Utah Division of Radiation Control

Comments on NRC 10 CFR 61 Rulemaking Initiative
Docket ID NRC-2011-012
July 31, 2012

A. General

We agree that NRC should allow, as an option, disposal facilities to establish site-specific waste acceptance criteria (WAC) based on the results of a performance assessment and intruder assessment, in addition to the use and application of current waste classification tables in 10 CFR 61.55. However, given that Utah's law prohibiting the management and disposal of Class B or C low-level radioactive waste (LLRW), is based on the existing waste classification system, it is therefore important and critical that this rulemaking and a potential option to allow a WAC-based approach not serve as means to replace or supersede the existing LLRW classification system.

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.

During development of revised LLRW rules at 10 CFR 61, the NRC should hold public meetings in each of the host States to provide the public opportunity to ask questions and provide direct feedback to NRC officials.

B. Performance Assessment

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,[1] where a much larger activity was previously predicted: 3,407 Ci for U-238 and 479 Ci for U-235.

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/m^3), Tier 2 would require the licensee and/or the regulator to know:

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[1] 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.

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.

Please be aware that the during 2010 and 2011, the Utah Radiation Control Board adopted new rules regarding performance assessment for disposal of large quantities of DU waste; i.e. proposals involving 1 metric ton (or more) and DU activity concentrations above 0.05% (by weight) [2]. In cases where such wastes are proposed for shallow land disposal the minimum POP (and compliance period) must be 10,000 years.

However, in light of DU disposal, the NRC 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 projected risk to future*

[2] See Utah Administrative Code, R313-25-8(5)(a-c).

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

Considering these uncertainties related to DU disposal, and in light of other factors, such as paleoclimate evidence [3], geologic issues, long DU half-lives, and increasing public health risk with time due to Ra-226 in-growth, 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 (i.e., POP > 20,000 years).

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 [4]. 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).

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.

We support the flexibility to use ICRP dose methodologies, so long as it does not impede, undermine, or otherwise reduce the host State's ability to monitor facility performance, and enforce any facility performance standard mandated by the regulatory authority.

C. Performance Objectives

See comments submitted by the Low-Level Radioactive Waste Forum Disused Source Working Group / Part 61 Working Group.

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3 For Great Basin paleoclimate evidence in the last 30,000 years, see Curry, 1990; for global evidence over a much longer timeframe, see Petit, et.al..

4 DFRN = NRC draft rule language found in October 3, 2011 email, Enclosure 1

D. Institutional Control Period

Any increase in current 100-year institutional control period must not in any way alter the current definition of Class A, B, or C waste in 10 CFR 61.55, Tables 1 and 2.

E. Compatibility Category

See comments submitted by the Low-Level Radioactive Waste Forum Disused Source Working Group / Part 61 Working Group.

F. Waste Classification

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).[5] 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).

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

State	Class A Limit	Class C Limit	Greater than Class C
South Carolina	< 10 nCi/gm	< 100 nCi/gm [6]	> 100 nCi/gm
Texas	< 10 nCi/gm	< 100 nCi/gm [7]	> 100 nCi/gm
Utah	< 10 nCi/gm	< 100 nCi/gm	> 100 nCi/gm
Washington	< 10 nCi/gm	< 100 nCi/gm [8]	> 100 nCi/gm

5 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

6 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.

7 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.

8 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.

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 (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 (i.e., zero valent [ZV] metal, U_3O_8, or UO_3). 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).[9]

Time to Become Class C Waste

URS calculations[10], performed for DRC, indicate that time needed for DU waste (post-disposal) to exceed the Utah's Ra-226 Class A concentration limit (Ra-226 $\geq$ 10 nCi/gm or 10,000 pCi/gm), and thus become Class C waste,[11] would range from 5,400 years[12] to 61,200 years.[13] 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 between 5,400 and 6,200 years. This time interval is significantly shorter than predicted by the NRC in its May 3, 2011 DFRN (Figure 2).

For DU from typical spent fuel reprocessing, this Ra-226 in-growth time would be between about 20,700 and 24,200 years.[14] 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,[15] assuming DU waste remains in a closed system and is not leached from the disposal cell. In

9 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.

10 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.).

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

12 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.

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

14 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.

15 See 11/18/10 URS Memorandum, Table 1.

contrast, the NRC proposed 20,000-year POP would allow DU from spent fuel reprocessing to continue to be designated as Class A waste.

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.[16] 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).[17] 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.[18] 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.[19] Both of these estimates are about half of the time predicted in the May 2011 NRC DFRN documents.

G. Inadvertent Intruder

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;[20] 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]:

[16] See 11/18/10 URS Memorandum, Table 2.
[17] Ibid.
[18] Ibid.
[19] Ibid.
[20] See NRC draft rule language found in October 3, 2011 email, Enclosure 1, p. 67.

> "(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…."

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.[21] 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).

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): *"(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."*

[21] See NRC DFRN from October 3, 2011 email, Enclosure 1, p. 23.

References

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