LOW-LEVEL RADIOACTIVE WASTE FORUM, INC.

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Dear Andrew Persinko:

On behalf of the Low-Level Radioactive Waste Forum's (LLW Forum) Disused Sources Working Group (DSWG), please accept the attached comments on the U.S. Nuclear Regulatory Commission's (NRC) Part 61 rulemaking initiative.

The LLW Forum formed the DSWG in September 2011 at the request of and with financial support from the National Nuclear Security Administration (NNSA). The purpose of the working group is to study issues related to the management and disposition of sealed sources, using a holistic approach that considers both the front-end and back-end, and to develop a list of potential action items and recommendations to address the issues. The working group is composed of eight (8) members representing New York, Texas, Utah, Washington, Atlantic Compact, Midwest Compact, Rocky Mountain Compact, and Southeast Compact.

Due to the potential impact of the Part 61 rulemaking initiative to impact options for the disposal of sealed sources, the DSWG members formed a subgroup named the Part 61 Working Group (P61WG) to review and provide comments on the rulemaking initiative for consideration by the NRC in advance of submittal of the technical basis document to the Commission in September 2012. The P61WG is composed of six (6) members representing Texas, Utah, Washington, South Carolina, Pennsylvania and Illinois.

Given the role of the sited states in regulating low-level radioactive waste disposal facilities, P61WG members relied heavily upon input from representatives of the four sited states of South Carolina, Texas, Utah and Washington in conducting its review of all elements of the Part 61 rulemaking initiative.

On July 19, 2012, the P61WG members attended the NRC's stakeholder meeting in Rockville, Maryland. The next day, on July 20, 2012, P61WG members met in Washington, District of Columbia to review and edit the attached document for consideration by the NRC.

On behalf of the DSWG and P61WG, I want to thank the NRC staff for their assistance during our review of the rulemaking initiative and for the agency's consideration of the working groups' comments. We believe this is an important document that has potentially significant impacts on the disposal of sealed sources and other low-level radioactive wastes and we sincerely appreciate the opportunity to provide the attached feedback and comments.

If you have questions or require additional information, please feel free to contact me at (202) 265-7990 or at LLWForumInc@aol.com.

Regards,

Todd D. Lovinger, Esq.
Executive Director of the LLW Forum
Project Manager of the DSWG and P61WG

Enclosure

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Comments on the U.S. Nuclear Regulatory Commission's
Part 61 Rulemaking Initiative from the
LLW Forum's Part 61 Working Group

A. General

Pennsylvania: Where practical, NRC should avoid "one size fits all" approach in the development of new regulations or requirements for disposal of low-level radioactive waste (LLRW). For example, the design of the Pennsylvania (PA) regional facility requires an above-grade construction with multiple barriers (engineered cover, overpacks and disposal modules). Shallow land burial is prohibited and PA regulations establishes a concentration limit for disposal of Ra-226 (100 nCi/gm) for the regional facility. The facility design and other State specific requirements would not allow disposal of large quantities of certain types of waste (low activity - high volume waste and depleted uranium) at a future PA facility.

Pennsylvania: NRC should consider potential impacts of proposed changes [to Part 61] on sited states as well as the impact on the existing LLRW disposal facilities.

South Carolina: The new definition of long-lived waste seems to apply to the characterization of a disposal site and not to individual waste. Guidance should be provided, concurrently with the new definition, for how a facility should plan to meet the new requirements when receiving waste containing long-lived radionuclides (such as DU) for disposal. For example, the ASTSWMO document dated April 2011 and entitled "Incidental TENORM – A Guidance for State Solid Waste Managers" recommends that for disposal of TENORM, "no more than 1-10% of the volume of the cell should contain these subject materials."[1]

South Carolina: It is stated that the revised Part 61 would have to be effective after one year for NRC licensees and applicants and would have to be adopted by states within one year after becoming effective. It would likely take longer than one year for a licensee to conduct a site-specific analysis under the new requirements and have it reviewed and approved by regulatory authorities. Typically States are given three years to adopt new regulations that are not as complex as this proposed revision. What is the rationale for giving states one year to adopt?

[1] http://www.astswmo.org/Files/Policies_and_Publications/Federal_Facilities/2011.04_FINAL_ASTSWMO_TENORM_Paper.pdf

Texas: In developing site-specific waste acceptance criteria it is important to seek input from all stakeholders. Licensee waste acceptance plans may not provide the specificity needed by generators to ensure their waste will be accepted without additional processing or re-packaging. A site-specific waste acceptance criteria approach maintains doses As Low As is Reasonably Achievable (ALARA) and provides some certainty to generators that if their waste is packaged in a certain manner and meets all the criteria it will be transported and received ready for disposal.

Working Group: Agrees that NRC should allow, as an option, disposal facilities to establish site-specific waste acceptance criteria based on the results of the performance assessment and intruder assessment, in addition to the use and application of current waste classification tables in 10 CFR 61.55.

Working Group: Part 61.1.a. states that "Applicability of the requirements in this part to Commission licenses for waste disposal facilities in effect on the effective date of this rule will be determined on a case-by-case basis and implemented through terms and conditions of the license or by orders issued by the Commission." Since this paragraph is not proposed for revision, does the NRC intend for the new regulations to apply to new disposal facilities (i.e., facilities that become operational after the revision of Part 61) only, or is NRC expecting that sited states with existing facilities will choose to incorporate the new requirements through license conditions?

Working Group: If a sited state has adopted the language in Part 61.1.a into State regulation and has previously incorporated license conditions requiring compliance with all Part 61 equivalent regulations, new revisions to Part 61 would automatically apply to existing sites in those states. The regulation should contain language that explicitly states that requirements pertaining to performance assessments for long-lived waste do not apply to existing facilities unless future waste acceptance can be characterized as "long-lived waste" (license conditions could be used to prohibit acceptance of large quantities of DU). Otherwise, NRC should gain a complete understanding of how revisions pertaining to performance assessments will affect existing sites, to avoid unintended consequences.

Working Group: The NRC should sponsor performance assessment training classes for sited state personnel and states with proposed disposal sites. Financial support for travel to this training would be extremely helpful to host states.

Working Group: NRC should consider extending the comment period in order to allow the public and the states adequate time to provide response comments.

Working Group: Will NRC offer a grandfather provision to low level waste disposal facilities in operation on the effective date of the new rule?

B. Performance Assessment

Illinois: A graph presented by the NRC at the May 18, 2011 public meeting indicated that commercial LLRW decays to 1% of its original activity within a 500-year period while the decay curve for DU remains constant until 50,000 years before it appears to begin to increase. It doesn't make sense to burden the entire LLRW waste classification system and resulting disposal facility performance assessment requirements with a 20,000-year period of compliance when most facilities will not receive significant quantities of DU and will not experience the in-growth of daughter products from DU.

Illinois: It also appears that the 20,000-year period of compliance is intended to include the extreme climate variations; i.e., glaciation. If the intent is to preserve the disposal facility and waste forms in a post-glacial environment, then that can only be accomplished using geologic disposal since any surface facility would be ground up by ice sheets (along with the rest of civilization in its path). For non-DU LLRW, this extended period of compliance is unnecessary since the waste will have decayed to a fraction of a percent of its original concentration and no longer presents an unacceptable hazard. Only facilities that receive significant quantities of DU should have a long period of compliance.

Illinois: It is unclear as to how the proposed 20,000-year period of compliance will work in the revised sections 61.13, 61.41 and 61.42. Section 61.13 states that the analysis of long-lived waste must calculate the peak dose that would occur 20,000 years or more after site closure. It then states that no dose limit applies to the results of this analysis. What is the point of performing the analysis if there are no criteria to determine whether the results are acceptable?

Illinois: Sections 61.41 and 61.42 pertain to the protection of the general public and inadvertent intruders. Both of these sections have dose limits (25 and 500 mrem/y TEDE) and a requirement that compliance with these standards be demonstrated through a performance assessment that evaluates peak annual dose up to 20,000 years following closure of the facility. A slide presented at the May 18, 2011 public meeting indicates that there is no dose limit for these peak annual dose calculations. What period of time do the dose limits (25 and 500 mrem/y TEDE) apply to? If they don't apply to the 20,000-year period, then what standard is used to demonstrate compliance with these two sections?

Pennsylvania: There is a need to make a distinction between unique waste streams such as depleted uranium and routine commercial waste streams to account for the differences in toxicity of the two (physical and chemical form and radiological properties). The long period of performance assessment (i.e., 20,000 years) might be appropriate for large quantities of depleted uranium but not for routine LLRW streams which contain mostly short-lived radionuclides.

Pennsylvania: The uncertainties associated with the long period of performance assessment are large enough that it would be very challenging to make a credible prediction about the long-term performance of the disposal facility. This could also complicate the licensing process for future commercial LLRW disposal facilities (such as the one in PA) that would not be disposing of large quantities of depleted uranium. Therefore, NRC should consider allowing Agreement States to select a period of performance assessment consistent with State policies, site specific physical and design feature, projected waste streams, and the waste acceptance criteria for the proposed facility.

Pennsylvania: A two-tiered approach for conducting performance assessment is appropriate for disposal of large quantities of depleted uranium. The terms "performance period" and "compliance period" should be defined clearly. If NRC decides to impose a two-tiered approach, additional clarification and guidance is needed regarding the use of peak annual dose for continuous assessment of the long-term performance of the disposal facility. The initial proposal by NRC did not require a dose limit or other method to account for peak dose beyond the performance period (i.e., 20,000 years).

Pennsylvania: The performance assessment requirements should include a periodic review and updating of the performance assessment to reflect changes in the source term, conditions of the site, new methodology, etc. and to ensure compliance with the performance objectives.

Pennsylvania: Allow licensees the flexibility to apply ICRP dose methodologies "consistently" in a site-specific performance assessment.

Texas: Dose methodologies should be based on the best available science. Effects, if any, on the methodology for calculation of organ doses should be specified in the existing limits in 61.41.

Texas: The term "reasonably foreseeable" is too subjective. Suggest use of different terminology to better define future timeframes. This does not necessarily mean specifying period(s) of performance. The use of a two-tiered or multi-tiered approach may be acceptable as long as the states have flexibility in evaluating varying period(s) of performance. This may be driven by the generation origin of depleted uranium (i.e., spent fuel reprocessing or DU waste from enrichment). For compliance with Part 61 requirements, Texas currently requires a period of performance for a minimum of 1,000 years or the time at which peak dose occurs. This provides the flexibility to evaluate various timeframes and maintain compatibility even if the NRC chooses to retain the proposed 20,000-year tier.

Texas: Longer timeframes of performance must be evaluated carefully with the understanding that regulatory decisions will be made with a greater emphasis on current policy rather than strict dose limits. Timeframes approaching millions of years for evaluating disposal of DU become purely speculative in nature as the uncertainty with future conditions and uncertainty with modeling parameters increases. In this regard,

some might consider shallow land burial of DU unacceptable due to the uncertainties associated with major climatic changes, societal changes, and changes in geologic features caused by erosion. This may prompt consideration of a different type of land disposal for DU, possibly greater depth of burial. There is no geology, no climate, and no engineering design that can be expected to remain static for timeframes approaching a million years or more.

Texas: Based on comments previously submitted by the State of Utah on the initial Part 61 rulemaking, the ingrowth of DU progeny occurred at much shorter timeframes than what the NRC had originally determined in their DU disposal analysis. These shorter timeframes may be instructive in reducing speculation and uncertainty, at least to some degree. Texas has not evaluated disposal of DU yet.

Texas: The current NRC rules and guidance on evaluating long-term performance do not recommend taking credit for waste form or any engineered features beyond 300-500 years. The site-specific characteristics, geology, hydrogeology, and arid versus humid are presently considered when evaluating long-term performance of a disposal site. Due to the long timeframes for evaluating DU and the uncertainty with how waste form, disposal technologies, and cover technologies will perform over the long term, only studied, tested, and best available technology should be considered. Disposal unit characteristics and, to a large degree, waste form characteristics cannot be relied upon for longer timeframes. Furthermore, performance periods based on other factors such as geochemistry within the disposal unit must be approached with caution. Taking credit for geochemical interactions, such as pH that retards transport, between the waste and the surrounding environment without sufficient study can make dramatic differences in when the peak dose occurs or if any dose occurs at all. Obviously, the performance period is also driven by the radionuclide inventory.

Texas: Although not explicitly stated in Part 61, flexibility for establishing site-specific waste acceptance criteria has been understood by the current operational disposal sites. The performance assessment (PA) guidance document, NUREG-1573, suggests that if performance objectives cannot be met, that limits on inventory be imposed. Texas has taken this approach and will continue to refine the PA to reflect changes in inventory and additional site-specific data over the operational life of the disposal site. Texas has a unique arrangement as compared to the other sited states in that Texas will take ownership of the site and the waste upon closure and license termination. The State of Texas has a vested interest in the waste types, waste forms, and specific criteria for waste disposal to ensure that performance objectives will be met now and in the future. Additionally, the Texas Radiation Control Act statutorily requires the State of Texas to develop waste acceptance criteria.

Utah: Most recently, the NRC estimated 17 Ci of U-238 and 3 Ci of U-235 were assumed to be disposed in the generic LLRW disposal site over a 20-year life. These activity values are actually low by 1-2 orders of magnitude. See the 1981 NRC Draft

Environmental Impact Statement (DEIS), NUREG-0782, Volume 2, Tables 3.3 and 3.4,[2] where a much larger activity was previously predicted: 3,407 Ci for U-238 and 479 Ci for U-235.

Utah: We appreciate how the tiered approach is an attempt to provide flexibility in estimating assumed waste concentrations that a future inadvertent intruder may be exposed to. As proposed, the inadvertent intruder analysis (IIA) in NRC Tier 2 considers protection of the intruder from 95% of the waste volume they might be exposed to. Since the IIA will need to assume an activity concentration in the waste form (e.g., Ci/m3), Tier 2 would require the licensee and/or the regulator to know:

a. *Waste Concentration Range and Physical Distribution* – meaning both the range of concentrations in a disposal cell and their three-dimensional distribution, as actually placed. While the licensee may have this information, Utah DRC does not, nor are State inspections used to verify any distribution claim the licensee may make. In addition, the uncertainties discussed below undermine any confidence a regulator may have during review of licensee's distribution claim.

b. *Dilution by Mixing of Bulk Waste Forms As Placed* – common Class A disposal practice at the Clive site often calls for mixing of various bulk waste shipments on the same disposal lift area, as a means to exploit complimentary engineering properties of different wastes, and maximize facility ultimate disposal capacity.

c. *Dilution by Use of Backfill Materials* – many waste shipments disposed at Clive are placed with native soil, flowable sand backfill or concrete low-strength material (CLSM) to reduce void ratio, improve strength properties of the waste form, and to minimize potential for future differential settlement.

Given these uncertainties, we recommend the NRC apply a simpler approach to IIA. An acceptable method would be the use of either the average waste concentration or the maximum waste concentration, for key isotopes in a disposal cell.

Utah: The proposed rule does not call for a quantitative maximum dose limit for the public beyond 20,000 years, which may be important in light of the significant dose potential that will occur as daughter products in-grow in the waste beyond 20,000 years. A possible approach would be to establish a maximum dose limit at a point of compliance for the lengthy POP in the PA model. We fully recognize the multiple uncertainties in long-term PA predictions, and we appreciate the NRC statement that (p. 24): "*The proposed approach is based on the position that there are a large number of uncertainties of the risks imposed on future generations, especially from processes or events other than radioactive waste disposal. In addition, there is uncertainty in the*

[2] NUREG-0782, Volume 2, Table 3.3 provides 20-year projected activity (Ci/m3) for 30 considered LLRW waste streams. Table 3.4 provides the volume (m3) projected for each. After accounting for 11 waste streams predicted without U-238 or U-235 concentrations, one can multiply the two factors to arrive at a total estimated activity for each isotope.

projected risk to future populations from waste disposal, which may be based on a number of assumptions about the behavior and characteristics of future society."

Considering these uncertainties, and in light of the paleoclimate, geologic, and half-life issues that exist, we believe it to be more protective of public health and the environment if NRC determines quantitative maximum dose limits in the rule for long-term PA model predictions (>20,000 years).

Utah: With regard to the new wording proposed in 10 CFR 61.7(c)(6), the term "compliance period" is undefined. The same is true for the term "performance period", as described in the Draft Federal Register Notice (DFRN), see page 34. We suggest that a formal definition of both terms be added to 10 CFR 61.2. This might also help prevent confusion, in that the DFRN also refers to a "period of performance" in its discussion of the new IIA requirements proposed in 10 CFR 61.42 (see DFRN, p. 48). Also a NRC compatibility category should be assigned in Section VI of the DFRN (pp. 50-53).

Washington: NRC staff proposed a two-tiered approach for evaluating compliance with 10 CFR Part 61's site compliance to 20,000 years, and long-term assessment that extends beyond 20,000 years to the time of peak dose. Washington does not support this regulatory period of compliance. With uranium mills using 1000 years (or at least 200 years) for an evaluation period, to impose a substantially higher number for LLRW disposal sites appears arbitrary. In comparison, with a shorter timeframe, uranium in-growth and decay to Ra-226 is apparently less hazardous than radioactive waste decay. During the development of Washington's LLRW PA circa 2000, several discussions with the NRC took place on how far out to go. Little if any guidance was available. The NRC thought 10,000 years was conservative. Washington used this value for compliance, and a much longer period for peak dose. Washington supports flexibility in the two-tiered regulatory scheme to allow longer-lived waste streams such as DU.

Washington: Washington does support a tiered approach for the period of performance; a regulatory period using a reasonably foreseeable future date (e.g., 1000 – 10,000 years) for compliance with the dose standard, and a longer period extending to peak dose for informational (non-regulatory) use only. Under the policy of risk-informed performance based, a non-standard regulatory compliance period should be encouraged. Once controlling radionuclides are identified, site-specific modeling will yield the appropriate performance period.

Washington: Washington supports a site-specific analysis for not only large quantities of DU, but to cover the entire inventory disposed at a facility. By having the complete inventory site analysis, the site operator and regulator are better informed about potential public doses. And new, previously unanalyzed, waste streams (e.g., DU) can be evaluated much faster and cheaper. If the analysis is periodically updated, a safety margin (e.g., sum of fractions for controlling radionuclides) can be determined and risk-informed decisions made.

Washington: Performance assessments can be done in many different forms (e.g., deterministic, probabilistic). NRC's methodology may be different than an Agreement State's. Understanding NRC's technical requirements for modeling would be beneficial as long as the requirements are guidance and not rule.

Washington: Washington fully supports the use of the most current ICRP dose methodologies during the development of the PA. Once the PA is incorporated into the "final" product (whatever that may be, or be it a stand-alone document), states do not need to update the document unless they revise the "final" product.

South Carolina: Given the Commission's expanded direction in January 2012 regarding the 20,000 years, will the proposed definition of long-lived waste be revised?

Working Group: Given the new proposed definition of long-lived waste and the staff's 2008 analysis showing that shallow-land disposal of large quantities of DU at humid sites may not meet the performance objectives in Subpart C, it seems reasonable that some disposal facilities may choose to prohibit or limit the acceptance of waste that would cause the disposal facility to be characterized as disposing of "long-lived waste". Determinations for waste acceptance are typically considered for each container of waste proposed for disposal. The current definition may be misinterpreted and used to characterize individual containers of waste sent for disposal. The definition of long-lived waste should be revised to clarify that the definition applies to the overall characterization of a disposal site and is a factor in determining the performance assessment approach to be used for a particular site. Instead of defining the term "long-lived waste", consider defining the concept of a facility that is subject to a more robust performance assessment based on the types of waste disposed.

Working Group: Supports the flexibility to use ICRP dose methodologies.

C. Performance Objectives

Pennsylvania: PA supports the use of TEDE in Section 61.41, and the annual dose limit of 25 millirems.

Texas: If the NRC chooses to base the period of performance on waste packaging, waste form, disposal technologies, etc., then demonstrating meeting performance objectives may be burdensome or almost impossible for site development because this will add additional uncertainty in the analysis. Limited credit for engineered features may be appropriate on a case-by-case basis.

Washington: New Part 61 needs to define "performance period" and/or "compliance period."

D. Institutional Control Period

Pennsylvania: PA regulations in Chapter 236 (section 236.416) require an "active" institutional control period and a "passive" institutional control period. During the active institutional control period (minimum of 100 years), the program will include active methods for access control, surveillance, monitoring, custodial care and administration of funds to cover the costs for these activities. During the passive institutional control period (at least as long as the hazardous life of the waste), the program will include passive access control, monitoring and administration of funds to cover the costs for these activities. The hazardous life is defined as, "the time required for radioactive materials to decay to safe levels of radioactivity, as defined by the time period for the concentration of radioactive materials within a given container or package to decay to a maximum permissible concentrations as defined by federal law or by standards to be set by the host state, whichever is more restrictive." The hazardous life of the PA disposal facility is projected to be about 500 years, which is consistent with the design goal of the PA disposal facility to provide containment for Class C waste for a minimum of 500 years.

South Carolina: Currently, Part 61.59 states the period of institutional controls will be determined by the Commission but institutional controls may not be relied upon for more than 100 years following transfer of control of the disposal site to the owner. Part 61.7.b.4 states "Institutional control of access to the site is required for up to 100 years." The wording suggests that 100 years is a maximum amount of time. Increasing the time (to 300 years for example) seems to be less conservative given the current wording. Before considering revising to a greater number, NRC should review the basis for limiting this period to 100 years in the original rule and determine whether it is still valid.

South Carolina: Part 61.29 states that "A shorter or longer time period for post-closure observation and maintenance may be established and approved as part of the site closure plan, based on site-specific conditions." Therefore, the timeframe for institutional control period could be done similarly.

South Carolina: The uncertainty associated with estimating future costs, site conditions, and normal O&M activities is a challenge when evaluating the sufficiency of funds set aside by the licensee for long-term care. Increasing the amount of time allowed for depending on institutional controls would make the evaluation more challenging by increasing the amount required in the fund at closure and increasing the uncertainty of the amount required.

E. Compatibility Category

Pennsylvania: NRC and the Agreement States (specifically the sited states) should collaborate to determine an appropriate compatibility category for various elements of the revised Part 61. This would alleviate and/or minimize the potential for unintended consequences.

Texas: It's not clear by this directive what "ensure alignment between the States and Federal government on safety fundamentals" means. The State of Texas is currently in alignment with the federal government as is demonstrated through Agreement State status and IMPEP reviews. Part 61 already allows for site-specific performance assessments. If a new compatibility category is being considered for site-specific waste acceptance criteria, the NRC should allow flexibility through either the "D" or "H&S" compatibility category.

Washington: Washington recommends Compatibility Category C for site specific aspects. Part 61 has four standards currently listed. These fundamental requirements ensure worker safety, public safety, protection from inadvertent intrusion, and site stability after closure. Higher compatibility category assignment is not required as a site-specific PA and site-specific WAC do not constitute program definitions nor present trans-boundary issues.

Working Group: The sited states request that a representative be added to NRC's Standing Committee on Compatibility for the Part 61 revisions.

F. Waste Classification

Illinois: The waste classification tables in Part 61.55 were developed during the original promulgation of Part 61 and are appropriate for the majority of commercial low-level radioactive waste generated in the nation. While there is the "new" commercial waste stream of depleted uranium resulting from the enrichment process, this waste stream will not be disposed at all LLRW disposal facilities. The closed sites of West Valley, NY; Maxey Flats, KY; Sheffield, IL; and Beatty, NV did not receive these wastes. The currently operating LLRW disposal facilities at Barnwell, SC and Richland, WA are not accepting these waste streams. This waste stream is only proposed for disposal at the Clive, UT LLRW disposal facility owned and operated by EnergySolutions and is under consideration by the state of Texas.

Texas: The waste classification tables, even if modified with this rulemaking, should be retained. Allowing waste acceptance based solely on a PA is problematic. Too much uncertainty and subjectivity in a PA could allow disposal of wastes that fall outside the definition of low-level radioactive waste.

Utah: The NRC has no LLRW waste concentration limits for Ra-226 in 10 CFR 61.55. However, Utah does have a Class C limit for Ra-226,100 nCi/gm (100,000 pCi/gm).[3] Class A concentrations are reached when a waste has less than 10% of this value, or 10 nCi/gm (10,000 pCi/gm) [ibid.]. Utah is not the only Agreement State with such limits; all four of the host States for LLRW disposal have these same Ra-226 waste concentration limits (see below).

[3] See Utah Radiation Control Rules at UAC R313-15-1009, Table I. Rule available online at: http://www.rules.utah.gov/publicat/code/r313/r313-015.htm#T47

Comparison of Agreement State LLRW Concentration Limits for Ra-226; Including State Limits for Class A, Class C, and Greater than Class C Waste:

	Class A	Class C	GTCC
• South Carolina	< 10 nCi/gm	< 100 nCi/gm[4]	> 100 nCi/gm
• Texas	< 10 nCi/gm	< 100 nCi/gm[5]	> 100 nCi/gm
• Utah	< 10 nCi/gm	< 100 nCi/gm	> 100 nCi/gm
• Washington	< 10 nCi/gm	< 100 nCi/gm[6]	> 100 nCi/gm

We recognize the NRC staff's May 3, 2011 DFRN calculation of Ra-226 in-growth for a LLRW waste form containing a large quantity of DU, as found in the attending NRC regulatory basis document (ML111030586), Figure 2. DRC review of this graph indicates the Utah Ra-226 Class A waste limit would be reached after about 20,000 years of in-growth (see NRC ML111030586, Figure 2), whereafter the DU waste would become Class C material under Utah rule. The same NRC graph also indicates that the DU waste would become a Greater than Class C (GTCC) waste at about 400,000 years post-disposal, per the NRC Ra-226 in-growth graph. It appears that the NRC Figure 2 Ra-226 in-growth calculations may have failed to consider the sensitivity of several factors, including: 1) initial U-234 concentration in the waste form, and 2) DU chemical form (zero valent [ZV] metal, U3O8, or UO3). These factors came to DRC attention when staff was asked to examine Ra-226 in-growth for 5,300 drums of DU waste shipped to Clive in early 2010 from the DOE Savannah River site (SRS).[7]

Utah: *Time to Become Class C Waste*

The URS calculations[8] indicate that time needed for DU waste (post-disposal) to exceed the Utah's Ra-226 Class A concentration limit (Ra-226 ≥ 10 nCi/gm or 10,000 pCi/gm), and thus become Class C waste,[9] would range from 5,400 years[10] to 61,200 years.[11] The lower end of this time range is where DU waste (irrespective of chemical form) starts with U-234 concentrations in natural or secular equilibrium with U-238. In this scenario, the Ra-226 in the DU material would in-grow to become a Class C waste sometime

[4] See South Carolina LLRW disposal regulations at RHA 3.56.1.3 and Table I. Rule available online at: http://www.scdhec.gov/health/radhlth/61-63-PART-III-D-E.pdf

[5] See Texas Administrative Code at T30S336.362(a)(3) and Table I. Rule available online at: http://info.sos.state.tx.us/pls/pub/readtac$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=30&pt=1&ch=336&rl=362.

[6] See Washington Administrative Code at WAC 246-249-040, Table I. Rule available online at: http://apps.leg.wa.gov/WAC/default.aspx?cite=246-249-040.

[7] See Westinghouse Savannah River Company, November 4, 2002, "Depleted Uranium Oxide Sampling Results", interoffice memorandum from K.S. Parkinson to S.A. Williams and D.L. McWharter, NMM-ETS-2002-00184, Revision 0, 5pp. 2 attachments.

[8] See URS Corporation Inc., November 18, 2010, "Ingrowth of Ra-226 from Depleted Uranium", technical memorandum by Messrs. Robert Baird and Gary Merrell (URS) to Loren Morton (Utah DRC), 3 pp., and attached calculations / spreadsheets (24 pp.).

[9] For Utah Class C waste threshold, see DRC rule at UAC R313-15-1009(1)(c)(ii).

[10] Where initial DU in waste is in zero valent metal form and initial U-234 at secular equilibrium, see 11/18/10 URS Memorandum, Table 1.

[11] Where initial DU in waste is in UO_3 form, and no U-234 is present, see 11/18/10 URS Memorandum, Table 1.

between 5,400 and 6,200 years. This time interval is significantly shorter than predicted by the NRC in its May 3, 2011 DFRN.

For DU from typical spent fuel reprocessing, this Ra-226 in-growth time would be between about 20,700 and 24,200 years.[12] For the DOE SRS DU waste, now held in a temporary storage building at Clive, the Class C threshold would be exceeded somewhere between 25,500 and 29,800 years post-disposal,[13] assuming DU waste remains in a closed system and is not leached from the disposal cell. In contrast, the NRC proposed 20,000-year POP would allow DU from spent fuel reprocessing to continue to be designated as Class A waste.

Utah: GTCC Implications for DU – as seen in the table above, all four Agreement States have a Ra-226 waste concentration standard for LLRW, where a waste becomes GTCC at concentrations above 100 nCi/gm (100,000 pCi/gm). Again, there is no NRC corollary for this State requirement.

Time to Become GTCC Waste

URS calculations also indicate that the Ra-226 in-growth time needed for DU waste to exceed the Utah's Ra-226 Class C concentration limit, and thus become "… generally unacceptable for land disposal," or Greater than Class C (GTCC) waste, ranges from 40,800 years and 269,000 years post-disposal.[14] Again, the most rapid transformation is found in DU waste where the initial U-234 concentration is in secular equilibrium with U-238, and could occur between 40,800 and 50,400 years post-disposal (irrespective of chemical form).[15] Again, this estimate is about ten times earlier than calculated by the NRC in their May 2011 DFRN documents.

For DU from typical spent fuel reprocessing, the material could become GTCC at about 171,000 to 223,000 years post-disposal.[16] As for the DOE SRS DU waste currently stored at Clive, the GTCC threshold would be exceeded at sometime between 187,000 and 223,000 years post-disposal.[17] Both of these estimates are about half of the time predicted in the May 2011 NRC DFRN documents.

Washington: Washington supports the flexibility this action allows a site operator and state regulator. The flexibility exercised by a state must be limited to areas supported by the site's PA. In areas not supported by a site's PA, Part 61's WAC should be used. The new table values still need to protect the inadvertent intruder. Isotopic table values need to be based upon site-specific waste form and packaging allowed, site characteristics, disposal practices, technologies employed, site appropriate scenarios and the probability of intrusion (currently assumed to = 1). Many of these factors are well established at the

[12] Where initial U-234 activity is about 17% of initial U-238 activity, and DU in zero valent metal form, see 11/18/10 URS Memorandum, Table 1. The larger value (24,200 yrs) is where DU is in UO_3 form instead.
[13] See 11/18/10 URS Memorandum, Table 1.
[14] See 11/18/10 URS Memorandum, Table 2.
[15] Ibid.
[16] Ibid.
[17] Ibid.

operating sites. Scenarios using probability of intrusion less than one should be permitted when obvious factors (e.g., USDOE burial grounds in close proximity) are present that would preclude abandonment.

G. Inadvertent Intruder

Pennsylvania: 10 CFR Part 61, section 61.42(a) should be amended to include a dose limit for inadvertent intruders. For example, PA regulations in Chapter 236 (section 236.320) states that, "the disposal facility design shall, to the extent practicable, limit radiation exposures to the inadvertent intruder to annual whole body dose equivalent of 25 millirem." This dose limit is consistent with the annual whole body dose limit of 25 millirems in section 236.13 (Part 61.42 equivalent), "Protection of the General Population and Environment from Release of Radioactivity."

Utah: To a degree we agree with the statement where the NRC explains "… *the safety of the inadvertent intruder is ensured by the waste classification system and the disposal requirements imposed for each class of waste.*" We also recognize that the existing requirements at 10 CFR 61.7(b)(4) and (5) only require an inadvertent intruder protection (and therefore analysis) for Class C waste. We see how NRC is proposing a new section in 10 CFR 61.7(c)(6) to provide an overriding requirement for an inadvertent intruder analysis (IIA), irrespective of the waste class;[18] this over-riding mandate should apply to all classes of LLRW, in order to provide uniformity of LLRW regulation nationally. As a result, we recommend the following change in the proposed wording at new section 10 CFR 61.7(c)(6) [changes in redline text]:

> "(6) Regardless of the waste classification, and requirements found at 10 CFR61.7(c)(4) and (5), all waste will require an inadvertent intruder assessment, and some waste may require enhanced controls or limitations at a particular land disposal facility to provide reasonable assurance that the waste will not present an unacceptable hazard over the compliance period…."

Utah: We appreciate the point of view that use of cultural information in determining a time period for the IIA be limited to a few hundred years.[19] We also note the much longer 20,000-year period proposed as a new IIA requirement in draft 10 CFR 61.42. However, possible consideration may be appropriate for a longer time period for IIA, given:

a. Long half life of DU.

b. Significant in-growth of radium-226 that NRC did not recognize in its May 3, 2011 DFRN and attending regulatory basis document (ML111030586).

Utah: In addition to the changes suggested by the NRC, we suggest the following improvement (NRC proposed changes in yellow highlight, State changes in red text):

[18] See NRC draft rule language found in October 3, 2011 email, Enclosure 1, p. 67.
[19] See NRC DFRN from October 3, 2011 email, Enclosure 1, p. 23.

"(b) Analyses of the protection of individuals from inadvertent intrusion must demonstrate that there is reasonable assurance that the waste classification and segregation requirements will be met, that adequate barriers to inadvertent intrusion will be provided for Class C wastes pursuant to § 61.7(b)(5), and that the exposure to any inadvertent intruder will not exceed the limits set forth in § 61.42 as demonstrated in an intruder assessment."

Working Group: The "reasonably foreseeable" exposure scenarios should be specified for the intruder assessment in guidance.