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January 7, 2013

Secretary
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
ATTN: Rulemaking and Adjudications Staff

Docket No. NRC-2011-0012

In addition to those comments submitted to the NRC on behalf of the Low-Level Radioactive Waste Forum, we appreciate the opportunity to provide the attached comments regarding the U.S. Nuclear Regulatory Commission's November 2012 Preliminary Rule Language for Proposed Revisions to Low-Level Waste Disposal Requirements, 10 CFR Part 61.

We compliment the NRC for engaging stakeholders throughout the development of the preliminary proposed rule changes and for opening up this opportunity to submit comments. Please feel free to contact me at 801-536-4257 (rlundberg@utah.gov), or Loren Morton of our staff at 801-536-4262 (lmorton@utah.gov) regarding any questions or if you need additional information.

Sincerely,

Rusty Lundberg

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Utah Division of Radiation Control (DRC) Comments on

December 7, 2012 NRC Preliminary Rule Changes to
10 CFR 20, Appendix G and 10 CFR 61
(NRC Ascension Number ML1231A444)
NRC Docket No. NRC-2011-0012

January 7, 2013

Utah DRC comments provided here are in response to a December 7, 2012 *Federal Register* Notice. After review of the preliminary rule changes to 10 CFR 20, Appendix G and 10 CFR 61, we have the following comments for the NRC's consideration.

10 CFR 20, Appendix G

1. Sections III.A.1 and III.A.3 – we acknowledge NRC's addition of reference to the new Waste Acceptance Criteria (WAC) proposed in 10 CFR 61.58 to these 2 sections. However, close review shows existing references in Appendix G to 10 CFR 61.55 (waste classification), and 61.56 (waste form characteristics / stability) have been removed. Since 10 CFR 20 is a main-stay requirement for waste generators, the existing references to §§ 61.55 and 61.56 may confuse generators and their regulators Alternatively, the proposed omission may send a message to generators that waste classification, waste form characteristics, and stability are no longer important.

2. Section III.A.2 – the same problem exists here, in that the proposed rule has removed reference to 10 CFR 61.55 (waste classification). This existing reference to classification must remain in the rule.

3. Section III.C.4 – waste classification is still an important information requirement for generators to disclose on the label for each waste package. Please re-instate this requirement, i.e., labels must bear the determination of waste classification as per 10 CFR 61.55.

4. Section III.C.5 – this section addresses quality assurance programs required of waste generator. However, our comments above (Sections III.A. 1 and 3) are similar to this Section; in that NRC has removed reference waste classification (10 CFR 61.55) and waste form characteristics and stability requirements (10 CFR 61.56). Please reinstate these references in Section III.B.5.

Eliminating the various references in the above paragraphs in 10 CFR Part 20, Appendix G, regarding the need for waste to be classified as well as characterized and solely relying on the site-specific waste acceptance criteria does not appear to be consistent with the explanation in the accompanying regulatory basis (analysis) document stating that the application or use of waste acceptance criteria is optional by an Agreement State. In the absence of retaining the existing text, an Agreement State will need to incorporate, by rulemaking, waste classification (and

characterization) as additional waste acceptance criteria, beyond the criteria being proposed by NRC in the revised §61.58. The NRC should add the proposed new text as an option without deleting the existing text related to waste classification and characterization.

10 CFR 61

1. 10 CFR 61.2, New Definitions – after review of the proposed NRC changes we offer the following comments, as listed below:

   A. *Compliance Period* – this new definition makes reference to 3 other revised sections in the proposed rule, i.e., §§ 61.41, 61.42, and 61.44. By making reference to the last two sections, it appears there may be unintended consequences:

      1) Reference to § 61.42 – by listing this reference, it appears NRC is now requiring the Inadvertent Intruder analysis (IIA) be conducted for a 10,000 year period. No explanation for this new requirement was found in the November 29, 2012 NRC Regulatory Analysis (RA) [1]. In the next NRC revision of the RA, additional explanatory text may be necessary.

      2) Reference to § 61.44 – similar to the paragraph above, does the citation to § 61.44 in the Compliance Period definition mean embankment stability will need to be demonstrated for 10,000 years?

   B. Need New Definition for Intermediate Depth Land Disposal – the November 29, 2012 RA describes how other nations require deeper disposal for long-lived radionuclides, e.g., below 100 feet (30 m). Further, the existing rule at § 61.7(a), explains how the NRC's intent is for the rule to apply to any land disposal of LLRW; followed by an explanation that " … *Part 61 … contains specific technical requirements for near-surface disposal of radioactive waste, a subset of land disposal, which involves disposal in the uppermost portion of the earth, approximately 30 meters.*" This wording suggests that the technical information currently required at §§ 61.12 and 61.13 are directed at shallow land disposal, and that requirements for deeper land disposal have yet to be promulgated.

   We appreciate the new proposed definition for Long-Lived Waste in § 61.2. We also fully agree with several NRC statements in the November 29, 2012 RA, including:

   Page 42: "*While the overall activity of LLW is dominated by short-lived radionuclides, the risk from waste disposal, as estimated under 10 CFR 61.41, is dominated by the long-lived radionuclides.*" ;

   Page 32: "*The performance assessment should be expected to provide results that can be used by licensees, applicants, and regulators to evaluate and communicate the performance of the disposal site with respect to the long-lived inventory. The 10 CFR Part 61 rulemaking should address the disposal of long-lived waste.*" ; and

[1] See NRC November 29, 2012 Regulatory Analysis (RA) document, that DRC received via a 12/3/12 email from Andrew Carrera, NRC staff.

Page 34: "*For short-lived waste and low concentrations of long-lived waste, the waste, disposal facility, and disposal site only need to remain stable on the order of hundreds of years as per the waste classification and stability requirements found in 10 CFR 61.55 (the stability requirements differ for different classes of waste). However, for concentrated long-lived waste, instability within the waste management system could result in releases of radioactivity to the environment that endanger public health and safety. Without requirements for concentration limits, long-term analyses, disposal depth, or other requirements there would be limited assurance that long-term risks are within the range of risks that are currently acceptable today*."

In light of all these NRC statements, a formal definition for Intermediate Depth Land Disposal should be considered to be added to § 61.2. This change will support other NRC rule changes needed for both long-lived nuclides and those whose progeny pose a greater risk in the future, i.e., DU.

C. Long-Lived Waste Definition

1) First Definition: 10% of Parent Remaining After 10,000 years - it would be much easier and simpler for the NRC rule to express the first definition as: "(1) wastes with parent isotopes having a half-life of greater than 3,000 years, " This statement is supported by DRC calculations based on the universal law of radioactive decay [2], which mandates that approximately 3.3 half-lives must elapse before a 10-fold decrease occurs in the parent nuclide activity. For convenience of the reader, the DRC calculations are found below in Attachment 1.

2) Second Definition: Long-Lived Parent, Short-Lived Progeny – it is clear to most readers that this definition at least includes the Uranium decay series (i.e., U-238 and progeny). For additional clarity, NRC should identify all other radioactive decay series it has in mind. If this is not done in the proposed rule, then certainly it should be in the upcoming NRC RA. To ensure that Ra-226 is captured under the "short lived progeny", in the second definition, "short-lived" should be defined as those daughter nuclides with a half-life ≤ 1,500 years. Alternatively, NRC may alter the 1st definition, above, to be > 1,500 years.

3) Third Definition: Short-Lived Parent, Long-Lived Progeny – it is unclear how many decay series would fall under this 3rd definition. At a minimum NRC should disclose these respective decay series, known to exist in LLRW, in the RA, or in future guidance.

D. Performance Period Definition: Circular Logic – the proposed definition uses internal citations to §§ 61.41(b) and 61.42(b), both of which have a circular logic problem, see discussion below.

2. Unexplained Redactions – the proposed NRC rule includes redactions (or perhaps relocations) of existing language at several citations, without any explanation. Some of these redactions include, but are not limited to, the following:

[2] See Weidner and Sells, p. 330, equation 10-19. Also see Radiologic Health Handbook, p. 28.

A. Buffer Zone Mitigation Requirement: § 61.7(a)(2) – some wording has been removed that requires buffer zones around a disposal unit to be large enough to "... *take mitigative measures if needed*." This redaction could allow disposal facility operators to expand the landfill footprint to close proximity to their physical property boundary. Consequently, this deletion seems to lessen the current protections provided the public in the existing § 61.7 requirements for buffer zones.

B. Performance Objectives, § 61.7(b), First Sentence – Two key words have been removed: "near surface". This redaction suggests the proposed changes in § 61 are to apply to Intermediate Depth (ID) disposal as well as near surface. However, no specific definition or requirements are included in the proposed rule changes for ID disposal.

C. Existing § 61.7(b)(2), (4), and (5) – these 3 sections appear to have been largely redacted in the proposed rule changes. Since much of this section is focused on waste stability, and separation of unstable Class A wastes [(b)(2)], institutional control concepts, as they relate to physical durability of waste containers [(b)(4)], and definition of the minimum elapsed time requirement by which engineered barriers are required to protect inadvertent intruders [(b)(5)], NRC should fully identify what has been eliminated in these sections.

D. Existing § 61.13(a) – the last part of this existing section appears to have been redacted. Key wording found there mandated that PA analysis clearly distinguish or attribute the roles performed by the engineered features of the disposal embankment, and contaminant controls provided by natural phenomenon at the site. No explanation has been provided for this removal. NRC should explain and justify this change. Continuation of this description would appear to reinforce the important effects of waste containers, embankment liners / cover systems, waste chemical form, etc, in compliance with the inadvertent intruder analysis requirement.

It may be possible that some of these apparent redactions have not been lost, but instead transferred (in part) to other locations in the proposed rules. If true, this confusion could have been avoided, if NRC had: 1) published the revised rule in redline and strikeout format, and 2) taken the time to describe these changes in its RA. Such courtesy would be greatly appreciated

3. New Performance Objectives on Performance Assessment, Proposed § 61.7(c)(2) – the last sentence of this added section should read as follows (see red text):

   "*A performance assessment examines the effects of these processes and interaction on the ability of the disposal facility, and its surrounding environment, to limit waste releases and estimates the annual dose to a member of the public for comparison with the appropriate performance objective of Subpart C of this part.*"

4. Proposed § 61.7(c)(4) – concerns have been raised above regarding proposed definition for compliance period, and the apparent inference that Inadvertent Intruder analysis be conducted for a 10,000 year period. To help address this concern, the first sentence in proposed § 61.7(c)(4) should be modified as follows (suggestions in red text):

   "*4) Demonstrating protection of inadvertent intruders requires an assessment of potential radiological exposures should an inadvertent intruder occupy the disposal*

facility following a loss of institutional controls after closure." *The minimum timeframes for this analysis must be: 100 years for Class A waste, 300 years for Class B waste, and 500 years for Class C waste. The results of the intruder assessment are compared …*"

5. Proposed Wording at § 61.7(c)(5) – See suggested text in red font.

   "*In general, for disposal facilities with limited quantities of long-lived waste, performance period analyses may ~~are~~ not be necessary to demonstrate protection of the general population from releases of radioactivity and protection of inadvertent intruders.*"

   The original NRC phrase depends on at least 3 key characteristics of the LLRW nuclides, namely half-life, soil/water partitioning coefficient (K_d), and initial parent concentration [3]. As mentioned above, NRC needs to be more direct in defining a half-life value above which an isotope is considered "long-lived" (see DRC comments on Long-Lived Waste definition (§ 61.2), above. Long-lived nuclides, commonly found to be mobile in groundwater (low K_d values), also deserve special attention in the upcoming rule changes, and are discussed below.

6. Proposed Changes at § 61.7(d) – we suggest the following changes to this new section (changes in redline / strikeout text):

   "*(d) Waste acceptance. Demonstrating compliance with the performance objectives also requires a determination of criteria for the acceptance of waste. The criteria can be determined from the results of the site-specific analyses that demonstrate compliance with the performance objectives for any land disposal facility (including performance assessment analysis for both the compliance and performance periods) ~~or~~ and, for a near-surface disposal facility, the waste classification requirements of Subpart D of this part.*"

   In order to ensure that a disposal facility and its environs perform over the long periods of time proposed to be included in "compliance period" and "performance period", there must be a direct link between the waste acceptance criteria and the PA analysis.

   Also, because the proposed NRC changes are intended to address Host State concerns with control of long-lived and mobile LLRW isotopes, and the in-growth of progeny in the waste form, it is paramount, that these 3 elements be integrated into the "waste classification" requirements in § 61.55, see discussion below.

7. Proposed Changes at § 61.7(e)(4) – we suggest the following changes to this new section (changes in redline / strikeout text):

   " *… Enhanced controls or limitations could include additional limits on waste concentration or total activity, more robust intruder barriers, burial below 30 meters (intermediate depth land disposal), and more robust waste-specific stability requirements. These enhanced controls or limitations could mitigate the uncertainty associated with the evolutionary effects of the natural environment and the disposal facility performance over the compliance period.*"

[3] Progeny activity in-growth / risk is also a 4th consideration.

Burial depth is not necessarily an intruder barrier, in that mineral resource or water well drilling could allow future intrusion of the waste form; hence clarification is in order. The addition of a new designation for intermediate depth land disposal is also important, for reasons discussed above.

8. Proposed Changes at § 61.7(g) – we suggest the following change to the proposed section (modifications in redline / strikeout text):

   "*(g) Implementation of dose methodology. The dose methodology used to demonstrate compliance with the performance objectives of this part shall be consistent with the dose methodology specified in the standards for radiation protection set forth in Part 20 of this chapter. After the effective date of these regulations, applicants and licensees may request use and approval of updated factors, which have been issued by consensus scientific organizations and incorporated by the U.S. Environmental Protection Agency into Federal radiation guidance. Additionally, applicants and licensees may use the most current scientific models and methodologies (e.g., those accepted by the International Commission on Radiological Protection) appropriate for site-specific circumstances to calculate the dose. The weighting factors used in the calculation of the dose must be consistent with the methodology used to perform the calculation. After prior site-specific Commission approval, licensees may dispose of significant quantities of long-lived radionuclides, in accordance with all other requirements of this Part.*

   This addition will emphasize that the approval of any up-dated dose conversion factors and methodologies will be on a disposal facility specific basis and done by the Commission only after review of the site specific PA analysis results provided by the licensee. For Agreement States, it is expected that a similar site-specific review and approval process would be implemented.

9. Proposed Changes at § 61.13(a)(1) - we suggest the following change to the proposed section (modifications in redline / strikeout text):

   "*(1) At a minimum, shall consider features, events, and processes that might affect demonstrating compliance with § 61.41(a) over the course of the compliance period. The site-specific features, events, and processes considered must represent a range of phenomena with both beneficial and adverse effects on performance, and must consider the specific technical information required in § 61.12(a) through (i). A technical basis for either inclusion or exclusion of specific features, events, and processes must be provided. Specific features, events, and processes must be evaluated in detail if their omission would significantly affect meeting the performance objective specified in § 61.41(a).*"

   It is critical to establish the minimum timeframe that site specific features, events, and process (FEPs) are to be considered. For PA analysis of the performance period (> 10,000 years), more discretion should be left to the licensee and regulator.

10. New Section § 61.13(e) - we suggest the following change to the proposed section (modifications in redline / strikeout text):

    "*(e) Analyses that assess how the disposal facility and site characteristics limit the potential long-term radiological impacts to human health during both the compliance*

and performance periods, consistent with available data and current scientific understanding. At a minimum, the analyses shall be required for land disposal facilities with: 1) long-lived waste that contains alpha-emitting transuranic radionuclides with average concentrations exceeding 10 nCi/g in an individual waste container, or 2) radionuclides in an individual container with average concentrations exceeding one tenth of the values listed in Table 1 of § 61.55, or 3) if necessitated by site-specific factors including engineering design, operational practices, and site characteristics. The analyses must identify and describe the features of the design and site characteristics that will demonstrate that the performance objectives set forth in §§ 61.41 and 61.42 will be met."

In addition, several other concerns come to mind, that we request the NRC address and resolve, including:

A. First Sentence, Required Timeframes – the wording as proposed is very general, and provides no indication of which PA timeframe must be analyzed. In order to evaluate the long term impacts of a LLRW disposal facility it is important to include a minimum duration for the PA analysis. Hence, the addition of "compliance and performance periods" to the first sentence. This is critical for both long-lived nuclides and those isotopes that generate progeny with increased activity in the waste form.

B. Test Condition 1 – NRC needs to explain and justify why the wording in Test 1 is inconsistent with the requirements of § 61.55, Table 1. At that existing section of the rule, the 10 nCi/gm limit is the current Class A limit for transuranic (TRU) isotopes. Omission of "transuranic" in this proposed test, implies that the 10 nCi/gm limit applies to both TRU nuclides and naturally occurring alpha emitters, e.g., uranium and thorium decay series isotopes. If this latter view is NRC's intention, then detailed description and justification needs to be provided to explain why a 10 nCi/gm limit is an appropriate de-minimus waste concentration level for naturally occurring alpha emitters at the time of disposal.

   We appreciate the 10 nCi/gm TRU limit for Class A waste, and recognize the historical precedence surrounding it [4]. If NRC's intent was that the new section apply to TRU nuclides, then please change the wording as suggested above.

   Once NRC determines its intentions for the new wording at § 61.13(e), decisions can be made regarding requirements for long-lived nuclides, mobile nuclides, and nuclides that generate higher activity progeny. Certainly, the goal of a successful site-specific PA analysis (for both the compliance and performance periods) is to define the respective waste concentration levels that will lead to safe long-term waste management and avoidance of adverse radiological impacts to human health at a specific disposal site. This said, it may be both simplier to allow the disposal site to perform the PA / II analysis, and secure regulatory approval, and then define the acceptable waste concentration level, below which no such analysis is required for these long-lived, mobile nuclides and isotopes with higher activity progeny.

[4] See NRC 1981 DEIS, pp. 7-13 to 7-16.

It is also important to note that any NRC justification of a de-minimus waste concentration level could be very complicated, in that specific activities of individual isotopes vary widely, see Table 1, below. Compounding this fact is that sum-of-fractions calculations are needed when multiple alpha-emitting nuclides are present in a waste container (upon arrival at a disposal site).

Table 1. Single Nuclide Mass Equivalent to 10 nCi/gm Activity [5]

Nuclide	Half-life (yrs)	Specific Activity (nCi/gm-U)	Mass Equivalent to 10 nCi-U/gm-waste Activity
U-238	4.47E+9	333.34	0.03 gm
U-235	7.04E+8	2,144.44	0.0047 gm
U-234	2.46E+5	6.17E+6	1.62E-6 gm

As seen in the simple Table 1 calculations, above, specific activity and mass equivalent vary by as much as 4-orders of magnitude between these 3 naturally occurring uranium isotopes.

C. Basis for Waste Averaging – in order to ensure consistent application of Test Conditions 1 and 2, with the existing requirements of § 61.55, Table 1, it is critical to articulate that the average waste concentration will be determined on an individual waste container basis; and not on any other construct of "average", e.g., waste shipment campaign, disposal cell volume, etc. This will be particularly important when Host States are forced to conduct out-of-state compliance inspections at waste generator sites to confirm compliance with WAC requirements that will result from the proposed disposal site specific PA and II analysis.

D. Test Condition 3 – because this last test condition is site specific, it is important to clarify that its application is to be done with prior Commission approval. The decision

E. Last Sentence – the references in this sentence to §§ 61.41(b) and 61.42(b), point to ALARA requirements for PA analysis during the performance period (> 10,000 years) as it pertains to dose to the general population, and to inadvertent intruders, respectively. Since the proposed wording at § 61.13(a) now points to the compliance period requirements for PA analysis in § 61.41(a), these 2 references should be revised to reflect both the compliance and performance periods.

11. Changes at §§ 61.28(a)(2) and (3) – new wording was added to the end of § 61.28(a)(2) that now makes reference to a "final closure plan". Unfortunately, there is no definition for this plan in § 61.2. Further, the minimum elements for the plan appears to be set out in § 61.28(a)(3). However, the information listed there is extremely brief. We suggest that the requirements at § 61.28(a)(3) be greatly expanded.

[5] Specific activity for each individual nuclide was calculated by DRC staff using the Radiologic Health Handbook, p. 103, equation 5. Half-live values were taken from "Nuclides and Isotopes, Chart of the Nuclides", 16th Ed., 2002, published by Lockheed Martin.

This is important now that NRC is about to diminish its previous LLRW rules that established nation-wide requirements to guide generators in the packaging and classification of waste; and instead is about to place more emphasis on site-specific PA and II analysis and corresponding WAC to govern LLRW shipments. Certainly, the final physical state of the disposal facility and site at the time of closure will significantly influence both short and long-term facility site performance. Thus, NRC needs to strengthen the § 61.28(a)(3) requirements to be commensurate with its re-tooling of the LLRW regulations.

Further, it is imperative that § 61.28(a)(3) require that the facility closure plan, submitted as part of the application, be fully and completely consistent with all assumptions, and bounding and initial conditions used by the licensee in the PA and II analysis approved by the Commission. To do otherwise, would be disposal cell / site construction to be incongruent with critical PA and II calculations.

12. Proposed Changes at §§ 61.41(b) and 61.42(b) – new wording in both of these sections refers to new text NRC wants to add at § 61.13(e). NRC needs to resolve DRC concerns mentioned above for that section.

13. New Section at § 61.52(a)(12) – this new wording makes reference to disposal site construction and operational practices [§ 61.12(f)], and a long list of technical requirements at § 61.13 that detail mandates for PA and II analysis. Since WAC requirements are fully dependent and integrated with the PA and II evaluation, § 61.52(a)(12) should also require waste disposal to be in compliance with the new WAC requirements at § 61.58.

14. Changes Needed To § 61.55, Table 1 – it is clear that when Table 1 was originally constructed in the early 1980's that the NRC was focused on LLRW isotopes that constituted the majority of activity that needed to be managed. Now that NRC has recognized that the risk to human health is dominated by long-lived nuclides [6], and that PA analysis needs to be required for 10,000 years or more, additional long-lived isotopes need to be added to § 61.55, Table 1. As stated above, these nuclides should be those with a half-life of 3,000 years or more, and should include:

    A. Long-lived Isotopes Known to be in LLRW - DRC staff has looked to research done by the Pacific Northwest National Laboratory (PNNL), published in August, 2000[7]. In that document, PNNL identified 7 nuclides known in LLRW that were not considered in the original development of the 10 CFR 61. Of these 7 isotopes, 3 have half-lives greater than 3,000 years: Be-10 (1.5E+6 yr), Cl-36 (3.01E+5 yr), and Mo-93 (3,500 yr), see Attachment 1, below.

    We recognize that disposal site-specific PA and II analysis will help determine ad hoc waste packaging standards for these 3 nuclides; for a given LLRW landfill. Nonetheless, a national standard is long overdue. These isotopes should be identified in Table 1 as a means of guiding regulators as they review PA and II analysis documents submitted as part of license applications. Adding waste classification

[6] See DRC Comment on 10 CFR 61 above, Comment 1.B, where several quotes from the November 29, 2012 RA are provided.

[7] See NRC NUREG/CR-6567, Section 3, pp. 11-13.

limits for new long-lived nuclides to Table 1, will also be a helpful guide for waste generators as they prepare packages for shipment for disposal.

Other mobile and long-lived radionuclides, that were not identified in the 1981 NRC DEIS, but have been considered by EnergySolutions as part of their existing PA analysis. These include: Al-26 (7.16E+5 yrs), Ca-41 (1.03E+5 yr), and Re-187 (4.1E+10 yr). There may be other long-lived nuclides that should be considered as part of this rulemaking. NRC should conduct a comprehensive examination of long-lived nuclides in LLRW and add them to Table 1 in § 61.55 as soon as possible.

B. Depleted Uranium (DU) – and other nuclides whose progeny in-grow to produce nuclides of higher activity and risk to human health. It is of great concern that while the November 29, 2012 NRC RA document recognized that human health risk is dominated by the presence of long-lived nuclides in LLRW, but made no attempt to construct draft rules to resolve the issue of higher health risk from progeny in-growth in the future (i.e., deep time). Given that in 2008, NRC staff have determined that shallow land disposal (< 100 feet) of large quantities of DU would not be appropriate at humid sites [8], this current lack of rulemaking action can only be explained by federal choice to defer the responsibility of solving this national disposal problem to 2 Host States found in the arid western U.S. (Texas and Utah). Alternatively, this conflict could be resolved should NRC change the 10 CFR 61 rules to require intermediate depth land disposal of DU waste.

15. Changes to § 61.58(a)(3) – this new section points to the requirements in Subpart C, which includes § 61.40 thru 61.44. At section § 61.43, Protection of Individuals During Operations, no changes are currently proposed by NRC. However, it is important to note that this section mandates that LLRW disposal facilities conduct their operations in compliance with the radiation protection standards found in 10 CFR 20. In effect, NRC is conflicted in that it fully acknowledges that the 10 CFR 20 radiation protection standards for LLRW workers are antiquated, since they were based on a 1977 ICRP publications (Publication 26) [9]. Yet the agency is now proposing that waste generators be allowed to use of more modern dose conversion factors / methodology to determine adequacy of waste disposal, without providing the same measure of modern health physics science to protect workers at LLRW disposal sites. Clearly, when the Commission mandated that NRC staff were to adjust the 10 CFR 61 rules to allow more modern dose methodologies, it had more interest in eliminating waste stockpiles in the nuclear industry, than to workers at LLRW disposal sites. To reconcile this imbalance of priorities, NRC must update its radiation protections standards at 10 CFR 20 immediately.

16. Changes to § 61.58(b)(1) – one of the physical and chemical characteristics of the waste needs to included includes degree of an nuclide's leachability from the waste form.

17. Changes to § 61.58(c) – in order to approve enforceability, we recommend the following wording changes to this new section (changes in redline / strikeout text):

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[8] See NRC October 7, 2008 SECY-08-0147, pp. 1, 2, and 4-5. Details also found in NRC Enclosure 1 to this document (ML081820800), pp. 15-16, and 18 (Table 1).

[9] See November 29, 2012 NRC RA, p. 61.

"(c) Waste certification. Each applicant shall provide, for prior Commission approval, a program to certify that waste meets the acceptance criteria prior to receipt at the disposal facility. Certification requirements shall apply to both waste generators and disposal facilities. On a waste stream specific basis, the certification program shall:

(1) Designate authority to certify and receive waste for disposal at the disposal facility.

(2) Specify documentation required for waste characterization, shipment (including the requirements set forth in Appendix G of 10 CFR part 20), and certification.

(3) Identify records, reports, on-site tests, and inspections that are necessary to maintain to demonstrate compliance with the requirements in § 61.80.

(4) Provide approaches for managing waste that has been certified as meeting the waste acceptance criteria in a manner that maintains its certification status at all times between the point of origin and final disposal."

References

Nuclear Regulatory Commission, November 29, 2012, "Regulator Analysis for Proposed Revisions to Low-Level Waste Disposal Requirements (10 CFR Part 61)", 86 pp, 2 appendices.

Radiological Health Handbook, January, 1970, U.S. Department of Health, Education, and Welfare, PB-230-846, 476 pp.

U.S. Nuclear Regulatory Commission, September, 1981, "Draft Environmental Impact Statement on 10 CFR 61 'Licensing Requirements for Low-Level Radioactive Waste', Volumes 1, -4", NUREG-0782.

U.S. Nuclear Regulatory Commission, November, 1982, "Final Environmental Impact Statement on 10 CFR 61 'Licensing Requirements for Low-Level Radioactive Waste", Volumes 1 and 2, NUREG-0945.

U.S. Nuclear Regulatory Commission, August, 2000, "Low-Level Radioactive Waste Classification, Characterization, and Assessment: Waste Streams and Neutron-Activated Metals", NUREG/CR-6567, Pacific Northwest National Laboratory, 95 pp.

U.S. Nuclear Regulatory Commission, October 7, 2008, "Rulemaking Issue (Notation Vote), Response to Commission Order CLI-05-20 Regarding Depleted Uranium", NRC memorandum from R.W. Borchardt to The Commission, SECY-08-0147, 12 pp. with 3 enclosures:
Enclosure 1: "Analysis of Depleted Uranium Disposal", undated NRC staff support document, 30 pp.
Enclosure 2: "Resources", undated spreadsheet by NRC staff, 1 p.
Enclosure 3: "Depleted Uranium – Additional Options Evaluated", undated NRC staff support document, 2 pp.

Weidner, R.T., and R.L. Sells, 1980, "Elementary Modern Physics, 3rd Edition, Allyn and Bacon Inc., 484 pp.

Attachment 1

DRC Calculations of Remaining Parent Half-life
After 10,000 years Elapsed Time
and
Review of Long-Lived Isotopes
Known in Low-Level Radioactive Waste

DRC Spreadsheet: Decay_10K.xlsx
Tabsheet: Decay_10K

Radioactive Decay - determine minimum half-life where 10% of initial parent activity remains after 10,000 yrs

Back-calculate a parent half-life where Ar > 10% after 10,000 yrs

Isotope	Half-life, $T_{1/2}$ (yrs)	Decay Constant, lambda (1/yrs)	Initial Activity, Ao (pCi/gm)	No. of Half-lives Elapsed	Elapsed Time, t (yrs)	Activity Remaining, Ar, pCi/gm fraction	%
X	10,000	6.93E-05	1	0	0	1.000	
				1	10,000	0.500	
				2	20,000	0.250	
				3	30,000	0.125	
				3.1	31,000	0.117	
				3.2	32,000	0.109	
				3.3	**33,000**	0.102	**10.2%**
				3.4	34,000	0.095	
Y	5,000	0.000139	1	0	0	1.000	
				1	5,000	0.500	
				2	10,000	0.250	
				3	15,000	0.125	
				3.1	15,500	0.117	
				3.2	16,000	0.109	
				3.3	**16,500**	0.102	**10.2%**
				3.4	17,000	0.095	
Z	3,000	0.000231	1	0	0	1.000	
				1	3,000	0.500	
				2	6,000	0.250	
				3	9,000	0.125	
				3.1	9,300	0.117	
				3.2	9,600	0.109	
				3.3	**9,900**	0.102	**10.2%**
				3.4	10,200	0.095	
Z1	3,030	0.000229	1	0	0	1.000	
				1	3,030	0.500	
				2	6,060	0.250	
				3	9,090	0.125	
				3.1	9,393	0.117	
				3.2	9,696	0.109	
				3.3	**9,999**	0.102	**10.2%**
				3.4	10,302	0.095	

= calculated fields

Moble, Long-Lived Isotopes Identified by NRC and Energy Solutions July, 2000 Performance Assesment Model

Isotope	Half-life (yr)	Power Plant IX Resins Activity Conc. (Ci/m^3) [As Generated / Untreated] PWR	BWR	Total	NRC Projected Inventory, 1980 - 2000 in Regional Landill (Ci)
Mobile Isotopes in 1981 NRC DEIS, Vol 2 (Table 3.3 - as generated / untreated)					
C-14	**5,760**	9.74E-05	1.19E-03	1.29E-03	142.81
Tc-99	**2.13E+05**	8.23E-07	7.65E-05	7.73E-05	8.58
I-129	**1.57E+07**	2.44E-06	2.04E-04	2.06E-04	22.90
Np-237	**2.14E+06**	9.06E-12	1.02E-11	1.93E-11	0.000002
				Total:	**174.29**
Other LLRW Isotopes Not Considered in 10 CFR 61 (see NUREG/CR-6567, Aug, 2000, Section 3)					
Be-10	**1.50E+06**				n/a
Cl-36	**3.01E+05**				n/a
Mo-93	**3,500**				n/a
Mobile, Long-lived isotopes not in 1981 NRC DEIS, but in 7/19/00 ES PA Model (Permit, Part I.D.7)					
Al-26	**7.16E+05**				n/a
Ca-41	**1.03E+05**				n/a
Cl-36	**3.01E+05**				n/a
Re-187	**4.12E+10**				n/a

IX Resin Source	1981 NRC DEIS, Table 3.4 NRC Projected LLRW Volumes, 1980 - 2000 (m^3) Region 1	Region 2	Region 3	Region 4	Total
PWR	6.93E+03	1.30E+04	6.59E+03	8.14E+03	3.47E+04
BWR	2.10E+04	2.51E+04	2.05E+04	9.67E+03	7.63E+04
				Total:	**1.11E+05**

KEY

PWR	= pressurized water reactor
BWR	= boiling water reactor
Bold	= long-lived isotopes for waste disposal / groundwater
	= isotopes in 7/19/00 ES PA Model (vertical domain)
	= isotopes in the 7/19/00 ES PA Model (horizontal domain)
	= LLRW isotope listed in NUREG/CR-6567, Section 3
	= calculated field

Cell: G7
Comment: Activity Remaining, A = Ao * e^ - (lambda * t), where:
Ao = initial activity,
e = natural log
lambda = isotope's decay constant,
t = time elapsed
(Radiological Health Handbook, January, 1970, U.S. Department of Health, Education, and Welfare, PB-230-846, p. 28). Also found in R.T. Weidner and R.L. Sells, 1980, "Elementary Modern Physics", 3rd Edition, p, 330, Equation 10-19.

Cell: C8
Comment: Decay Constant, lambda = 0.693 / T, where T = isotope half-life (Radiological Health Handbook, January, 1970, U.S. Department of Health, Education, and Welfare, PB-230-846, p. 28).

Cell: O9
Comment: Lmorton:
Inventory (Ci) = Activity Concentration (Ci/m3) * Projected Volumes (m3).