Order 435.1 to implement its health and safety responsibilities under the Atomic Energy Act.

In sum, the performance objectives of Part 61 which underlie the Part 61 disposal requirements are the accepted standard in the United States for the protection of the public health and safety in disposing of LLRW. This same regulatory framework has been adopted by all states with operating or planned LLRW disposal sites and the DOE, which operates LLRW disposal facilities at 10 sites. They are adequate to protect the public. There exists no evidence to the contrary and no basis to conclude otherwise.

Response

See General Response to Comment 39, Nos. 1 and 2. Also *see* generally the Statement of Basis

and Part A, above.

Comment 39.24

III. THE PROPOSED ACTION CONTRAVENES NRC PUBLIC POLICY

The NRC has found that the existing disposal regulations in Utah Administrative Code at R13-25 are compatible with the NRC regulations and are adequate to protect the public health and safety. These regulations are consistent with Part 61 and allow for the disposal of LLRW, which would include DU and other Class A waste, if the performance objectives and other applicable requirements are met. The proposed regulation, if enacted, will deny the disposal of LLRW and create a de facto moratorium for the disposal of DU which is inconsistent with federal regulations. This is because the proposed regulation singles out DU from other Class A waste and requires a performance assessment to be submitted and approved before significant quantities of DU are disposed of. The period of time necessary to gain approval of the performance assessment is unknown, which means in effect that the Radiation Control Board is proposing by rule to ban the disposal of DU for an indeterminate period of time. Consequently, the rule will result in a moratorium lasting at least two years in light of the time it will take to develop a robust performance assessment and the time it will take the State to review it.

As explained above, there is no basis for concluding that there is a current or immediate health and safety issue if additional DU is added to the site and that there is clearly sufficient time to take action should later reviews determine such actions are warranted. Furthermore, the NRC has reached the same conclusion regarding the absence of a near-term threat.

Response

The Executive Secretary disagrees with the commenter's characterization that the Proposed Rule is a de facto moratorium, inconsistent with federal regulations and in contravention of NRC public policy. As acknowledged in the comment, NRC regulations allow the disposal of LLRW "if the performance objective and other applicable requirements are met." The Proposed Rule would require the licensee to conduct a performance assessment to show its site meets the performance objectives. *See also* Response to Comment No. 39.6 and General Response to Comment 39, No 6.

Comment 39.25

FN 9: The Proposed Rule provides that the performance assessment must be updated to reflect NRC guidance once such guidance is prepared and any requirements that results from NRC rulemakings. It is unclear from the proposed rule language whether the revised performance assessment must be resubmitted if a performance assessment has already been approved and if so, whether additional DU maybe disposed of pending the review of the revised performance assessment.

Response

The additional analysis that will be required, if any, will only become clear after NRC completes its rulemaking and guidance. The risk that a licensee will have to do additional analyses is a necessary consequence of the licensee's decision to dispose of depleted uranium in advance of the completion of NRC's process.

Comment 39.26 (Neptune)

I. SUITABILITY OF THE CLIVE FACILITY FOR DISPOSAL OF DU

In October 2008, the Nuclear Regulatory Commission ("NRC") prepared "Analysis of Depleted Uranium Disposal" as Enclosure 1 to the SECY-08-0147 [4], which concluded that near surface disposal of large quantities of depleted uranium (DU) may be appropriate at disposal depths of at least three meters. Although the NRC has acknowledged that this generic radiological performance assessment (PA) should not be relied upon as the sole basis for making site-specific licensing decisions, it does provide useful context for assessing site-suitability. In fact, the NRC relied on just such an approach for development of the classification tables in 10 CFR 61.55, which are based on a generic analysis of potential impacts at a reference site. Based on the 2008 NRC analysis, Neptune's preparation of PAs at other sites, and Neptune's knowledge of site conditions and disposal configurations at the Clive Facility, Neptune's collective professional judgment is that a fully quantitative PA can be developed that will demonstrate compliance with applicable standards within a 10,000-year time period for disposal of some quantity of DU. Consistent with NRC guidance, such a PA would project current conditions and current knowledge about society for the next 10,000 years. The remoteness of the Clive Facility and hostile environment for both humans, for whom there is little evidence of habitation of the area, and ecological receptors, tend to make it well suited for disposal of DU.

Response

See Response to Comment No. 39.8 and General Response to Comment 39, No 5.

Comment 39.27

To evaluate the performance of the Clive Facility with respect to DU disposal, Neptune has been engaged by EnergySolutions to prepare a model using the latest analytical tools (GoldSim [5]) and PA methodologies (probabilistic systems-level modeling). GoldSim was first used to support performance assessment at Yucca Mountain in the 1990s, and GoldSim modeling has continued at Yucca Mountain through this decade. Indeed, GoldSim was initially developed specifically for the Yucca Mountain Project. Neptune started using GoldSim to model the Los Alamos National Laboratory ("LANL") low-level radioactive waste ("LLRW") disposal facility in1999. This was followed by Neptune's implementation of GoldSim models in support of PAs for DOE's LLW disposal facilities at the Nevada Test Site ("NTS") and the Savannah River Site (SRS).

GoldSim is well-suited for dynamic system-level models that fully couple transport processes, and manage uncertainty through probabilistic specification of models, and subsequent Monte Carlo simulation. Neptune has also developed a generic PA model in GoldSim that is available for public use, which has been downloaded by NRC and other organizations. Neptune will develop a quantitative PA for the Clive Facility using GoldSim, modeling source term, source release, engineered barriers, transport through environmental media, and dose to potential human receptors. The model approach will be based on regulatory guidance (including a DOE white paper on probabilistic modeling), and on standard practices for performing risk/dose assessments. A fully quantitative model will be prepared to model the next 10,000 years.

There are some notable similarities between the Clive Facility and the NTS facilities, one of the sites analyzed by Neptune using GoldSim. The PA models that Neptune has developed for the NTS modeled a hostile desert environment. For example, both areas are hostile environments for humans and ecological receptors, groundwater is unlikely to serve as a drinking water source (for different reasons), and transport of radionuclides is affected by the low rates of precipitation, the high evaporation potential, and the presence of arid lands biota. The NTS PAs developed by Neptune demonstrated compliance for disposal of large quantities of low-level radioactive waste in shallow land burial, some of which produced large amounts of radon. Consequently, it seems reasonable that a quantitative PA for the Clive Facility might demonstrate compliance with performance objectives for disposal of DU.

Response

See General Response to Comment 39, No 5.

Comment 39.28

Because peak radon activity will occur following about 1,000,000 years into the future, a more qualitative model will also be developed to evaluate ultra-long term performance. This is in keeping both with NRC guidance and our experience at other LLW sites. This approach will be used rather than relying on quantitative dose projections because of the uncertainty associated with evaluating human receptor scenarios that far into the future. This uncertainty is associated both with projecting human behavior and environmental conditions. For example, several ice ages might occur, and recurrences of Lake Bonneville can be expected.

The status of human civilization that far into the future, particularly after geologic events, also is uncertain. For example, modem man has not been in the position of surviving a glacial epoch. Nonetheless, it is possible to assess concentrations or activity of radon, uranium and other radionuclides in various media for different possible futures of ice age and Lake Bonneville recurrences, to which any human receptors at that time could be exposed.

Although conditions far into the future are uncertain, it is no more reasonable to assume only negative outcomes than it is to assume positive outcomes. One could imagine scenarios under which ice age and Lake Bonneville effects might be beneficial for the disposal facility (e.g., sediment deposition), as well as scenarios under which the performance of the Clive Facility is adversely affected (e.g., wave action). This will be explored further in the ongoing PA effort based on data and information from available geology, climatic, and hydrology studies of the local Basin and Range province and Lake Bonneville in particular.

An important aspect of this ultra-long term analysis will be to identify and model a set of scenarios that are representative of potential future conditions. This is done by conducting a thorough examination of features, events and processes that are relevant to site performance. For this analysis for the Clive Facility, this might include isostatic rebound effects when a future Lake Bonneville recedes, and different ecological biomes that might occur as conditions change.

Response

See General Response to Comment 39, No 5.

Comment 39.29

II. POTENTIAL MITIGATIVE STRATEGIES

One erroneous assumption implicit in the Proposed Rule is that a moratorium is needed because once DU is disposed of at the Clive Facility, no mitigation will be possible in the event that a future PA fails to demonstrate compliance. This assumption is incorrect because performance might be enhanced by various forms of mitigation. For example, the ongoing PA effort will include a model of the planned engineered cap. However, if the PA for these cap conditions does not demonstrate compliance, mitigation measures can be identified that would show how compliance might be achieved. These could involve using a thicker native clay soil layer to reduce radon emissions, or could involve a thicker layer of riprap to reduce the effects of wave action if the lake rises.

Once the PA model for current conditions is completed and transport and exposure pathways have been identified, the results can be used to inform which additional mitigating measures would be most effective. For example, the PA model could be used to optimize the thickness of various engineered cap layers to mitigate release of radon from the disposal system, or the thickness of the riprap layer to sufficiently reduce the effect of wave action on the Clive Facility. Other possibilities are to increase the depth at which the DU is disposed or reduce the overall amount of DU disposed. Site-specific analyses are very useful not only for understanding site performance, but enhancing site performance.

Response

See General Response to Comment 39, No 7.

<u>Comment 39.30</u> (Enchemica)

EnergySolutions has carried out a site-specific analysis applicable to the disposal of large quantities of depleted uranium (DU) at their facility in Clive, Utah (Whetstone 2009), attached as Exhibit 1. This groundwater transport evaluation was carried out in a manner consistent with previously approved site-specific assessments (Whetstone 2000, 2007); except for the modeling of additional uranium decay chains and extension of the time period to more than 10,000 years after cell closure (Whetstone 2009). Potential environmental effects of DU disposal were addressed by modeling the groundwater transport of radionuclides from the disposal cell to a compliance well at the site. The site-specific analyses included many conservative assumptions that resulted in the overestimation of leaching and transport of DU constituents from the disposal cell to a compliance well. This report reviews the characteristics of DU and summarizes the conservative assumptions and results of the site-specific modeling calculations of groundwater transport that demonstrate large-quantity DU disposal can be safely carried out at the Clive facility.

2.0 Radiological and Chemical Properties of Depleted Uranium

Uranium can exist in natural, enriched, or depleted form. Natural uranium is ubiquitous in the environment and consists of a mixture of isotopes (Table l). Natural uranium, like most naturally occurring elements, can be present in soils at a range of concentrations. Typical soil uranium concentrations are a few parts per million (ATSDR 1999). Low-grade uranium ore deposits generally have uranium concentrations from about 0.03 to 0.25% (Finch 2003). Uranium also occurs in higher-graded deposits, such as the McArthur River and Cigar Lake deposits in Canada, which have average grades of 17% and 2l%o U3O8, respectively (Cameco 2009).

Enriched uranium is produced by separation of uranium isotopes to enhance the concentrations of uranium-234 and uranium-235. Depleted uranium is a byproduct of the enrichment process and contains lower proportions of uranium-234 and uranium-235 and a slightly higher percentage of uranium-238 than natural uranium (Table l). Because the concentrations of higher-activity isotopes have been reduced, the specific activity of DU is only about 60% of the specific activity of natural uranium (Table 2). Consequently, the radiological hazard of DU at the time of disposal is less than that of natural uranium. The radiological hazards of both natural uranium and DU are considered to be low because of their low specific activities (ATSDR 1999).

The radioactivity of natural uranium at secular equilibrium (i.e., all progeny are in equilibrium) will remain constant for an extremely long time, although the uranium will eventually decay to stable lead isotopes. DU will become slightly more radioactive with time because of the production of radioactive progeny by decay. During the first year after DU separation, the activities of immediate progeny (thorium-234, protactinium-234m and thorium-231) reach equilibrium. Following this initial in-growth, the activity of DU remains approximately constant for over 1,000 years until in-growth of protactinium-23l becomes significant (WHO 2001). Peak activity of DU would be expected about 1,000,000 years after separation (NRC 2008) but would not exceed the activity of natural uranium.

Because the chemical hazard of uranium does not depend on its isotopic composition, DU has the same chemical toxicity as natural uranium (WHO 2001). The environmental behavior of DU and natural uranium, including solid phase solubility and adsorption, are also the same.

Because the progeny produced by radioactive decay are different elements, their environmental mobilities are not the same as uranium and were addressed by the site-specific transport modeling.

3.0 Site-Specific Analyses of Depleted Uranium Disposal at the Clive Facility

The site-specific groundwater transport assessments for the Clive facility (Whetstone 2000, 2007, 2009) included a number of conservative assumptions, resulting in overestimations of the transport of uranium isotopes and their progeny. Key elements of these assessments that incorporated conservative assumptions include: 1) source term concentrations and constituent release, 2) disposal cell design and infiltration modeling, 3) vertical and horizontal transport modeling, and 4) the site standards/groundwater protection levels ("GWPLs") used in the evaluations.

3.1 Source Term and Constituent Release

The source term concentrations of uranium isotopes in the groundwater transport assessments carried out for the EnergySolutions Clive facility included a number of conservative assumptions (Whetstone 2000, 2007, 2009). The activities of uranium-232, uranium-234, uranium-236 and uranium-238 were assumed equal to the specific activities of each isotope. This assumption is equivalent to assuming that the concentration of each isotope is equal to the concentration present when the entire source term is composed solely of that isotope as metallic uranium. Because the waste form cannot be completely composed of all four of these isotopes at the same time, use of these activities in the site-specific assessments is extremely conservative. The assumed activities are also conservative because disposed DU will be a uranium oxide (U3O8 or UO2) rather than metallic uranium, which would result in even lower uranium activity (Table 2).

Uranium-233 and uranium that is enriched in uranium-235 are special nuclear materials (SNM). EnergySolutions was granted an exemption allowing their possession of waste containing SNM (NRC 1999); this exemption states that concentrations in individual waste containers at the EnergySolutions site must not exceed 75,000 pCi/g for uranium-233 or 1,900 pCi/g for uranium-235. Accordingly, the groundwater transport assessments used source-term concentrations of uranium-233 and uranium-235 equal to these maximum SNM concentrations.

Uranium-232,urantum-233 and uranium-236 arc not naturally occurring isotopes and are not present in DU, so the source-term activities of these isotopes used in the groundwater transport assessments are extremely conservative. The total activities of the combined uranium isotopes used in the site-specific groundwater transport assessment exceed the expected total activities in DU by many orders of magnitude (Table 2). Sixteen isotopes were modeled in the site-specific assessment based on six decay chains for uranium (Whetstone 2009). The isotopes modeled included six uranium isotopes (Table 1), nine isotopes important in the decay chains (americium-234, curium-244, plutonium-238, plutonium-239, plutonium-240, plutonium-242, radium-226, thorium-230 and thorium-232) and potassium-40 to provide a comparison to previous modeling results. The source term concentrations for thorium-230 and potassium-40 were set equal to their specific activities, which far exceeds their likely concentrations as the DU or any other waste accepted at the site will never consist solely of these materials. The source term concentrations for the remaining decay-chain isotopes were set equal to the maximum concentrations allowed for Class A waste (40 CFR 61.55, Table 1).

Because waste typically has radionuclide concentrations well below the Class A limits, the assumed concentrations are conservatively overestimated. The waste container life was conservatively assumed equal to zero in the site-specific groundwater transport analyses. It was also assumed that release rates from the waste form remained constant until the source concentration was totally mobilized. This is a conservative assumption because release rates would be expected to decline as the source concentrations decreased. The release rates were calculated from sorption coefficients (Kds) for the radionuclides that were conservatively selected to be the lowest values available in the literature, except for radionuclides with site-specific values (Whetstone 2000). Thus, the source term and constituent release calculations used either site-specific information or conservative, bounding values where site-specific information was not available to provide conservatively high estimates of constituent release rates.

3.2 Cell Design and Infiltration Modeling

The engineered cover on the Class A disposal cells at the EnergySolutions Clive facility is a multi-layer system. From bottom to top, the components of the cover include a two-component compacted clay radon barrier (2 ft), lower granular filter zone (0.5 ft), sacrificial soil layer (1 ft), upper granular filter zone (0.5 ft), and erosion (rock rip rap) barrier layer (1.5 ft). The minimum thickness of the engineered cover is 1.7 meters (5.5 ft). The site-specific evaluations of groundwater transport (Whetstone 2000, 2007, 2009) included the effects of the cover on infiltration. The Class A disposal cells are lined with a 2-foot-thick layer of compacted clayey native soil, which was also included in the site-specific analyses (Whetstone 2000, 2007, 2009).

The calculations performed for the Clive facility used infiltration rates modeled from site-specific weather data, including evapotranspiration, temperature, precipitation and solar radiation data, as well as landfill soil and design data (Whetstone 2000 ,2007, 2009). The site-specific modeling was based on a very conservative approach that ultimately overestimated the amount of infiltration that would enter the disposal cells. EnergySolutions' Clive facility is located in an area with evaporation rates several times higher than precipitation rates. Based on the site characteristics, it is highly unlikely that incident precipitation will infiltrate through the cover and enter the disposal cell.

3.3 Vertical and Horizontal Groundwater Transport Calculations

The vertical and horizontal groundwater transport calculations used the conservative calculated site-specific infiltration data, and site-specific or conservative Kd, hydraulic conductivity, hydraulic gradient, and effective porosity data (Whetstone 2000, 2000, 2009). These calculations incorporated the effects of the many Clive facility features that limit release of uranium isotopes and other radionuclides to the groundwater and transport to the compliance well, including extremely low infiltration and groundwater flow rates and the presence of soil constituents that will remove uranium and other radionuclides from leachate and groundwater by sorption.

The site-specific groundwater transport calculations were carried out for time periods of up to 12,000 years (Whetstone 2009). Results from these transport calculations were used to evaluate concentrations at the groundwater table underneath the disposal cell and at the compliance well. Results of the transport modeling calculations showed that none of these modeled radionuclides would exceed the GWPLs at the compliance well within the 10,000-year period of performance, even though many extremely conservative assumptions were used in the evaluations (Whetstone 2000, 2007, 2009).

3.4 Performance Standards

The performance standards for protection of the general public from releases of radioactivity to the general environment (groundwater, surface water, air, soil, plants or animal) or to an inadvertent intruder are specified in 10 CFR 61.41 and 10 CFR 61 .42. The concentrations released must not result in an annual dose to any member of the general public greater than 25 mrem to the whole body, 75 mrem to the thyroid, and 25 mrem to any other organ. The GWPLs used in the EnergySolutions site-specific modeling calculations (Whetstone 2000, 2007, 2009), are included in the site groundwater quality discharge permit (No. UGW450005). These GWPLs are based on a dose limit of 4 mrem from consumption of site groundwater, which is much less than the regulatory standards.

The GWPLs used in the groundwater transport assessments are based on the assumption that site groundwater can be used as drinking water. Although drinking water standards were used in the assessment of radionuclide transport from the disposal cell, the site groundwater is not a realistic source of drinking water because of its high salinity and the low yield of the aquifer. Indeed, groundwater concentrations at some site wells exceed the GWPLs by an order of magnitude due to the naturally occurring background levels of a variety of naturally occurring constituents.

4.0 Lack of Public or Inadvertent Intruder Receptors at the Clive Facility Site

Federal regulations for near-surface land disposal of low-level waste are provided in 10 CFR 61. In the original risk analysis carried out to support development of 10 CFR 61, two types of receptors were defined: a public receptor who engages in residential, agricultural, or other activities at the boundary of the disposal site, and an inadvertent intruder who engages in these activities on the disposal site (NRC 2008). It was assumed that these residential, agricultural or other activities were consistent with current regional practices (NRC 2008). Because of low rainfall, high groundwater salinity, low aquifer yield and salinity of the site soils, many of the potential pathways used in the 10 CFR 61 risk assessment do not exist at the EnergySolutions Clive facility site. For example, site groundwater cannot be used for drinking water or crop irrigation. These site conditions have precluded human habitation in the past and make future human habitation and associated exposure pathways extremely unlikely.

In addition to the natural characteristics that preclude a public receptor or inadvertent intruder at the Clive facility site, the engineered disposal cell cover would limit the potential radon dose to any transient receptor. The uppermost portion of this cover is composed of rip rap that limits erosion and serves as an intrusion barrier.

5.0 Summary and Conclusions

Site-specific groundwater transport modeling for waste disposal at the EnergySolutions Clive facility has demonstrated that uranium can be safely placed in the disposal cells, even when the waste is assumed to contain uranium isotopic concentrations that greatly exceed plausible concentrations, along with significant concentrations of uranium progeny (Whetstone 2000, 2007, 2009). The chemical risks associated with DU are the same as natural uranium and the radiological risks of DU are likely to be much smaller than those assessed by the groundwater transport calculations. These site-specific calculations included a number of conservative assumptions that resulted in the overestimation of radionuclide transport through the groundwater to the compliance well location.

The results of these site-specific performance assessments demonstrate that large quantities of DU can be safely placed in the Clive facility, because significant radionuclide transport through the groundwater will not occur. The low rainfall, lack of potable water and saline soils make the site unsuitable for present-day or future habitation. The radon barrier and the intrusion protection function of the engineered cover would provide protection to receptors exposed through a non-resident exposure scenario.

Response

See General Response to Comment 39, Nos. 4 and 5.

<u>Comment 39.31</u> (Whetstone)

Whetstone Associates performed fate and transport modeling of uranium and daughter products for the EnergySolutions Class A cell, Class A North, and Class A South disposal cells for a period of over 10,000 years after cell closure. The modeling was performed using the PATHRAE-RAD model (Merrell, et al, 1995). The methodology and input parameters were identical to the previously approved Class A cell modeling (Whetstone, 2000) except that six uranium decay chains were modeled and the model output time was extended to 12,000 years (2,000 years beyond the time period of interest).

Model Input Parameters

The PATHRAE model was run using the input parameters described in the Class A Cell modeling report (Whetstone, 2000), including infiltration rate, path length, moisture content, vadose zone velocity, and aquifer velocity. Six decay chains for uranium were modeled:

1. *Cm-244 → Pu-240 → U-236*
2. *Pu-240 → U-236 → Th-232*
3. *Am-243 → Pu-239 → U-235*
4. *Pu-238 → U-234 → Th-230 → Ra-226*
5. *Pu-242 → U-238 → U-234*
6. *U-238 → Th-230 → Ra-226*

Sixteen isotopes were modeled, including six uranium isotopes (U-232,U-233, U-234, U-235,U-236, and U-238), nine isotopes important in the decay chain calculations (Am-243, Cm-244, Pu-238, Pu-239, Pu-240, Pu-242, Ra-226, Th-230, Th-232), and one isotope as a comparison to previous modeling results (K-40). All 16 isotopes listed in Table 1 were modeled in both the vertical and horizontal modeling runs. In previous modeling (Whetstone, 2000), only Am-243 and K-40 were carried forward to the horizontal modeling, because none of the uranium species arrived at the water table within 1,000 years.

Source concentrations in the model were set at the maximum concentrations for Class A waste (10 C.F.R. 61.55). This approach is conservative, because it assumes that all of the waste is received at the highest concentrations for all constituents. In reality, many waste streams received at the facility will be well below the Class A low-level radioactive waste limits for specific nuclides. Maximum waste concentrations in pCi/g were converted to Ci/m3 using the average waste bulk density of 1,800 kg/m3.

The model was run for both the top slope (0.265 cm/yr infiltration) and side slope (0.364 cm/yr infiltration) conditions. The infiltration rates, moisture contents, aquifer hydraulic properties, and transport distances used in the fate and transport modeling for uranium species are applicable to the Class A cell, Class A North, and Class A South disposal cells listed in Table 2 because the limiting case with the highest infiltration rate (0.364 cm/yr) and shortest transport distance (90 feet to the compliance well) are included in the modeling. PATHRAE model input parameters for the top slope are shown in Table 3 and for the side slope are shown in Table 4.

Model Results

Vertical Model Results

Vertical PATHRAE modeling was performed for the 0.265 cm/yr top slope and the 0.364 cm/yr side slope. The top slope modeling results indicate that five of the seven uranium species (U-234, U-235, U-236, and U-238) would exceed Ground Water Protection Levels (GWPLs) at the water table directly beneath the embankment in 5,000 - 8,300 years after cell closure (Table 5). Uranium concentrations at the water table under the top slope area of the cell would peak at approximately 19,000 years after cell closure, below the top slope. U-232 and U-233 have relatively short half lives, and would not arrive at the water table at concentrations exceeding GWPLs.

The side slope modeling results indicate that five of the seven uranium species (U-234, U-235, U-236, and U-238) would exceed GWPLs at the water table directly beneath the embankment in 3,600 - 6,000 years after cell closure (Table 6). Uranium concentrations at the water table under the side slope area of the cell would peak at approximately 13,000 years after cell closure, below the side slope.

A complete listing of output times and concentrations at the water table is provided in Table 7 for the top slope

and Table 8 for the side slope. All 16 constituents were carried forward from the vertical modeling into the horizontal modeling.

Horizontal Model Results

The horizontal modeling results (Table 9, Table 10) indicate that none of the uranium species modeled would reach the compliance well within 10,000 years.

Concentrations of K-40, which was run as a surrogate, are similar to the results from previous modeling for the early output times (100 through 1,000 years) which confirms that the longer term model results are comparable to the previously approved modeling results. However, the results are not identical due to differences in timestep discretization. The previous model required very short timesteps during the early years, while the 10,000 year model uses a 100-year timestep. Because uranium does not arrive at the water table before 1,000 years, the coarser timestep used in the current modeling is appropriate for modeling uranium species.

Summary

The fate and transport of uranium species disposed in the Class A cell was evaluated using the PATHRAE model. The model was run for over 10,000 years, for both the top slope and side slope areas of the cell. The modeling indicates that although uranium species would exceed GWPLs at the water table in 5,000 - 8,300 years for the top slope and 3,600 - 6,000 years for the side slope, uranium would not arrive at the compliance well within 10,000 years. Uranium concentrations in groundwater at the compliance well would remain well below GWPLs for at least 10,000 years.

Response

See General Response to Comment 39, Nos. 4 and 5.

Comment 40 (Oral Comments at public hearing)

Comment 40.1 (Ed Firmage)

For the last year, the DEQ has struggled to deal with the consequences of the NRC's shockingly shortsighted and scientifically-indefensible decision to classify depleted uranium as Class A low-level waste. The proper response from Utah to this decision should have been, and still could be, to ban depleted uranium all together. In view our State's relationship with EnergySolutions, however, this seems unlikely.

The least, therefore, that our State should do is to ensure that appropriate new measures are in place to limit future damage. DU violates every essential definition of true low-level waste. It becomes more, not less, radioactive over time. And it is long lasting. EnergySolutions Clive facility is designed for waste with a short half life and relatively low levels of radioactivity. On this basis alone, storing DU at Clive must necessarily involve extra site-specific measures.

But concerns about longer lived and eventually more potent radioactive material are not the only reasons that new, much more stringent requirements should be in place. EnergySolutions touts Clive as a remote and arid facility ideal for storing dangerous material. On the time scale of true low-level waste, this claim is not inaccurate. On the time scale of DU, however, it is entirely misleading. Clive is located at the bottom of historic Lake Bonneville, which has inundated the area several times in the last 100,000 years. In geologic time, which is what we're talking about with the active life of DU, it is near certain that Lake Bonneville will return. And with its return, Clive ceases to be a remote, arid anything. The integrity of Clive will be destroyed by wave action, and radioactive material could be dispersed by currents, storms and the rise and fall of the lake to every part of the basin and potentially beyond.

It is therefore incumbent on Utah, if it will not do the sensible thing and ban DU all together, to provide a higher level of safety for DU storage here than currently applies at Clive. It should be the purpose of the RCB's new rule to ensure that this is the case.

Response

The commenter's support for the rule is noted. The request for a rule to ensure that no depleted uranium comes to Utah is beyond the scope of this rulemaking. Please *see* Part F, Response No. 2. With respect to the request to consider peak dosage, please note that the Proposed Rule requires a qualitative review of simulations for peak dosage. With respect to the request for consideration of geological processes, please *see* Part F, Response No. 1.

Comment No. 40.2 (Robert Henline)

"The Utah Division of Radiation Control protects Utah citizens and the environment from sources of radiation that constitute a significant health hazard." These words were taken from the Utah Division of Radiation Control website, in Director Finerfrock's welcome message. I think it unfortunate that I need to come before the Board to remind you of your obligation to Utah's people and her environment, but the Board's recent refusal to act in any interests but those of corporate greed does, in fact, necessitate such a reminder.

There is no doubt that depleted uranium poses a significant health and safety risk. There is not a credible scientific expert that will contest this simple fact. It is a substance that is not only toxic for billions of years, it also becomes increasingly toxic over time. This, we know. What we don't know is if the EnergySolutions Clive facility is capable of storing this waste safely. Let me repeat that. We don't know if that facility is capable of safely storing the depleted uranium.

In a letter dated 21, September 2009, EnergySolutions' president, Val Christensen, stated, "EnergySolutions has contracted with Neptune and Company, the industry-recognized experts in the field of performance assessments, to provide an updated performance assessment for depleted uranium disposal....We anticipate that the performance assessment will be provided to your staff by December 2010." What this tells us is that the facility at Clive has not been properly evaluated for the safe, long-term disposal of depleted uranium by the admission EnergySolutions. Yet, they still demand the right to import this deadly substance and to dispose of it on out land in our backyards.

It is now time for the people of Utah to make a demand of their own, a demand that this body live up to its obligations and act in the best interests of the people and the environment of Utah, not a corporation that has repeatedly demonstrated its disdain for the rules and regulations meant to protect us. What that means, ladies and gentlemen, is that as you evaluate the regulations regarding disposal of depleted uranium, you err on the side of caution, on the side of protection, on the side of doing the job as you've accepted it. And unless and until it can be proven that this toxic waste can be safely and permanently stored at this facility, your jobs and your integrity that you have taken demand that you refuse to allow this waste to come into Utah.

Response

The Executive Secretary has interpreted this comment as supportive of the rule. Note that technical concerns about the performance assessment will be addressed through the performance assessment process. *See* Part F, Response No. 1.

Comment No. 40.3 (Cindy King)

Hello. My name is Cindy King. And I'd like to make my comments very brief.

I'd like to congratulate the Division of Radiation Control for its due diligence in taking upon a risk that's bigger than they actually need to do. I'd like to encourage them to make sure that they prove without a reasonable doubt that if they're going to dispose of depleted uranium, that EnergySolutions can do so. To date, the record of that facility does not speak for safety, does not speak for protection and does not speak for public health.

Response

The commenter's support for the rule is noted. Please note that the Proposed Rule would require completion of a performance assessment that would demonstrate compliance with NRC's Performance Objectives. The standard for that demonstration is found in 10 CFR § 61.40:

> Land disposal facilities must be sited, designed, operated, closed, and controlled after closure so that reasonable assurance exists that exposures to humans are within the limits established in the performance objectives in §§ 61.41 through 61.44.

By regulation, then, the standard is demonstration of reasonable assurance, not proof beyond a reasonable doubt. The latter standard of proof is generally not used in regulatory or civil matters.

Comment No. 40.4 (George Chapman)

Specifically, with regards to the rule 313-25-8 proposed, I recommend you put in birds. All you have in the way of animals is burrowing animals, and based on past experience with EnergySolutions, they will use that to drive more DU in. It's a loophole you need to close. Again, I recommend you add specifically birds. We don't want radioactive seagulls flying around.

I also recommend that you put in something about monitoring directly the barrel viability, because those barrels aren't supposed to last more than 50 years.

I also recommend, and I understand the performance assessment coming will indicate the curies, but it is important for this rule that curies be limited and specified. And that's the only way to monitor, really, radiation.

Also, earthquakes are not listed here. And I think it's mentioned a couple of times in other rules, but I think you specifically have to mention that in the event of an earthquake there should be better monitoring.

And again, the biggest issue with regards to this rule is there is a drop dead date of March 1st. Between now and March 1st, EnergySolutions, in their mind, can do anything they want. And I strongly recommend you somehow make it clear that EnergySolutions is not allowed to bring in anything else until this rule goes into effect and they prove, through a performance assessment, that it's safe.

Response

The commenter's support for the rule is noted. With respect to the request to expand the analysis from burrowing animals to consider birds, that is beyond the scope of this rulemaking. To the extent contamination of birds could impact the ability of a facility to meet NRC Performance Objectives, and with respect to the request for consideration of geological processes, please *see* Part F, Response No. 1.

Comment No. 40.5 (John Cuomo)

As a citizen of Utah, as a Ph.D. research scientist, I'm quite concerned about the safety of Utah's citizens and future generations, and risk of contamination exposure from depleted uranium. I, therefore, fully support a course of action to devise a new rule to ensure that no depleted uranium comes to our state in advance of the completion of thorough public health studies and performance assessments.

We need to fully evaluate the health effect, the level of possible exposures and the timing of peak radiation dosing.

In addition, the ruling should take into account the possibility of geological events that could occur during the

storage period, including flooding, earthquakes or other likely events that could impact the security of these stored materials.

Response

The commenter's support for the rule is noted. With respect to the request to consider peak dosage, please note that the Proposed Rule requires a qualitative review of simulations for peak dosage. With respect to the request for consideration of geological process, please *see* Part F, Response No. 1.

Comment No. 40.6 (Claire Geddes)

I'd like to thank the Board for the time and effort they've put into looking at this issue.

I'm convinced that this isn't a safe disposal for depleted uranium. Most of the time, they're using a clay liner in there. In studying clay liners, clay liners heave in an area where you have freeze and thaw. And they're not something that's going to keep anything from coming through. So this seems to be more suitable to deep geological burial.

I also am concerned about the concentrations of the toxic metals, and hope that this'll be looked at just as much as the long life of the depleted uranium.

It just makes good sense that we shouldn't be putting anything out there that we aren't absolutely sure is suitable for that area. And as many others have said, I don't think there's any proof that this is suitable.

I'm also concerned that what we may see here is someone come in, EnergySolutions will go out and hire a firm to tell us that it's okay. They'll bring it to Dane Finerfrock, and Dane Finerfrock will say, "Yeah. It's okay." That's kind of the way we've done things in the past. I find that very unsuitable. Most people want an independent report on this anyway, not the company that's trying to get the waste in to go out and authorize it. So that's a real concern of mine, how we're going to look at this report, how this report is generated.

So I would urge the Board to look at those issues and also the issues that the others have talked about, earthquake, flood, all of the natural disasters that could happen that would impact that site.

I appreciate the work the Board's done. I think they need to be vigilant on this. And that nothing should be put in the ground until there's definite proof, and I don't know how they can ever prove that, that it would be safe.

Response

The commenter's support for the rule is noted. The concern expressed that no depleted uranium should come to Utah is beyond the scope of this rulemaking. Please *see* Part F, Response No. 2. With respect to the request to consider clay liners, toxic metals, earthquakes and floods, please *see* Part F, Response No. 1.

With respect to the request that the agency rather than the licensee conduct the performance assessment, it is the licensee's obligation to demonstrate that it meets NRC Performance Objectives. The DRC anticipates an extensive review role, with contractor support, of analyses submitted by the licensee. *See* Part F, Response No. 3.

Comment No. 40.7 (Steve Nelson)

My concerns with the rule are that the 10,000-year performance period is too short and that the requirement for only a qualitative analysis out to the time of what is currently in the rule peak doses is inadequate. And I think there are some other requirements in the rule that conflict with that.

And I'll be providing the Board with lengthy written comment.

There is some things -- just a few things I wanted to express tonight.

First of all, I was concerned with the audio that I listened to regarding some of the staff discussions from December talking about the probability of repeated flooding having to do with the stars being aligned. Long-term hazard assessment in the geological sciences is based upon the observation of past behavior of natural system. And the past behavior of this natural system is telling us that the lake has expanded to the elevation of Clive at least five times -- or has reached the elevation of Clive at least five times in the last 150,000 years.

In other waste regulatory programs, we have the concept of what is called a "disruptive event." This is a feature event or a process that could disrupt the containment integrity of a storage facility. And usually the point, the tipping point at which you have to consider in a performance assessment a disruptive event is if it has a one in 10,000 chance of occurring in 10,000 years. Our analysis shows that it has about a one in three chance of occurring in 10,000 years. Much, much higher than the threshold.

Some other things we will show, that if the 60,000 tons -- and I realize that's an upper limit based upon EnergySolutions' good faith estimates of what's been placed in the past -- but if you take the upper limit of 49,000 tons, plus 11,000 that are on their way, and dissolve them in a lake that has expanded to the elevation of Clive, you get a concentration of uranium in water that is .25 parts per million, which, by the way, is about eight times the Environmental Protection Agency limits for water.

If the market place is opened, if the more than a million tons of depleted uranium, which are anticipated to be produced in addition to the inventory that's already in existence, if a million tons are buried out there and dissolved in that lake, it will exceed the EPA limit on uranium in water by about 140 times.

And by the way, uranium oxides are fairly soluble in waters. A recent study from 2000, at the Idaho National Engineering and Environmental Lab, showed that uranium oxides are soluble at about 100 parts per million. That's -- I haven't done the math, but that's undoubtedly a few thousand times the EPA limit.

So some recommendations, which I am going to put forth for the Board:

From the discussions that the Board had in December, they were concerned about the ability to have realistic models that extend beyond 10,000 years. Well, I happen to agree with that, but that is no excuse for inadequate protection and not modeling out longer than that. If they want to take time out of the equation, the EnergySolutions' contractor can assume the full activity of depleted uranium as its daughter's ingrown into the model at time equal zero. If, as I heard from the audio, if they're going to assume flooding, they can assume that a shore line develops at EnergySolutions on piles for an extended period of time. If we're concerned about things like differential compaction as we're concerned about in the rule, they can assume that the lake returns to the Provo level, which is about 460 feet higher than the elevation of EnergySolutions. And they can model what will happen in terms of differential compaction in enhanced seepage due to a water column that's 460 feet deep.

More importantly, it is my very strong recommendation that the Board, and not the DRC staff, read and respond to all public comment. The Board wrote the draft rule, the Board should read and respond to the input.

And finally, a final recommendation would be that an independent peer review panel be formed, not a contractor to DRC, not DRC staff, but an independent, multi-disciplinary peer review panel be formed to review the performance assessment.

As a final statement, I heard EnergySolutions acknowledge that they were going to consider flooding in their model. And so my immediate reaction was, of course, if they have to consider flooding in the model, isn't that an implicit assumption that this is the wrong place for the storage of depleted uranium?

Response

These comments reflect written comments submitted by the same person (co-authored with two others). *See* Response to Comment No. 27.

<u>Comment No. 40.8</u> (Geri Roos)

It disturbs me that this company believes that the citizens of this state are so dumb that we don't understand what is going on. One thing that we do understand is that this is very nasty waste that we are talking about. Waste that becomes more dangerous with time. And no one wants it. Thus, the other states would like to ship it off to Utah

under the assumption that we are just a wasteland and good for nothing else. Many people love that wasteland and do not want to see it destroyed.

I stand with the Board to find new rules to ensure that no depleted uranium comes to our state ever, or at least until a complete and thorough performance assessment can be made. EnergySolutions and other states would have us believe it is perfectly safe. Never mind that 84 percent of the citizens of this state are opposed to our becoming a radioactive waste dump. It doesn't matter if we don't understand all the scientific information about it, what matters is we don't want it. Just like the other states don't want it.

As regulators, you should determine if it can be safe. Please remember, what may be safe today, may not be safe tomorrow. This state is prone to earthquakes, and when Mother Nature hits, man is powerless. Haiti is a prime example of that. And we don't know what the Great Salt Lake is going to do.

Utah has done it's share of storing dangerous waste. Now, let's let the other states step up to the plate.

Response

The commenter's support for the rule is noted. The request to ensure that no depleted uranium comes to Utah is beyond the scope of this rulemaking. Please *see* Part F, Response No. 2 with respect to this and with respect to the lack of public support for radioactive waste disposal. With respect to the request to consider future impacts, please note that the Proposed Rule requires a qualitative review of simulations for peak dosage. With respect to the request for consideration of geological processes, please *see* Part F, Response No. 1.

Comment No. 40.9 (Christopher Thomas)

I want to start by thanking the Radiation Control Board for looking at this rule in the first place. And I want to thank everybody who is here in the audience who came out because this issue is so important.

Our State is at a crossroads. 5,000 drums of depleted uranium await disposal at EnergySolutions nuclear waste dump site 80 miles west of where we sit tonight. Thousands more are lined up in South Carolina waiting to be loaded and shipped across the country here to Utah. Because the threat from depleted uranium is so great and so long lived, the choices we make today will literally impact Utah's health and environment forever. The stakes are great and the new standards proposed by the Utah Radiation Control Board cannot be enacted soon enough. We are racing the clock, attempting to close the door before the Department of Energy sends two more train loads full of depleted uranium to Utah. Because the Department of Energy has decided that spending stimulus money to send nuclear waste to Utah is more important than respecting Utah's democratic process and is more important than ensuring this waste is held to more rigorous health and safety standards, we are counting on you and the Board to enact these new standards quickly.

It's important to remember that it did not have to be this way. When the Federal Government first looked at low-level waste, it recognized that large amounts of concentrated depleted uranium should never be buried in landfills, like EnergySolutions, period. Under those first draft rules, the drums of depleted uranium that now threaten us would never have been eligible to come here in the first place because these drums would have exceeded the allowable limit by ten times. The more than 700,000 tons of depleted uranium stockpiled around the country would be classified as greater than Class C waste, and would have been required to be disposed far below the earth's surface.

As we now know, the Nuclear Regulatory Commission did away with the proposed limits on depleted uranium because, quite frankly, they didn't anticipate the million-ton depleted uranium problem that we now face. In fact, the NRC only assumed that 17 curies of depleted uranium, total, would be disposed at a site like EnergySolutions. The amount that we are now threatened with is thousands of times greater than that amount.

The radioactivity of depleted uranium is most like transuranic waste, and the National Research Council acknowledged this in a report released in 2003. "If treated like transuranic waste, depleted uranium would need to be disposed in a mined salt cavern in New Mexico 2,000 feet below the earth's surface." Scientists and engineers have mentioned this fact to me repeatedly. They have said our country already knows how to deal with waste like this, it needs to be put in a deep geologic disposal.

But instead, the Department of Energy has put a bullseye on the State of Utah and wants to bury a billion-year hazard in a landfill made of dirt and rocks and concrete, that scientists tell us will likely be washed away by the nearby Great Salt Lake over the next tens of thousands of years. This defies science, logic and basic common sense.

The way we deal with nuclear waste in this country and internationally comes from a very simple concept. The concept is that future generations should not have to pay for the nuclear messes we make today. They shouldn't have to pay with their health and they shouldn't have to pay with their resources. We know now that depleted uranium grows in radioactive hazard, starting in 1,000 years, peaking at a million years and then remaining at that high level of radioactivity for billions of years. Seen from a more global view, depleted uranium only meets our Class A limit on nuclear waste for far less than one percent of its hazardous life. We know now that EnergySolutions was only designed to limit radioactive releases for up to 1,000 years, a limit that is grossly insufficient to meet this hazard.

The more I learn, the more I've talked to experts in the field, even considering putting depleted uranium here in Utah is a gross misjudgment. We would rather not have this waste here at all period. But if we cannot stop it outright, then we must hold it to a much, much higher standard. And the rule you're accepting comment on tonight is a step in that direction. But it must be made even stronger.

First, the new studies required by this rule must be transparent and they must be open to public scrutiny. It is shocking to many that EnergySolutions gets to choose and pays for the new safety study that will be required. How do we ensure that this black box of a study is rigorous enough and conservative enough that it will actually be protective of Utah's public health and safety for the foreseeable future? The first thing we need to do is require that before the Executive Secretary can accept a performance assessment as complete, it must be made available for public comment, there must be a finding of fact issued and it must be open to public review and comment.

Second, this performance assessment that is undertaken must be no less rigorous than the studies that the NRC originally performed to create the whole A, B, C waste classification system. They looked at very specific issues where people would come into contact with the waste at future times. And those same scenarios must be considered at a minimum in any new performance assessment that EnergySolutions has to do.

Third, disruptive events or any events that could cause a catastrophic failure of the EnergySolutions landfills must be looked at. And I think that the disruptive events mentioned by Dr. Nelson may be a very good place to start. We have a model already for how to look at the safety of waste that lives -- that is hazardous for many, many thousands of years of high-level waste, and we should, where appropriate, adopt the same standards here for depleted uranium because of the long-lived hazard.

There also must be a very clear line distinguishing what threshold makes depleted uranium supposedly acceptable for disposal versus unacceptable for disposal. I am shocked that the Nuclear Regulatory Commission, in their recent analysis, accepted a two percent success rate as evidence that depleted uranium could be disposed of safely. I mean, to me, that's 98 percent evidence that near service disposal is absolutely inadequate. And I think in this case, we must consider something like a 95 percent bar that must be met before depleted uranium would be considered safe to come to Utah.

We must also take into account changes in climate that can happen over tens of thousands of years. I've heard experts talk about this at great lengths, and there's no way that using the last 40 years of precipitation out at the Clive site can be used to then predict the changes in climate that can happen over the next several thousand years. It just doesn't make sense.

And along those same lines, I've heard that, you know, modeling beyond 10,000 years is difficult. Well, it's difficult to know what'll happen. It's difficult to have a crystal ball and to see exactly what will happen. That should be absolutely no excuse for allowing depleted uranium waste into this State. Our rules, our law in Utah requires scientifically defensible modeling to support, you know, the conclusion that a certain site would be safe for waste. Of any kind. And I think if looking at more than 10,000 years is a high bar to set, that's a high bar that EnergySolutions should be expected to meet and meet fully. There is no reason we should have a less -- reduced standard for waste that's dangerous for a longer time.

I'm prepared to submit more detailed written comments before the close of the public comment period on February 2nd that will detail more of what I think should be in the rule to ensure that Utah's public health and safety is protected.

But in conclusion, this is what I want to say: Utah deserves very strong protections. We deserve regulators who have the expertise, resources and will to enforce those protections in the strongest possible way. And we need leadership in the Governor's Office to ensure that no one, including and even especially the Federal Government, no

one is given free reign to circumvent or preempt those protections.

Response

The commenter's support for the rule is noted. The request to ensure that no depleted uranium comes to Utah is beyond the scope of this rulemaking. Please *see* Part F, Response No. 2. With respect to the many comments regarding what should be considered in the performance assessment, please *see* Part F, Response No. 1.

The comments regarding the procedure for reviewing the performance assessment are noted, but are also beyond the scope of this rulemaking. *See* General Response, Response No. 3, however.

Comment No. 40.10 (Amy O'Connor)

I'd like to start by saying I would encourage the Committee to not allow one more ton of DU into Utah. However, for the sake of clarity and exactness, what I would like to bring to your Committee today is a paper by -- that was written in 2003 by the National Research Council. It's entitles, "Improving the Scientific basis for Managing DOE's Excess Nuclear Materials and Spent Nuclear Fuel." And it outlines many of the potential health risks that I'm very much concerned with.

And let me just read this to you, again, for the sake of clarity.

"Options for future disposition of DU, once converted to oxide, are continued storage, reuse and disposal as waste. There are significant gaps in understanding health effects of uranium and its compounds that need to be resolved before DOE can fully evaluate these options. Beneficial ways to reuse large amounts of uranium have not been identified. Because of uranium's unique chemical and physical properties, the Committee believes that this lack of reuse options reflect gaps in current knowledge rather than being a reason for disposing of the material as waste. There are significant challenges for deciding how the uranium might be disposed if it were declared to be waste."

They address disposal.

"The current plans for conversion to oxide will put the DU in a form that will be more stable than the DUF6 for further storage. If disposal is necessary, it is not likely to be simple. The alpha activity of DU is 200 to 300 nanocuries per gram. Geological disposal is required for transuranic waste with alpha activity above 100 nanocuries per gram. If uranium were a transuranic element, it would require disposal in a Waste Isolation Pilot Plant based on its radioactivity. The chemical toxicity of this very large amount of material would certainly become a problem as well. One option suggested by the U.S. Nuclear Regulatory Commission is disposal in a mined cavity, or former uranium mine. Challenges for this option would include understanding the fundamental differences between uranium ore and the bulk uranium oxide powder."

As for long-term research for reuse and disposal: "The World Health Organization has compiled a list of the research needed to better assess chemical and radiological health risks from exposure to uranium compounds. The Committee believes that this research will assist the DOE in its future decisions for reusing or disposing of its DU."

And as an aside, I just encourage the Committee to carefully look at these and make sure that they are addressed in your rule.

First, "Neurotoxicity: Other heavy metals are known neurotoxins, but only a few studies have been conducted on uranium. Studies are needed to determine if DU is a neurotoxic. Reproductive and developmental effects have been reported in single animal studies, but no studies have been conducted to determine if they can be confirmed or that they can occur in humans."

Second, "Hematological effects: Uranium distribution within bone is thought to be such that irradiation of bone marrow and blood-forming cells are limited due to the short range of alpha particles emitted during decay. Research is needed to determine if this view is correct."

Third, "Genotoxicity: Some in vitro studies suggest genotoxic effects occur via the binding of uranium compounds to DNA. Research is needed to determine if uranium is genotoxic by this or other mechanisms. There are also opportunities to extend current knowledge in the following areas:

"Understanding of the extent, reversibility and possible existence of thresholds for kidney damage in people exposed to DU. Important information could come from studies of populations exposed to naturally-elevated concentrations of uranium in drinking water.

"Better assessments of impacts of exposure of children. This is particularly important given their unique exposure scenarios such as geophagia and hand-to-mouth activities.

"Validation of transfer coefficients for uranium compounds entering the food chain, for example, from soil ingested by livestock during grazing and then to humans. Investigations are needed on the chemical and physical form, physiological behavior, leaching and subsequent environmental cycling of specific forms of uranium from various industrial and military sources. Particular attention should be paid to how the bulk of DU might eventually be deposed. Aside from the possible presence of containments in some of the DU from recycled uranium, the isotope enrichment process leaves a material that initially has a lower radioactivity than natural uranium. Not only U-235, but most of the uranium decay chain isotopes are removed. Modeling the long-term behavior of DU should include the fact that these daughter isotopes will gradually reappear over time."

So as you can see, "all of these considerations," I believe, "should have been dealt with prior to EnergySolutions accepting any quantity of depleted uranium." Please, please ensure that each and every one of these serious, possible health risks is fully investigated before Utah accepts one more ounce of depleted uranium. And while I haven't, obviously, done all these studies, my personal feeling is simply that not one more ton should come to Utah.

Response

The commenter's concerns relate to appropriate exposure limits. Exposure limits for the general public are found in 10 CFR Parts 20 and 61, which are not proposed for change in the Proposed Rule. These comments are therefore outside of the scope of this rulemaking. Exposure limits that are not established by rule will be considered in the course of the performance assessment process. Please *see* Part F, Response No. 1 and Response to Comment No. 31.2.

Comment No. 40.11 (Joe Andrade)

Thank you for the opportunity to provide some input.

I'm going to read parts of a letter that I submitted to Governor Herbert about two weeks ago, and has been received by his staff. And I will, of course, leave that with you as a written comment.

"I am an engineer, professor and teacher with over 40 years on the University of Utah faculty. During 1983 to '87, I served as Dean of the University's College of Engineering. My office was almost directly above the University's small teaching nuclear reactor. I have used radioactive isotopes as research aids for my studies on blood proteins in the early part of my career. I am familiar with radiation, radioactive isotopes, their hazards and risks and generally their safety and disposal issues. I have tested my own basement for Radon, using the State's very effective resources. By the way, this is National Radon Awareness Month, or Radon Action Month. I'd encourage you all to do the same. My basement is on the borderline of requiring some mitigation. I am well aware of safety and risk issues and the problems of relative risks.

"We are all responsible for waste, radioactive, CO2 and otherwise. We want our garbage picked up. We don't want to breathe asbestos. We want efficient industrial processes, some of which use radioactive isotopes. We want safety and risk detection equipment, like smoke detectors, many of which use radioactive isotopes. Some of us want nuclear energy, which generates waste, most of that from the mining and enrichment operations for the reactor fuel. We want the most modern and effective medical diagnosis and treatment, many of which utilize radiation and radioisotopes. And we don't want any of this stuff in our own backyard. We want to mine Utah's uranium ores, coal, silver and gold to generate employment and taxes, but we don't want to fully face the health and environmental hazards involved.

"It's all a question of balance: minimizing reasonable risks and maximizing reasonable benefits.

"I am thankful that we have reasonable, appropriate and safe waste disposal facilities, such as the landfills we all use and the Clive facility under discussion. I am thankful that we have a State DEQ and Division of Radiation Control to help monitor and regulate such facilities. And I am thankful that our wastes, my wastes are located in

such facilities, and thus, not spread throughout our communities and environments and not in my own backyard or in yours. Some such facilities even eventually become resources, such as the energy generated via the methane at the County landfill.

"As I understand it, the depleted uranium coming to and already at Clive is low-level waste in the oxide form. Thus, not particularly chemically hazardous. The radioactivity is significantly less than the uranium ores common in many parts of Utah. Of course it decays, and some of its decay products are of concern, Radon in particular. The uranium in the soils and concrete in my basement also decay. And the Radon they emit is also of concern. But not of great concern. Half of the average background radiation dose we all get in this State is due to Radon. It's emitted in your basement, in mine, in the soils, in the concrete. Radon is a decay product of uranium. And uranium is actually a fairly common element in the earth's crust. You and I each have right now about a 100 micrograms of uranium in our bodies, according to the World Health Organization. We each carry in our own bodies the elemental makeup of Planet Earth, our own, personal periodic tables.

"I am far more concerned with our highly polluted air, leading to respiratory and related problems, with the rapidly increasing CO2 in our environment, leading to climate disruption and major planetary issues, with the increasing Mercury levels in the Great Salt Lake and in our waters and fish, and with many other environmental, social and community hazards, including auto accidents, gun accidents, domestic violence, substance abuse and child abuse.

"I'd encourage you all to arrange to test your office and basement for Radon.

"I also recommend that DEQ and the State encourage EnergySolutions to fully use the Clive facility to store low-level radioactive waste, including depleted uranium.

"I encourage the landfills, to keep taking and storing our other wastes.

"And encourage DEQ to continue to do the very best they can regarding the disposal and storage of the waste of our excessively consumption-oriented society."

Response

The comments are noted. It is not clear whether the commenter is opposing the Proposed Rule. To the extent he is, please *see* the Statement of Basis and Part A, above.

Comment No. 40.12 (Helene Cuomo)

First of all, I'd like to thank the Radiation Control Board and say, whoa, we need to do more research in this and we need to put a halt and set up new standards and new rules before more of these barrels come in of depleted uranium.

And on my drive over here I was thinking about the down-winders. If we don't know somebody personally, we've heard about the down-winders. And at that time, the Government said all these nuclear tests were safe.

And then just recently we've been hearing about these open burn pits, how some of our combat soldiers are coming back and they have strange ailments, whether it's leukemia or trouble breathing. Some are even dying. And once again, the Government is slow, saying, you know, "We don't know what's going on." And I think down the road we'll find out, almost like Agent Orange, that there is stuff going on.

But the Government, who is supposed to protect us, it takes awhile for, I guess, the research to come in for them to admit, "Yeah. We can't let this hide."

And so when the NRC comes -- when they came this fall and they said, "They don't know," that really scared me. That here, we're supposed to know what to do with this depleted uranium when the Government is final saying, "We don't know." And that says to me we need to put a halt to this now, until we do know.

There is only a shallow site out at Clive. And the NRC said, "We don't know if that's safe. There hasn't been studies like that." And so, if the Government's taking that caution up front, I think we all need to listen. Because in the past, they haven't. And in the future, they might not. But if they're saying, "Wait. We don't know," everybody's ears should perk up.

And I'm very disappointed in Governor Herbert that -- I feel like he was doing it both ways. He waits and waits and waits, knowing that this stuff is coming to Utah unless he can put a halt to it or get the Radiation Control Board to get stuff moving, and then when it's already on the way, he writes this letter and there's big headlines in the paper,

"Governor asks to stop depleted uranium."

Well, we all know that was too late to do that.

And so I really thank the Radiation Control Board for having the guts and the fortitude to say, "Halt. Let's see what's going on." Because this stuff -- it's just going to get hotter. And we don't know. And until we figure it out more and if our Government officials aren't protecting us, I'm really happy that the volunteers -- or if you do get paid, it's very little, I presume -- that they do care about the safety of Utahans, about us now and about our future generations. Because we really don't know. And so we need to slow down. We need to stop. And let's listen to the NRC. We don't know. And that means more research needs to be done and more controls. And somebody needs to have the back bone to say, "Halt," before it's too late.

Response

The commenter's support for the rule is noted. Other comments are beyond the scope of this rulemaking.

<u>Comment No. 40.13</u> (Sam Ghosh)

My name is Sam Ghosh. I am an engineer and retired professor from the University of Utah.

I do not have a prepared statement, but I had a few things, like putting water or washing down radioactive isotopes. The thing is as -- because I am a civil engineer I know, that once water gets into the ground, there is no telling which way it's going to go. It can stay static. The isotope, uranium 235 can be exchanged with minerals on the ground and stay there for awhile and then flushed out as it breaks through. So putting water under the ground with anything in it is very, very dangerous. Because we would lose track of it completely.

And many of these things have very long lives, so they're going to stay there for a long time. And they will keep emitting gamma rays. It is not going to stop. Because some of the half lives are tens of thousands of years. There is one other thing that I have not heard mentioned, and that is the pressure we are now having from climate change. A lot of people think that climate change is happening because of fossil fuels and so let's go nuclear, so then we won't have the CO2 and the global warming problem. So then next some people are saying, "Well, let's cut out the fossil fuel and let's go with nuclear fuel." So there'll be more pressure to have nuclear fuel. So climate change, unfortunately, may trigger another problem.

EnergySolutions, I understand, was going to bring waste from Japan and other countries. I think one solution they may consider is send our waste to Japan.

Response

The Executive Secretary interprets this comment as supportive of the rule. With respect to the comments regarding uranium in groundwater, please *see* Part F, Response No. 1. Other comments are beyond the scope of this rulemaking.

<u>Comment No. 40.14</u> (Joe Nickols)

My name is Joe Nickols. And I did sign something over there, but here I am anyway.

First, I'd like to say that I'm a recovering physics addict for 29 years sober. And I've seen the light then. And it's alarming that I'm seeing it through these regulations again.

I have to commend you on trying to make this at all possible. You know, it is an open forum, which is good. And trying to go from the laws of physics to man-made statutes is a pretty tall order. And it does take some more insight. And that's why I'm here.

One of the difficulties I've seen and I'm hearing is that a lot of these basic assumptions kind of get swept over and they're kind of lost in the technical part of these presentations. And energy is neither created nor destroyed, just transformed. So I think if you put that under the umbrella of that's a law of physics, you begin to see some of the

anxiety that the folks have.

One interesting thing I did discover was that the statutes make differences between "dispose," "deplete," "decay" and "industry" as stable. So here you're trying to figure out how to use land waste -- land for waste, which is invisible energy at this point. And I looked it up in a 1974 college physics book called, "Physics for the Life Sciences," and it seems to me that what's lacking is some way to standardize this. And the simplest way would be the ground states of this waste. And when you're hearing someone saying a container can only last 50 years, well, how long does it take this waste to go back to ground state, which physically means it's not emitting. So that would satisfy all the different types of emissions and different types of daughter particles that get made.

So I think in your policies, there needs to be something that's standardized, rather than something that is just made up and then amended and deleted on political will.

So in conclusion, the nuclear industry still can't find private insurance. And that, to me, is a great concern because when you're dealing with risk benefit ratios and then actuaries, this is not possible at this time.

So I'm saying that you need to put a halt on this. You need to develop a statute that actually goes by the law of physics and something easy to be able to tell the difference. And then this insurability is a concern for everyone, because every other industry has to work under some type of insurability. And years ago, when this started, part of that was a, you know, $50 billion bond, or I would say gold at this point. And I don't see that anymore.

So I just hope that you guys read this book and answer the arguments here today. I think it would put a lot of insight onto at least clarifying and creating some kind of standard that's either agreed on or mitigated on or gone through the courts. So I think a lot could be avoided but creating a standard that's physically attached to some science rather than half a technical story.

Response

The comments raised are not specific to the rulemaking proposed.

Comment No. 40.15 (Bob Brister)

My name is Bob Brister. I'm a resident of Salt Lake City.

One of my favorite means of recreation is going out to the West Desert and enjoying our beautiful public lands out there. It really breaks my heart to see the West Desert treated as the Nation's toxic waste dump.

You know, the people of Utah have suffered tremendously over the decades, from the nuclear power/nuclear weapons industry, from the down-winders to the Navajo Indian miners of uranium, and I don't think the people of Utah should be made to suffer anymore from this industry.

I think it's a really sad reflection on the state of politics in Utah that a state that has suffered so much from the nuclear industry has so much of its political system bought off by the industry, apparently. EnergySolutions is a malignant corporation. I'd love to see its charter revoked.

And I urge the Radiation Control Board to be our last line of defense against nuclear waste dumping here in Utah, especially depleted uranium, which, as people have said so many times, just gets worse and worse over time.

Response

The request that no radioactive waste come to Utah is beyond the scope of this rulemaking. Please *see* Part F, Response No. 2.

ATTACHMENT 1

Proposed Depleted Uranium Performance Assessment Rule,
as Published January 1, 2010

DEPLETED URANIUM PERFORMANCE ASSESSMENT RULE
as proposed January 1, 2010

Note: Strikeout and underline show changes from current rules.

R313-12-3. Definitions. [No change proposed; included only for context.]

"Depleted uranium" means the source material uranium in which the isotope uranium-235 is less than 0.711 weight percent of the total uranium present. Depleted uranium does not include special nuclear material.

R313-25-8. Technical Analyses.

(1) The specific technical information shall also include the following analyses needed to demonstrate that the performance objectives of R313-25 will be met:
~~(1)~~ (a) Analyses demonstrating that the general population will be protected from releases of radioactivity shall consider the pathways of air, soil, ground water, surface water, plant uptake, and exhumation by burrowing animals. The analyses shall clearly identify and differentiate between the roles performed by the natural disposal site characteristics and design features in isolating and segregating the wastes. The analyses shall clearly demonstrate a reasonable assurance that the exposures to humans from the release of radioactivity will not exceed the limits set forth in R313-25-19.
~~(2)~~(b) Analyses of the protection of inadvertent intruders shall demonstrate a reasonable assurance that the waste classification and segregation requirements will be met and that adequate barriers to inadvertent intrusion will be provided.
~~(3)~~(c) Analysis of the protection of individuals during operations shall include assessments of expected exposures due to routine operations and likely accidents during handling, storage, and disposal of waste. The analysis shall provide reasonable assurance that exposures will be controlled to meet the requirements of R313-15.
~~(4)~~(d) Analyses of the long-term stability of the disposal site shall be based upon analyses of active natural processes including erosion, mass wasting, slope failure, settlement of wastes and backfill, infiltration through covers over disposal areas and adjacent soils, and surface drainage of the disposal site. The analyses shall provide reasonable assurance that there will not be a need for ongoing active maintenance of the disposal site following closure.

(2)(a) Any facility that proposes to land dispose of significant quantities of depleted uranium (more than one metric ton in total accumulation) after [effective date of rule] shall submit for the Executive Secretary's review and approval a performance assessment that demonstrates that the performance standards specified in 10 CFR Part 61 and corresponding provisions of Utah rules will be met for the total quantities of depleted uranium and other wastes, including wastes already disposed of and the quantities of depleted uranium the facility now proposes to dispose. Any such performance assessment shall be revised as needed to reflect ongoing guidance and rulemaking from NRC. For purposes of this performance assessment, the compliance period will be a minimum of 10,000 years. Additional simulations will be performed for a qualitative analysis for the period where peak dose occurs.
(b) No facility may dispose of significant quantities of depleted uranium prior to the approval by

the Executive Secretary of the performance assessment required in R. 313-25-8(2)(a).
(c) For purposes of this R. 313-25-8(2) only, depleted uranium means waste with depleted uranium concentrations greater than 5 percent by weight.

ATTACHMENT 2

Proposed Depleted Uranium Performance Assessment Rule,
as Recommended to the Radiation Control Board for April 2010 Board Meeting

DEPLETED URANIUM PERFORMANCE ASSESSMENT RULE
Proposed Rule as recommended to the Radiation Control Board
for April 2010 Board Meeting

Note: Strikeout and underline show changes from rule as proposed on January 1, 2010.

R313-25-8. Technical Analyses.

(1) The specific technical information shall also include the following analyses needed to demonstrate that the performance objectives of R313-25 will be met:
(a) Analyses demonstrating that the general population will be protected from releases of radioactivity shall consider the pathways of air, soil, ground water, surface water, plant uptake, and exhumation by burrowing animals. The analyses shall clearly identify and differentiate between the roles performed by the natural disposal site characteristics and design features in isolating and segregating the wastes. The analyses shall clearly demonstrate a reasonable assurance that the exposures to humans from the release of radioactivity will not exceed the limits set forth in R313-25-19.
(b) Analyses of the protection of inadvertent intruders shall demonstrate a reasonable assurance that the waste classification and segregation requirements will be met and that adequate barriers to inadvertent intrusion will be provided.
(c) Analysis of the protection of individuals during operations shall include assessments of expected exposures due to routine operations and likely accidents during handling, storage, and disposal of waste. The analysis shall provide reasonable assurance that exposures will be controlled to meet the requirements of R313-15.
(d) Analyses of the long-term stability of the disposal site shall be based upon analyses of active natural processes including erosion, mass wasting, slope failure, settlement of wastes and backfill, infiltration through covers over disposal areas and adjacent soils, and surface drainage of the disposal site. The analyses shall provide reasonable assurance that there will not be a need for ongoing active maintenance of the disposal site following closure.
(2)(a) Any facility that proposes to land dispose of significant quantities of concentrated depleted uranium (more than one metric ton in total accumulation) after [effective date of rule] shall submit for the Executive Secretary's review and approval a performance assessment that demonstrates that the performance standards specified in 10 CFR Part 61 and corresponding provisions of Utah rules will be met for the total quantities of concentrated depleted uranium and other wastes, including wastes already disposed of and the quantities of concentrated depleted uranium the facility now proposes to dispose. Any such performance assessment shall be revised as needed to reflect ongoing guidance and rulemaking from NRC. For purposes of this performance assessment, the compliance period ~~will~~ shall be a minimum of 10,000 years. Additional simulations ~~will~~ shall be performed for ~~a qualitative analysis for~~ the period where peak dose occurs and the results shall be analyzed qualitatively.
(b) No facility may dispose of significant quantities of concentrated depleted uranium prior to the approval by the Executive Secretary of the performance assessment required in R. 313-25-8(2)(a).
(c) For purposes of this R. 313-25-8(2) only, "concentrated depleted uranium" means waste with depleted uranium concentrations greater than 5 percent by weight.

ATTACHMENT 3

Utah Radiation Control Board
Statement of Basis for Administrative Rulemaking
Regarding Disposal of Significant Quantities of Depleted Uranium
December 1, 2009

UTAH RADIATION CONTROL BOARD
STATEMENT OF BASIS FOR ADMINISTRATIVE RULEMAKING
REGARDING DISPOSAL OF SIGNIFICANT QUANTITIES OF DEPLETED URANIUM

December 1, 2009

This Statement of Basis for Administrative Rulemaking Regarding Disposal of Significant Quantities of Depleted Uranium (Statement of Basis) has been prepared to support the proposed rule in Part VI of this Statement of Basis. If the Radiation Control Board votes to begin rulemaking on this matter, information about how and when to comment on the rule, including information about a public hearing, will be posted at http://www.radiationcontrol.utah.gov/.

I. REGULATORY AND FACTUAL BACKGROUND

Following is background information and descriptions of some of the most significant among many actions taken by the regulatory agencies discussed below regarding depleted uranium.[1]

A. What is depleted uranium and how is it similar to and different from other wastes?

> "Depleted uranium oxide contains approximately 85 percent uranium by mass. In comparison, a low-grade uranium ore common in the United States may contain 0.1 percent uranium by mass."
>
> . . .
>
> "For mill tailings, a significant portion of the total activity at the time of disposal is associated with radium, therefore disposal or management decisions can focus on the radiological inventory at the time of disposal. For example, a barrier to attenuate the emanation of radon from mill tailings can be designed based on the concentration of the material at the time of disposal. On the other hand, DU is essentially depleted in the daughter radionuclides but concentrated (compared to natural ore or mill tailings) in the parent radionuclides. Over long periods of time, the uranium parent radionuclides have the potential to produce quantities of daughter radionuclides significantly in excess of natural ores or mill tailings because the DU source has much higher concentrations of uranium. For example, mill tailings commonly have from 0.004 to 0.02 wt percent U3O8, 26 to 400 pCi/g 226Ra, and 70 to 600 pCi/g 230Th at the time of disposal (Robinson, 2004). Depleted uranium (in oxide form) would have approximately 99.9 percent uranium oxide at the time of disposal and greater than 300,000 pCi/g 226Ra and 230Th approximately 1 million years after disposal (values cited were calculated with a simple decay/in-growth calculation)."
>
> . . .
>
> "Whereas the activity in a commercial LLW facility decreases to a few percent of the initial value over a few hundred years, the activity in a facility for DU would be expected to remain relatively constant initially, but begin increasing at around 1,000 years. Peak activity, assuming no release from the source, would not be attained until after 1 million years after disposal."

U.S. Nuclear Regulatory Commission (NRC) Staff, SECY-08-0147.[2]

B. U.S. Nuclear Regulatory Commission actions

1. 1981-82: NRC developed its waste classification system and concentration limits for land disposal of radioactive waste, now found in 10 CFR Part 61*, based on modeling that informed what maximum levels of radioactivity would still allow 10 CFR Part 61 performance objectives to be met.[3] For this analysis, NRC did not evaluate environmental impacts of land disposal for significant quantities of depleted uranium. *See* Part II.B.1 of this Statement of Basis.

2. October 2000: NRC issued NUREG-1573, guidance for those conducting site-specific performance assessments for radioactive waste land disposal facilities.[4]

3. October 2005: The NRC Commission asked its staff to consider whether the signficant quantities of depleted uranium in the waste stream, which were not anticipated in 1981, warranted reclassification of depleted uranium or other amendments to NRC's regulations.[5]

4. June 2006: Louisiana Energy Services was licensed as a uranium enrichment facility. The facility will create a waste stream with substantial quantities of depleted uranium.[6] In the course of this proceeding, depleted uranium disposal at EnergySolutions was analyzed. The Commission rejected claims by an intervenor that Envirocare's performance assessment was inadequate and that NRC had previously found that depleted uranium could not be disposed of in a near-surface facility and that NRC could not therefore find that disposal at EnergySolutions was acceptable. While expressing concern that its Staff may not have fully explored the long-term impacts from the disposal of depleted uranium "whose radiological hazard gradually *increases* over time,"[7] the Commission nevertheless upheld the decision by the Atomic Safety Licensing Board. However, it noted in doing so that its decision on the adequacy of an Environmental Impact Statement was not intended to take the place of a Part 61 compliance review,[8] and that "[p]rior to a final determination on disposal, we would expect that the pertinent regulatory authority will have considered both the characteristics of the waste and the site-specific features of the disposal site to assure that all radiological dose limits and safety regulations indeed can be met."[9]

5. October 2008: NRC staff, in October 2008 (SECY-08-0147) responded to the Commission's October 2005 order.[10] The staff:
   (a) Evaluated a generic case to determine whether it was possible to meet 10 CFR Part 61 standards with near-surface disposal of depleted uranium, and concluded that it was.

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* There are Utah rules equivalent to 10 CFR Part 61 found in Utah Admin. Code R. 313. As appropriate, references to 10 CFR Part 61 should also be read as referring to the equivalent state rules. *See* endnote 1 for web access information.

(b) Prepared several regulatory options, and recommended that the Commission not change classification for depleted uranium, but add language requiring a site-specific performance assessment before significant quantities of depleted uranium are accepted for disposal.

6. October 2008: In the October 2008 SECY-08-0147 and in subsequent statements, NRC staff has also indicated that there are limitations to the generic case study described in Part I.B.5 of this Statement of Basis, and recommended that it should not be relied upon for any site-specific licensing action. *See* Part II.B.2 of this Statement of Basis.

7. March 2009: NRC agreed with the course of action recommended by the NRC staff in SECY-08-0147. The Commission made determinations:
   (a) To keep depleted uranium as Class A waste; and
   (b) To initiate rulemaking proposing enhanced performance assessment requirements for facilities proposing to dispose of significant quantities of depleted uranium.[11]

8. August 2009: NRC made a recommendation regarding any proposals to dispose of significant quantities of depleted uranium in the interim period before NRC's depleted uranium rulemaking process is completed.[12] It recommended that, prior to disposal of significant quantities of depleted uranium at a near-surface disposal facility, site-specific performance assessments should be evaluated against criteria developed in the October 2008 SECY-08-0147 staff analysis and in a Federal Register notice at 74 Fed. Reg. 30175 (June 24, 2009). See Part II.A. of this Statement of Basis.

C. Utah Division of Radiation Control actions

1. March 1991: Depleted uranium was first approved for disposal at Envirocare, but disposal was limited to volumetric bulky materials or structural debris with a concentration limit of 1.1 E5 pCi/g.[13]
2. October 1998: Envirocare's license was amended to approve an increase in the concentration limit to an average concentration per container of 3.7E5 pCi/g.
3. Approximately 1999: Envirocare submitted a performance assessment for a new proposed land disposal facility for Class A, B, and C wastes. The assessment showed that 10 CFR Part 61 performance standards would be met for very large quantities of depleted uranium based on the assumptions specified in that document. The performance assessment reported results from an analysis of 500 years.
4. October 2000: The Executive Secretary approved a license amendment for a new disposal cell for Class A waste. Disposal of depleted uranium in the new cell was not limited by concentration or quantity. Both diffuse and concentrated depleted uranium have been disposed of pursuant to this amended license; approximately 49,000 metric tons of depleted uranium have been disposed of at EnergySolutions to date.

5. September 2009: The license was changed, at EnergySolutions' request, to require that all wastes with depleted uranium concentrations greater than 5 percent (by weight) be placed a minimum of 10 feet below the top of the cover.

D. Other states' actions

1. Washington: In response to an inquiry in the course of the the NRC's Unique Waste Streams Rulemaking Worskhop held in Salt Lake City in September 2009, Washington State's representative responded as follows to this question:

> "Has the NRC or any of the agreement states that have low level waste sites been approached about reviewing the performance assessment of your particular disposal facility under this process?"
>
> "We've talked about it in good detail. I think the prudent thing we've decided is we really need to wait until this kind of works through because we could do a performance assessment that may not meet the criteria that the NRC ends up getting, and you'd end up having to do it twice. So I think from our standpoint we wait."[14]

2. Texas: In response to the same inquiry, the representative from Texas said:

> "We do not have a new performance assessment to review for the interim in Texas."[15]

Texas regulations state, regarding the licensing of radioactive waste land disposal facilities:

> "The specific technical and environmental information in the application shall also include the following analyses needed to demonstrate that the performance objectives of this subchapter, referenced in §336.723 of this title (relating to Performance Objectives), will be met:
>
> (1) Pathways analyzed in demonstrating protection of the general population from releases of radioactivity shall include air, soil, groundwater, surface water, plant uptake, and exhumation by animals. The analyses shall clearly identify and differentiate between the roles performed by the natural disposal site characteristics and design features in isolating and segregating the wastes. The analyses shall clearly demonstrate that there is reasonable assurance that the exposures to humans from the release of radioactivity will not exceed the limits specified in §336.724 of this title (relating to Protection of the General Population from Releases of Radioactivity). A minimum period of 1,000 years after closure or the period where peak dose occurs, whichever is longer, is required as the period of analysis to capture the peak dose from the more mobile long-lived radionuclides and to demonstrate the relationship of site suitability to the performance objective in this section to the performance objective in §336.724 of this title."[16]

E. Standards governing the Board's rulemaking authority

Utah Code Ann. § 19-3-104(4):

> The board may make rules:
> (a) necessary for controlling exposure to sources of radiation that constitute a significant health hazard;
> (b) to meet the requirements of federal law relating to radiation control to ensure the radiation control program under this part is qualified to maintain primacy from the federal government; (c) to establish:
> (i) board accreditation requirements and procedures for mammography facilities; and
> (ii) certification procedure and qualifications for persons who survey mammography equipment and oversee quality assurance practices at mammography facilities; and
> (d) as necessary regarding the possession, use, transfer, or delivery of source and byproduct material and the disposal of byproduct material to establish requirements for:
> (i) the licensing, operation, decontamination, and decommissioning, including financial assurances; and
> (ii) the reclamation of sites, structures, and equipment used in conjunction with the activities described in this Subsection (4).

II. SUMMARY OF PRELIMINARY BASES FOR ACTIONS

Following is a summary of information particularly pertinent to the Board's proposed rulemaking action, although all of the information provided in this Statement should be considered part of the Board's basis.

A. NRC Recommendation.

1. For this interim period before completion of NRC rulemaking, The NRC has explicitly recommended that agreement states conduct a new review of performance assessments, prior to disposal of significant quantities of depleted uranium.

> "What is NRC's position regarding disposal of significant amounts of depleted uranium before the rulemaking is complete?"
> . . .
> "If a site wishes to dispose of significant amounts of depleted uranium, it would be prudent for the site operator and State regulator to review the existing performance assessment supporting the site and determine whether the issues that were raised in the technical analyses supporting the Commission decision to initiate this potential rulemaking and in the Federal Register Notice for the NRC public workshops are adequately addressed. If not, it would be prudent to revise the performance assessment to adequately address these issues on a site-specific basis before disposal of significant quantities of depleted uranium."

NRC's Frequently Asked Questions in the Communication Plan.[17]

NRC Staff has repeated this advice in other arenas, e.g., its Unique Waste Streams Rulemaking Record.[18]

2. The NRC did not define the quantities of depleted uranium that would have to be land disposed before raising concerns, but it did define "small quantities," 1 to 10 metric tons of depleted uranium that could, it concluded, be disposed of at shallow depth.[19]

B. Past environmental analysis.

NRC has recognized that there has been no adequate analysis of the health and safety-related impacts of near-surface disposal of depleted uranium.

1. The NRC has acknowledged that at the time the initial classification system for radioactive waste was created it was not anticipated that significant quantities of depleted uranium would be disposed of in near surface facilities. It also acknowledged that environmental studies done did not address the significant quantities that are now expected.

> "At the time of development of [10 CFR] Part 61, it was envisioned that [low level radioactive waste regulated in that Part] in a disposal facility would decay, in a maximum of 500 years, to activity levels that would not pose a significant risk to an inadvertent intruder, and that there would not be significant quantities of long-lived isotopes which would pose unacceptable long-term risks to the public from releases from the facility. In developing Part 61, NRC considered longer periods of institutional control in the DEIS (NRC, 1981). Assumptions about the persistence of institutional controls in the international community were considered and a series of public meetings were conducted to get input from stakeholders. The consensus among the stakeholders was that it is not appropriate to assume institutional controls will last for more than a few hundred years. The resultant regulatory framework for commercial LLW disposal assumes material that does require institutional control for much longer than 100 years to demonstrate compliance with the performance objectives would generally be determined to not be suitable for near-surface disposal as LLW ."

NRC, SECY-08-0147.[20]

> "When NRC regulations on low-level waste disposal were developed, there were no commercial facilities generating significant quantities of depleted uranium waste. Therefore, the impacts of depleted uranium disposal were not explicitly considered."

NRC Fact Sheet on Depleted Uranium and Other Waste Disposal.[21]

> "Large quantities of uranium were not evaluated in the EIS for 10 CFR Part 61
> - 17 Ci of 238U (in 1 million m^3 of waste)
> - 3 Ci of 235U
>
> The quantity of DU [now entering the waste stream] is ~ 470,000 Ci 238U."

NRC's Unique Waste Streams Rulemaking Record, Workshop Presentations.[22]

2. NRC staff has advised against using its October 2008 analysis (SECY-08-0147), which was done to support the NRC Staff's rulemaking recommendation, for site-specific licensing purposes.

> "The model was developed to evaluate the radiological risk to potential future residents and intruders (acute or chronic exposures) near or on the land overlying a hypothetical disposal facility for DU. The model was designed to provide the user with flexibility to evaluate different waste forms, disposal configurations, performance periods, institutional control periods, pathways, and scenarios. The impact of these variables on projected radiological risk can be significant. Therefore, the model was developed as a first-order assessment tool to risk-inform decision making. Refinement of the model would be necessary if it was to be used for licensing decisions, and rigorous validation would be needed. Because site-specific waste management decisions or other variables can strongly influence whether performance objectives can be met, care should be taken not to take the model results out of the analysis context."

SECY-08-147, Enclosure 1, at page 1.[23]

3. NRC has recognized that depleted uranium is not suitable for disposal at a near-surface facility simply because it is classified as a Class A waste.

> "That the Commission has determined that DU is Class A waste merely makes that waste *eligible* for near-surface disposal. The final determination rests instead with the question of whether near-surface disposal meets the [10 CFR] Part 61, Subpart C performance objectives."

NRC's Atomic Safety and Licensing Board. [24] In addition, NRC staff concluded that it was not beneficial to change the waste classification for depleted uranium, not because it was similar to other Class A waste, but because it would not allow the same amount of disposal flexibility as the site-specific performance assessments preferred by Staff:

> "The primary disadvantage of Option 3 [reclassifying depleted uranium] is that the concentration limit developed could be so low for a reference site that it would unnecessarily constrain disposal options at sites with significantly different characteristics (e.g., humid vs. arid). As such, this approach would be prescriptive rather than a risk-informed approach, which would take into account the performance of the waste in a specific disposal environment. Another drawback to Option 3 is that it propagates the existing waste classification system, which was developed using often conservative assumptions based on the environment for LLW at the time the Part 61 FEIS was developed; some of these assumptions are not necessarily applicable in today's environment of limited disposal options and improved performance assessment capabilities."

NRC, SECY-08-0147, at page 9.[25]

C. Adequacy of current federal regulations.

1. As described elsewhere in this Statement of Basis, NRC has concluded both that its regulations should be changed, and that until its regulations are changed, additional analysis should be conducted on a site-specific basis before depleted uranium is accepted. These decisions constitute a recognition by NRC of the inadequacy of its current regulations.

2. NRC comment:

> "Why is it necessary to update the regulations?"
>
> "The licensing of new uranium enrichment facilities in the United States has raised depleted uranium to the forefront of low-level radioactive waste disposal issues. The depleted uranium waste stream is unique amongst LLRW streams; the relatively high concentrations and large quantities of depleted uranium that are generated by enrichment facilities were not considered in the Final Environmental Impact Statement (NUREG-0945) supporting the development of 10 CFR Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste." When NUREG-0945 was issued in 1982, there were no commercial facilities generating significant amounts of depleted uranium waste streams, therefore, NUREG-0945 considered only types of uranium-bearing waste streams being typically disposed of by U.S. Nuclear Regulatory Commission (NRC) licensees at that time."
>
> "With the existing U.S. Department of Energy enrichment facilities, and the recent NRC licensing of commercial enrichment facilities, more than one million metric tons of depleted uranium will require a disposition path. Existing disposal facilities such as the EnergySolutions' facility in Clive, Utah and the Waste Control Specialists' facility in Andrews County, Texas, have expressed interest to their Agreement State regulators in disposing of depleted uranium at their sites."
>
> "The NRC recognizes that the analysis supporting regulations in 10 CFR Part 61 did not address the disposal of significant quantities of depleted uranium, and that there may be a need to place additional restrictions at a specific site or deny such disposal based on unique site characteristics. Therefore, the NRC will update the regulations to specify a requirement for a site-specific analysis that demonstrates unique waste streams, including significant quantities of depleted uranium, can be disposed of safely."

NRC's Frequently Asked Questions about Land Disposal of Unique Waste Streams.[26]

3. David Esh, lead modeler for preparation of SECY-08-0147:

> "As part of that EIS developmental analyses, they developed a waste classification system, and that was developed by doing intruder and various scenario analyses and basically doing an inverse calculation.
>
> So they did the analyses. They set a dose limit that they were trying to achieve, and then they did a backwards calculation to determine what concentrations would give me those impacts. And that's what you see in the table values that are in the regulations right now.

So where we are now, if we have a waste stream that's a lot different or could be a lot different than what was analyzed. Then you have to say, well, I don't have table values for that. So what do I need to do about it?

And our opinion is we need to change the regulations and insure you could either develop new table values or you could insure that they do the analysis, but somebody has to do the analysis. You can't have an unanalyzed situation basically."[27]

D. Quantities of depleted uranium.

In the absence of action by the Board, it is very likely that significant quantities of depleted uranium will be disposed of at EnergySolutions before the performance assessment recommended by NRC (as discussed in II.A of this Statement of Basis) is reviewed and approved.

1. Texas and Washington have indicated they are not allowing disposal of significant quantities of depleted uranium until completion of new performance assessments, and those have not been initiated. *See* I.D of this Statement of Basis.

2. Only EnergySolutions and Barnwell will currently accept depleted uranium for disposal. Barnwell is only available for disposal of waste within its compact.[28]

3. The amounts of depleted uranium awaiting disposal are significant:

   "DOE has said they will need to begin disposal shipments for the DUF6 facilities in mid 2010. More than one million metric tons of depleted uranium will need to be disposed of over the next several years."[29]

4. Louisiana Energy Services (LES), a uranium enrichment facility licensed in June 2006, has identified a "private near-surface disposal facility" as its preferred method for disposal of the significant quantities of depleted uranium it will create; LES offered an analysis of impacts at EnergySolutions (then Envirocare) in support of its NRC license application.[30]

5. Department of Energy depleted uranium

   DOE's depleted uranium management policy requires disposal of depleted uranium it owns at one of its own disposal facilities or, with a waiver, allows disposal at a non-DOE facility. DOE has issued a waiver with respect to disposal of depleted uranium at EnergySolutions.[31]

6. EnergySolutions has acknowledged before this Board that it is marketing depleted uranium disposal and that it projects receiving significant quantities.

   "Tom Magete [*sic* - Magette, with EnergySolutions] responded that EnergySolutions did have contracts with DOE, but they did not have active task orders. EnergySolutions had

> the potential of disposing of waste from the Savannah River within the next year (about 10,000 tons). The next five years, he projected 46,000 tons coming from Portsmouth and Paducah."

Utah Radiation Control Board minutes, July 2009.[32]

E. Performance period

NRC makes the following recommendation regarding the time period for performance assessments:

> "Considering the technical aspects of the problem, the performance assessment staff recommends a performance period of 10,000 years for the analysis of DU disposal. However, analyses should be performed to peak impact, and if those impacts are significantly larger than the impacts realized within 10,000 years, then the longer term impacts should be included in the site environmental evaluation."

NRC, SECY-08-0147.[33]

III. IMPACTS OF RULEMAKING

The Utah Administrative Rulemaking Act, at Utah Code Ann. § 63G-3-301, requires an agency proposing rules to consider the potential impact of the rule on business and on government.

A. Impacts to business

If the rule is promulgated, one Utah business – EnergySolutions, L.L.C. – will be unable to dispose of depleted uranium until it has submitted a performance assessment and the performance assessment has been approved. The financial impacts on EnergySolutions are potentially substantial, but are difficult for the Board to specify because the impact depends on the following information not known to the Board at this time:

- When the requirement takes effect;
- When EnergySolutions will submit a performance assessment and when it is approved;
- When EnergySolutions would otherwise have received shipments of depleted uranium for disposal; and
- Whether receipts by EnergySolutions would simply be delayed, or whether there are competitors for depleted uranium disposal space such that EnergySolutions could lose reciepts altogether.[**]

[**] This rulemaking analysis does not consider the impact of any potential inability by EnergySolutions to demonstrate that it meets the requirements of 10 CFR Part 61 and the equivalent Utah rules, since that inability would not be by operation of this rule.

EnergySolutions will also bear the cost of preparing and submitting a performance assessment, but has indicated this is an action it was already taking.

No small business in Utah will be directly impacted. The only potential sources of substantial quantities of depleted uranium for disposal – the United States Department of Energy and privately-held uranium enrichment facilities – are not small businesses and are not located in Utah.

Any affected business is invited to submit information about potential costs of this proposed rule during the public comment period.

B. Impacts on government budget

The State of Utah receives fees from facilities that dispose of depleted uranium at a land disposal facility. Utah Code Ann. § 19-3-104. EnergySolutions has such a land disposal facility and has stated that it would, in the absence of this rule, seek to dispose of depleted uranium. The financial impacts of this on the state's budget are potentially substantial, particularly for FY 2010, but as described above are difficult to specify. The State of Utah receives $0.15/cubic foot of waste disposed of, plus $1 per curie.

IV. ADDITIONAL DOCUMENTATION

The documents cited in this Statement of Basis are incorporated in their entirety by this reference. In addition, all documents linked through the NRC's Unique Waste Streams Rulemaking website are incorporated by reference. *See*:

> http://www.nrc.gov/about-nrc/regulatory/rulemaking/potential-rulemaking/uw-streams.html.

V. STATEMENT REGARDING UTAH CODE ANNOT. § 19-3-104(8) and (9).

The Board intends to issue a determination, after the public comment period, about whether there are "corresponding federal regulations that are not adequate to protect public health and the environment of the state."

The statute states:

> (8) (a) Except as provided in Subsection (9), the board may not adopt rules, for the purpose of the state assuming responsibilities from the United States Nuclear Regulatory Commission with respect to regulation of sources of ionizing radiation, that are more stringent than the corresponding federal regulations which address the same circumstances.
> (b) In adopting those rules, the board may incorporate corresponding federal regulations by reference.

(9) (a) The board may adopt rules more stringent than corresponding federal regulations for the purpose described in Subsection (8) only if it makes a written finding after public comment and hearing and based on evidence in the record that corresponding federal regulations are not adequate to protect public health and the environment of the state.
(b) Those findings shall be accompanied by an opinion referring to and evaluating the public health and environmental information and studies contained in the record which form the basis for the board's conclusion.

VI. PROPOSED RULE

R313-12-3. Definitions. [No change proposed; included only for context.]

"Depleted uranium" means the source material uranium in which the isotope uranium-235 is less than 0.711 weight percent of the total uranium present. Depleted uranium does not include special nuclear material.

R313-25-8. Technical Analyses.

(1) The specific technical information shall also include the following analyses needed to demonstrate that the performance objectives of R313-25 will be met:
~~(1)~~ (a) Analyses demonstrating that the general population will be protected from releases of radioactivity shall consider the pathways of air, soil, ground water, surface water, plant uptake, and exhumation by burrowing animals. The analyses shall clearly identify and differentiate between the roles performed by the natural disposal site characteristics and design features in isolating and segregating the wastes. The analyses shall clearly demonstrate a reasonable assurance that the exposures to humans from the release of radioactivity will not exceed the limits set forth in R313-25-19.
~~(2)~~(b) Analyses of the protection of inadvertent intruders shall demonstrate a reasonable assurance that the waste classification and segregation requirements will be met and that adequate barriers to inadvertent intrusion will be provided.
~~(3)~~(c) Analysis of the protection of individuals during operations shall include assessments of expected exposures due to routine operations and likely accidents during handling, storage, and disposal of waste. The analysis shall provide reasonable assurance that exposures will be controlled to meet the requirements of R313-15.
~~(4)~~(d) Analyses of the long-term stability of the disposal site shall be based upon analyses of active natural processes including erosion, mass wasting, slope failure, settlement of wastes and backfill, infiltration through covers over disposal areas and adjacent soils, and surface drainage of the disposal site. The analyses shall provide reasonable assurance that there will not be a need for ongoing active maintenance of the disposal site following closure.

(2)(a) Any facility that proposes to land dispose of significant quantities of depleted uranium (more than one metric ton in total accumulation) after [effective date of rule] shall submit for the Executive Secretary's review and approval a performance assessment that demonstrates that the performance standards specified in 10 CFR Part 61 and corresponding provisions of Utah rules will be met for the total quantities of depleted uranium and other wastes, including wastes already

disposed of and the quantities of depleted uranium the facility now proposes to dispose. Any such performance assessment shall be revised as needed to reflect ongoing guidance and rulemaking from NRC. For purposes of this performance assessment, the compliance period will be a minimum of 10,000 years. Additional simulations will be performed for a qualitative analysis for the period where peak dose occurs.

(b) No facility may dispose of significant quantities of depleted uranium prior to the approval by the Executive Secretary of the performance assessment required in R. 313-25-8(2)(a).

(c) For purposes of this R. 313-25-8(2) only, depleted uranium means waste with depleted uranium concentrations greater than 5 percent by weight.

ENDNOTES

1. The following frequently cited documents in this Statement of Basis may be found at the indicated web locations.

Records

NRC Communication Plan Key Messages (August 19, 2009): http://www.nrc.gov/about-nrc/regulatory/rulemaking/potential-rulemaking/uw-streams/key-messages.html

NRC Fact Sheet on Depleted Uranium and Other Waste Disposal (August 26, 2009): http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/fs-du-other-waste-disposal.html

NRC's Frequently Asked Questions about Land Disposal of Unique Waste Streams (August 4, 2009): http://www.nrc.gov/about-nrc/regulatory/rulemaking/potential-rulemaking/uw-streams/faq.html

NRC Frequently Asked Questions in the Communication Plan (August 19, 2009): http://www.nrc.gov/about-nrc/regulatory/rulemaking/potential-rulemaking/uw-streams/workshop-faq.html

NRC Staff Requirements, SECY-08-0147, Response to Commission Order CLI-05-20 Regarding Depleted Uranium (October 7, 2008) (hereinafter SECY-08-0147): http://www.nrc.gov/reading-rm/doc-collections/commission/secys/2008/secy2008-0147/2008-0147scy.pdf

NRC's Unique Waste Streams Rulemaking Record, Workshop 1, Day 1 Transcripts (September 2, 2009): http://www.nrc.gov/about-nrc/regulatory/rulemaking/potential-rulemaking/uw-streams/workshop-1-transcripts-day1.pdf

NRC's Unique Waste Streams Rulemaking Record, Workshop 2, Day 1 Transcripts (September 23, 2009): http://www.nrc.gov/about-nrc/regulatory/rulemaking/potential-rulemaking/uw-streams/workshop-2-transcripts-day1.pdf

NRC's Unique Waste Streams Rulemaking Record, Workshop Presentations (September 2009): http://www.nrc.gov/about-nrc/regulatory/rulemaking/potential-rulemaking/uw-streams/du-workshop-presentations.pdf

NRC's Unique Waste Streams Rulemaking Record Website (October 20, 2009): http://www.nrc.gov/about-nrc/regulatory/rulemaking/potential-rulemaking/uw-streams.html

Rules and Statutes

NRC Rules, 10 CFR Part 61: http://www.nrc.gov/reading-rm/doc-collections/cfr/part061/

DRC Rules, Utah Admin. Code R.313: http://www.rules.utah.gov/publicat/code/r313/r313.htm

DRC Statute, Radiation Control Act, Utah Code Ann. Title 19, Chapter 3: http://le.utah.gov/~code/TITLE19/19_03.htm

2. SECY-08-0147, Enclosure 1 at pages 2-3; see also chart at page 3.

The NRC also has descriptions of depleted uranium at a number of other web locations, *e.g.*, "NRC Fact Sheet on Depleted Uranium and Other Waste Disposal," and "NRC Frequently Asked Questions in the Communication Plan."

See also NRC's Unique Waste Streams Rulemaking Record, Workshop Presentations, Slide 78 of 115 and comment by David Esh, NRC's lead modeler for SECY-08-0147:

> "So we call it depleted uranium because it's depleted in the U-235 isotope, but chemically it's really concentrated uranium because you've made pure uranium out of the process of trying to develop fuel for reactors."

NRC's Unique Waste Streams Rulemaking Record, Workshop 2, Day 1 Transcript at page 92.

3. U.S. Nuclear Regulatory Commission (NRC). 'Draft Environmental Impact Statement on 10 CFR Part 61 Licensing Requirements for Land Disposal of Radioactive Waste.' NUREG-0782 (1981); NRC, 'Final Environmental Impact Statement on 10 CFR Part 61 Licensing Requirements for Land Disposal of Radioactive Waste,' NUREG-0945 (1982).

Note also NRC's statement that "Waste class concentrations [are] based primarily on inadvertent intruder exposure." NRC's Unique Waste Streams Rulemaking Record, Workshop Presentations, Slide 33 of 115.

4. "A Performance Assessment Methodology for Low-Level Radioactive Waste Disposal Facilities: Recommendations of NRC's Performance Assessment Working Group," NUREG-1573. Note that among the many recommendations made by the authors of this document are a recommendation for a time period of 10,000 years for analyzing performance (*Id.* at 3-13), and a recommendation for "refraining from excessive speculation about the extremely distant future, and . . . limiting evaluations of the natural site's geologic evolution to the next 10,000 years," based, for example, on the assumption that geological changes such as glaciation will result in conditions under which humans will not be living close enough to the waste to be exposed. *Id.* at 3-9 and 3-10.

Web access through: http://www.nrc.gov/reading-rm/doc-collections/nuregs/pubs/.

5. In the Matter of Louisiana Energy Services (National Enrichment Facility), 62 NRC 523, CLI-05-20, October 19, 2005.

   Web access: http://www.nrc.gov/reading-rm/doc-collections/commission/orders/2005/2005-20cli.html.

6. *See* NRC website, Louisiana Energy Services (LES) Gas Centrifuge Facility.

   Web access: http://www.nrc.gov/materials/fuel-cycle-fac/lesfacility.html.

7. In the Matter of Louisiana Energy Services (National Enrichment Facility), 63 NRC 687 at 690, CLI-06-15, June 2, 2006.

   Web access: http://www.nrc.gov/reading-rm/doc-collections/commission/orders/2006/2006-15cli.pdf

8. *Id.*

9. *Id.*, at 699. *See also* In the Matter of Louisiana Energy Services (National Enrichment Facility), 63 NRC 241, ASLBP 04-826-01-ML, LPB-06-08, March 3, 2006; and In the Matter of Louisiana Energy Services (National Enrichment Facility), 63 NRC 687, CLI-06-15, June 2, 2006 and Environmental Impact Statement for the Proposed National Enrichment Facility in Lea County, New Mexico (NUREG-1790).

   Web access for EIS: http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1790/

10. *See* SECY-08-0147.

11. *See* Commission Order in Memorandum re: Staff Requirements – SECY-08-0147 – Response to Commission Order CLI-05-20 Regarding Depleted Uranium.

    Web access: http://www.nrc.gov/reading-rm/doc-collections/commission/srm/2008/2008-0147srm.pdf.

12. See NRC Communication Plan Key Messages, and NRC Frequently Asked Questions in the Communication Plan.

13. All references in this section are to Envirocare and EnergySolutions' license amendments and related submissions for the dates given; license amendments and related submissions are in Division of Radiation Control files. The information in numbers 1 through 3 is also described in an analysis by the U.S. Department of Energy. *See* Evaluation of the Acceptability of Potential Depleted Uranium Hexafluoride Conversion Products at the Envirocare Disposal Site, ORNL/TM-2000/355, December 2000.

Web access: http://www.ornl.gov/~webworks/cpr/rpt/109279 .pdf.

14. NRC's Unique Waste Streams Rulemaking Record, Workshop 2, Day 1 Transcript at page 55.

15. *Id.*

16. Texas Admin. Code, Rule § 336.709.

    Web access: http://info.sos.state.tx.us/pls/pub/readtac$ext.TacPage?sl=T&app=2&p_dir=N&p_rloc=106855&p_tloc=&p_ploc=1&pg=41&p_tac=106856&ti=30&pt=1&ch=336&rl=709&z_chk=1072573.

17. NRC's "Frequently Asked Questions in the Communication Plan." *See also* Communication Plan Key Messages.

18. NRC's Unique Waste Streams Rulemaking Record, Workshop 2, Day 1 Transcript at page 40.

19. *See, e.g.,* SECY-08-0147, at page 5.

20. *See* SECY-08-0147, Enclosure 1 at page 4.

    See also comment made by David Esh, NRC's lead modeler for SECY-08-0147:

    > "Basically the large quantities were not evaluated in EIS [the document supporting rulemaking for Part 61]. They did something like 17 Curies of Uranium-238 and three Curies of Uranium 235, and something like a million cubic meters of waste in the analyses, and if you look at the potential waste streams that may be anticipated, you could be looking at something like 470,000 Curies of Uranium-238. So you're really outside of the box from what was done, and we recognize that, and that's why we're here today."

    NRC's Unique Waste Streams Rulemaking Record, Workshop 2, Day 1 Transcript at page 90.

21. NRC Fact Sheet on Depleted Uranium and Other Waste Disposal. This has also been acknowledged by NRC in many other documents, e.g., NRC, SECY-08-0147, Enclosure 1 at page 1, and In the Matter of Louisiana Energy Services (National Enrichment Facility), 62 NRC 523, CLI-05-20, October 19, 2005, Part V.

    Web access for CLI-05-20: http://www.nrc.gov/reading-rm/doc-collections/commission/orders/2005/2005-20cli.html.

22. See Workshop Presentations, slide 40 of 115.

Note that risk is a function of quantity and concentration. *Id.* at Slide 58.

23. *See* SECY-08-147, Enclosure 1, at page 1.

See also Slide 54 of 115 of the "Workshop Presentations" made by NRC at its NRC's Unique Waste Streams Rulemaking Workshop:

> "Analysis not intended to replace site-specific evaluations."

24. In the Matter of Louisiana Energy Services (National Enrichment Facility), 63 N.R.C. 591, 70-3103-ML, (ASLBP 04-826-01-ML) (May 31, 2006).

25. See SECY-08-147, at page 9.

26. NRC's Frequently Asked Questions about Land Disposal of Unique Waste Streams.

27. NRC's Unique Waste Streams Rulemaking Record, Workshop 2, Day 1 Transcript at page 82.

28. *See* NRC's Unique Waste Streams Rulemaking Record,"Workshop Presentations," Slide 12, "Commercial LLW Disposal Sites, and accompanying commentary at Workshop 1, Day 1 at page 32 and Workshop 2, Day 1 Transcript at pages 37-38.

29. NRC's Unique Waste Streams Rulemaking Record, Workshop 1, Day 1 Transcript (cited in note 1) at p. 25 and Workshop 2, Day 1 Transcript at p. 30.

30. *See* citations in notes 7 and 9.

31. *See* "U.S. Department of Energy Manual, Approval of Exemptions for Use of Non-DOE Facilities," at I-7.

Web access: https://www.directives.doe.gov/pdfs/doe/doetext/neword/435/m4351-1c1.pdf.

Representatives of the Board have been unable to locate a copy of DOE's exemption for disposal of depleted uranium at EnergySolutions or related documentation of DOE's decision to dispose of its depleted uranium in Utah, but the need for an exemption is also referenced in two pre-decisional documents: "Evaluation of the Acceptability of Potential Depleted Uranium Hexafluoride Conversion Products at the Envirocare Disposal Site," December 2000; and "Draft Supplement Analysis for Location(s) to Dispose of Depleted Uranium Oxide Conversion Product Generated from DOE's Inventory of Depleted Uranium Hexafluoride (DOE/EIS-0359-SA1 AND DOE/EIS-0360-SA1), March 2007."

Web access (respectively): http://www.ornl.gov/~webworks/cpr/rpt/109279 .pdf

and http://gc.energy.gov/NEPA/nepa_documents/na/EIS-0359-SA1_EIS-0360-SA1.pdf.

32. Web access: http://www.radiationcontrol.utah.gov/Board/minagd/7142009.pdf.

33. SECY-08-0147, Enclosure 1 at page 21. *See also* SECY-08-0147, Enclosure 1 at pages 6-8 for a fuller discussion.

ATTACHMENT 4

NRC Performance Objectives for
Land Disposal of Radioactive Waste
10 CFR Subpart C

NRC PERFORMANCE OBJECTIVES FOR
LAND DISPOSAL OF RADIOACTIVE WASTE
10 CFR Subpart C

§ 61.40 General requirement.
Land disposal facilities must be sited, designed, operated, closed, and controlled after closure so that reasonable assurance exists that exposures to humans are within the limits established in the performance objectives in §§ 61.41 through 61.44.

§ 61.41 Protection of the general population from releases of radioactivity.
Concentrations of radioactive material which may be released to the general environment in ground water, surface water, air, soil, plants, or animals must not result in an annual dose exceeding an equivalent of 25 millirems to the whole body, 75 millirems to the thyroid, and 25 millirems to any other organ of any member of the public. Reasonable effort should be made to maintain releases of radioactivity in effluents to the general environment as low as is reasonably achievable.

§ 61.42 Protection of individuals from inadvertent intrusion.
Design, operation, and closure of the land disposal facility must ensure protection of any individual inadvertently intruding into the disposal site and occupying the site or contacting the waste at any time after active institutional controls over the disposal site are removed.

§ 61.43 Protection of individuals during operations.
Operations at the land disposal facility must be conducted in compliance with the standards for radiation protection set out in part 20 of this chapter, except for releases of radioactivity in effluents from the land disposal facility, which shall be governed by § 61.41 of this part. Every reasonable effort shall be made to maintain radiation exposures as low as is reasonably achievable.

§ 61.44 Stability of the disposal site after closure.
The disposal facility must be sited, designed, used, operated, and closed to achieve long-term stability of the disposal site and to eliminate to the extent practicable the need for ongoing active maintenance of the disposal site following closure so that only surveillance, monitoring, or minor custodial care are required.

ATTACHMENT 5

Draft Findings and Opinion Regarding Adequacy of Corresponding Federal Regulations
Under Utah Code Ann. § 19-3-104(9)

[Draft] Findings and Opinion of the Utah Radiation Control Board Regarding Adequacy of Corresponding Federal Regulations Under Utah Code Ann. § 19-3-104(9)

Finding

The Board does not consider the Proposed Rule to be more stringent than corresponding federal rules, as described in the Comment Response document, Part C. In the event that determination is not accepted, however, and in particular in the event it is determined that the agency lacks authority to require a licensee to demonstrate through an approved performance assessment that NRC Performance Objectives will be met prior to receipt and disposal of depleted uranium, the Board finds that corresponding federal regulations are not adequate to protect public health and the environment of Utah. Disposal of depleted uranium is an unanalyzed condition and, in the absence of a performance assessment, the impacts of that disposal will not be adequately analyzed to ensure that public health and safety will be protected.

Opinion

The analyses in the Utah Radiation Control Board's Statement of Basis for Administrative Rulemaking Regarding Disposal of Significant Quantities of Depleted Uranium (December 1, 2009) and in the Executive Secretary's Response to Comments Regarding Proposed Amendments to Utah Admin. Code R313-25-8 to Address Depleted Uranium (March 5, 2010) are hereby adopted by the Board and constitute the opinion required by Utah Code Ann. § 19-3-104(9)(b).

Approved by the Utah Radiation Control Board

_____ _____

Peter C. Jenkins, Chair Date

ATTACHMENT 6

Email from Assistant Attorney General, Laura Lockhart
To EnergySolutions' Attorney, Craig Galli
December 2, 2009

From: Laura Lockhart
To: Galli, Craig; Thomas, Christopher
Date: 12/2/2009 2:15 PM
Attachments: Basis for rulemaking - final proposed.pdf

Craig Galli & Christopher Thomas,

Attached FYI is the Statement of Basis that will be considered by the Board. It is going out with the Board packet today.

Laura Lockhart