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Department of
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Executive Director

DIVISION OF RADIATION CONTROL
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(9)

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February 17, 2012 *(transmitted via email)*

Mr. Andrew Persinko
Deputy Director, Environmental & Performance Assessment Directorate
Division of Waste Management and Environmental Protection
Office of Federal & State Materials & Environmental Management Programs
U.S. Nuclear Regulatory Commission
Mail Stop T-8-F-5
Washington, DC 20555

Re: State of Utah Comments on the August, 2011 NRC Draft Branch Technical Position (BTP) on LLRW Concentration Averaging and Encapsulation.

Dear Mr. Persinko:

This letter transmits comments from the Utah Division of Radiation Control (UDRC) on the Draft BTP, referenced above. As you might know, UDRC is participating on the Low-Level Radioactive Waste Forum's (LLW Forum) Disused Sources Working Group (DSWG). Because of the importance the Draft BTP has with respect to sealed sources of radioactive material, we are offering our comments separately as well as collectively under a separate letter from the Working Group.

Please find our comments enclosed with this letter. We appreciate the opportunity to comment on this important issue, and look forward to continued discussions with your staff.

If you have questions, please contact myself at 801-536-4257 (rlundberg@utah.gov), or Loren Morton of my staff at 801-536-4262 (lmorton@utah.gov).

Sincerely,

ORIGINAL DOCUMENT SIGNED BY RUSTY LUND BERG ON 2/17/2012

Rusty Lundberg
Division Director

RL/LBM:lm

Enclosure: Utah Comments

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Add = M. Heath (MLH5)

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File: NRC August, 2011 Draft CAE BTP

Utah Division of Radiation Control
Comments on
August, 2011 NRC Draft Branch Technical Position For Waste Concentration Averaging and Encapsulation

February 17, 2012

A. Increase in Sealed Source Activity

1. The LLRW classification system (Class A, B, C concentrations) is based on protection of the inadvertent intruder at 100, 300, or 500 years after waste disposal. The 1982 NRC Final EIS was able to eliminate certain intruder scenarios on the basis that if future excavation exposed a drum of waste, the intruder would recognize it as artificial. The 1995 NRC Concentration Averaging BTP built on this intruder scenario by assuming a Cs-137 sealed source (30 Ci) was centered in a 55-gallon drum and encased with cement grout at the time of disposal. In the 1995 BTP, the NRC made several other assumptions, including:

   a) 500 years of time elapsed before excavation / discovery,
   b) The drum would be physically intact on discovery,
   c) Drum would produce an acceptable contact dose rate $\leq$ 0.2 mR/hr, which is compliant with current NRC decommissioning rules for unrestricted areas, and
   d) The drum would not be carried away to someone's residence for continued exposure.

   We are concerned about the dramatic increase in the allowed sealed source concentration limit, e.g., from 30 Ci to 130 Ci for Cs-137. While we recognize that the August, 2011 draft BTP was based on a "carry-away" scenario it is unclear how a higher sealed source concentration limit could be derived, given that:

   A. Less Shielding Present – considering short term direct skin contact with the source (and not the drum) for 4 hours while in transit to the residence, and for the longer term exposure, less dense intervening materials (less than cement) to shield the intruder while inside his/her residence.

   B. Greater Exposure Time – in that now the intruder would reside in the home for about 16 hours/day for many years, and not 8-hours during a temporary excavation project.

   Additional explanation and justification seams warranted to address the increased Cs-137 sealed source concentration limit. Careful coordination is also needed to ensure the back-calculations are consistent with the inadvertent intruder scenario.

2. Sealed sources are of a concern in that they generally constitute large activity, small volume sources of radioactivity, and thus appear to conflict with the

original mission and purpose of the Clive facility (large volume, low activity). Thus, increased Class A activity limits resulting from the proposed sealed source disposal have to potential to be in conflict with Clive's original mission, and deserve careful consideration. Review of the historic NRC findings on sealed sources is also in order. In the 1981 NRC DEIS the inadvertent intruder analysis concluded that elimination of sealed sources from LLRW classification would result in a decrease of dose on the order of more than 2-orders of magnitude.

3. The CAE BTP increases the maximum activity allowed in a sealed source for more than 1 nuclide at the time of encapsulation for land disposal as shown. As can be seen in Table 1, the CAE BTP proposes no changes in activity limits for the non-gamma emitting nuclides. In contrast, changes are proposed for the gamma emitters.

   The decrease in the Class A limit for Co-60 (700 to 140 Ci) appears to be driven by the new "carry-away" intruder scenario where NRC staff assumed where the intruder comes into intimate contact with the cladded source 100 years after disposal. The removal of any activity limit for Class B or C waste, appears to be largely driven by the isotope's short half-life (5.27 years) and the longer decay time assumed before intruder contact, i.e., 300 and 500 years, respectively; made possible by an assumed lengthy delay for intrusion.

   The activity limit increase proposed for Cs-137/Ba-137m for all classes appears to be the product of the same "carry-away" intruder scenario, and related assumptions. No changes were proposed for Nb-94.

4. All of these proposed NRC class limits are based on the assumption that the cladded source remains physically intact and sealed for 100, 300, and 500 years, respectively. Given the saline soils and groundwater at the Clive site, it is difficult to conceive this would be the case. Hence, the NRC assumptions behind the proposed sealed source activity limits for gamma emitters appear to be better suited for land disposal in Washington, Texas, and South Carolina, not Clive, Utah.

B. Factor of 10

1. This is a more complex classification process and doing away with the Factor of 10 Rule and substituting instead a 2 page, 13 step decision tree adds more complexity to waste classification, and provides more opportunities for generators to err. It also places more burden for generator State regulators to inspect waste treatment and classification.

C. BTP as Guidance

1. The ACRS stated that the CAE BTP sealed source intruder scenario was overly conservative, did not recognize the depth of burial, and that the "carry-away" scenario had already been ruled unlikely in the Final EIS. Further, they concluded that the most appropriate scenario for sealed source disposal was the "discovery-scenario" in the 1982 Final EIS; which is actually an abbreviated version of the dwelling construction scenario from the 1981 DEIS. In this 1981 scenario, excavation workers recognize the waste form is artificial and stop digging. This assumes the drum and encapsulation matrix remain intact. It also denies the habitation / agriculture scenario from ever happening.

   The ACRS also went on to say: "*...the use of overly conservative scenarios "for inadvertent intrusion into presumably abandoned, unmarked, and unsecured LLRW disposal facilities can change the focus of the facility design from the protection of the health and safety of the public during the period of operation of the facility (and a reasonable period thereafter), to the protection of hypothetical intruders many thousands of years in the future.*" Unfortunately, the ACRS provided no definition of what it considered a "reasonable period" after disposal.

   At the root of the discussion, it appears the ACRS prefers NRC use a short period of performance, in that they envision the drum and encapsulation matrix is intact, allowing the intruder to easily recognize the waste form is artificial, and prevent exposure. In contrast, NRC staff appears to view the problem in terms of "deep time", and acknowledge the shortcomings in the 1981 DEIS, 1982 FEIS in that the 10 CFR classification system is flawed, as follows:

   - Short Lived Waste Assumption – that LLRW will experience significant decay in 100 (Class A), 300 (Class B), and 500 years (Class C) after disposal. Unfortunately, the current NRC rule fails to acknowledge long-lived isotopes, known to exist in LLRW and power plant wastes, e.g., Tc-99 (half-live = 211,000 years), that will not significantly decay in 500 years or less.
   - Opposite Behavior of Depleted Uranium – where long term ingrowth of decay products increase the risk to the public. This was the mission the NRC staff were charged with by the Commission, as a means to reconcile the Louisiana Energy Services lawsuit.

   So a disparity exists between the NRC staff and the ACRS, that is critical to reconcile before any final NRC rule is revised, adopted, and final guidance issued. From the ACRS letter, it appears the advisory group prefers a shorter 1,000 year period of performance (POP), as is the case with current DOE policy for waste disposal. In contrast, longer time periods are being considered by NRC staff in response to SECY-08-0147.

2. The CAE BTP, Section 3.8 describes how the new guidance will allow an off-ramp to the proposed CAE BTP decision tree; largely based on disposal site PA results and intruder analysis. This "off-ramp" is consistent with the current alternative waste classification / characteristics requirements found in 10 CFR

61.58. However, one would expect that in 1982 when 10 CFR 61.58 was framed, it was anticipated that when an alternative was proposed, it would be subject to public notice and comment. However, given now that proposed "off-ramp" is in guidance, which is not mandatory for an Agreement State to follow, a potential situation could exist where either the generator or disposal State (or both) could make a change to a license, without public participation. Under these circumstances, the public would be denied the opportunity to comment. Inversely, if a disposal site PA / intruder analysis is approved by a sited State, and forms the basis for waste packaging / classification in a generator State, does or will this compel the generator State to undergo a public comment period?

3. As laid out in the draft CAE BTP the first test in the CAE BTP guidance in process is to ask if the waste is "homogeneous or a mixture of items". NRC describes homogeneous waste as (CAE BTP, pp. 5, 9-10):

- Solidified or absorbed liquids,
- Spent ion exchange (IX) resins, filter media, evaporator bottom concentrates, ash, contaminated soil, and
- Dry Active Waste (DAW) , and
- With regard to the "items", that might be mixed into LLRW or are not homogeneous, the NRC CAE BTP (p. 5) mentions:
  - Activated metals (e.g. tools, equipment, large objects, etc.),
  - Contaminated materials,
  - Spent cartridge filters, and
  - Sealed sources.

It is clear that the new NRC guidance addresses a very wide range of LLRW waste types. Examination of these waste types in context of the 1981 NRC Draft Environmental Impact Statement (DEIS) and the 1982 Final Environmental Impact Statement (FEIS) provides some very interesting information. With the exception of "contaminated materials", all of the waste types discussed in the draft CAE BTP were considered in the 1981 NRC DEIS.

D. Benefit to Very Large Generators

1. Larger sealed source owners will benefit from the new guidance, and not disposal States. CAE BTP Figure 1 flowchart shows how "coffee cup" sized items with certain activity levels are separated from the waste form, and then undergo another series of tests. In turn, the NRC Figure 2 tests allow "coffee cup" sized items to be diluted by encapsulation and averaging over a larger volume container. This dilution provides a potential for generators to segregate small items with elevated activity and down-grade their classification. Taken to an extreme, GTCC equivalent material could be downgraded to Class C, or Class B/C equivalent materials could become Class A. This potentially would benefit generators with GTCC sources or who are mandated by law to manage GTCC waste.

E. Homogeneous/ Similar Type Material

1. The NRC flowchart (CAE BTP Figure 1) outlines the new classification process, and shows the least scrutiny is given LLRW that is homogeneous and of similar type. Spent ion exchange resins at nuclear power plants certainly meet these criteria. As a result, generator States with nuclear power plants have a more streamlined process and will benefit more than other LLRW generators.

F. Alternative Approaches

1. Alternative approaches off-ramp provided on NRC Figure 1, allows a generator to classify waste on the basis of the disposal site's performance assessment (PA) model analysis (also see CAE BTP pp. 20-23). This is a direct benefit to generators, in that provides an "off-ramp" for generators to avoid following the proposed classification criteria on NRC Figures 1 and 2. It also opens the door for variability in its application on a state-by-state basis.

2. Use of PA model analysis for alternative approaches has the potential to exploit an inherent disconnect between host States and generator States. If this "off-ramp" is used, host States will need to develop detailed Waste Acceptance Criteria (WAC) to ensure that generators properly prepare, package and ship their waste to be consistent with the specific intruder scenarios and waste form (physical / chemical) assumptions used in the approved PA model analysis for each disposal site. This could lead to extensive WAC guidelines that could vary from host State to host State, and waste class to waste class. This has the potential for additional burden on disposal States to communicate and educate generators and their regulators on how to comply with new WAC guidelines.

G. Enforceability Issue

1. To a large degree the CAE BTP has the same flaw as the 1995 BTP guidance; in that separate regulatory jurisdictions govern different activities (generators vs. disposal), have different interests and motivations, and are separate and independent of one another. As such, generator States are more apt to worry about elimination and transfer of the waste from their jurisdiction, and pay less attention to disposal site considerations (e.g. design / site factors, PA analysis results, etc.). Because disposal States will live with the long-term fate and consequences of LLRW disposal, they are more likely to be concerned about adverse effects that waste treatment, classification, and packaging may have on their local environment and public health from the perspective of both near term and "deep time"; but are without legal jurisdiction or reach to oversee or enforce waste characterization / classification by the generator.

   In addition, the CAE BTP (Figures 1 and 2) classification guidance for each waste container, is just that - guidance. There is no guarantee that it will be uniformly applied in all generator States. Utah will be dependent on each generator State

agency to voluntarily implement the new guidance for each generator. NRC will not be able to compel the generator Agreement States to invoke the guidance. It is likely that there will be a high degree of variability on if, how and when, the new guidance is implemented in generator States. While the CAE BTP calls for generator States to cooperate with disposal State regulators (ibid., p. 4); there is no guarantee it will happen.

2. It is true that the CAE BTP suggests that in the case of conflict between disposal site waste acceptance criteria (WAC) / License requirements and the generating State waste treatment process / requirements, that the disposal State requirements should prevail (ibid., p. 24). Unfortunately, this posture is unenforceable, in that the disposal State has no legal jurisdiction over the Out-of-State generator, and cannot directly enforce its WAC / License requirements beyond its borders.

3. The current EnergySolutions (ES) License requires ES to apply the existing 1983 and 1995 NRC guidance documents via the waste prohibitions in License Condition 16.L, that stipulate that ES not accept a package of LLRW unless it has been:

> "*i. Classified in accordance with R313-15-1009, "Classification and Characteristics of Low-Level Radioactive Waste." In addition, the Licensee shall require that all radioactive waste received for disposal meet the requirements specified in the Nuclear Regulatory Commission, "Branch Technical Position on Concentration Averaging and Encapsulation", as amended.*
>
> *ii. Marked as either Class A Stable or Class A Unstable as defined in the most recent version of the "Low-Level Waste Licensing Branch Technical Position on Radioactive Waste Classification." originally issued May, 1983 by the U.S. Nuclear Regulatory Commission. ...*"

From the first paragraph, the intent of the License is to indirectly mandate that generators properly package and classify the LLRW in accordance with the 1995 NRC BTP requirements. However well-meaning this requirement, it is currently un-inspectable; in that the Utah DRC (UDRC) has no authority in the generator States, nor are we easily able to independently verify if generators actually classify their waste as required. Instead UDRC is dependent on the generators to perform and the NRC or other Agreement States to confirm this. UDRC is without legal power or reach to independently verify if generators actually comply with the NRC classification guidelines.

4. There appears to be a conflict on performance of drums and encapsulation media. as mentioned above, the NRC requires Class B and C waste to be disposed in robust and stable containers, in that [10 CFR 61.7(b)(2)]::

> "*Those higher activity wastes that should be stable for proper disposal are classed as Class B and C waste. To the extent that it is practicable, Class B and C waste forms or containers should be designed to be stable, i.e.,*

maintain gross physical properties and identity, over 300 years. For certain radionuclides prone to migration, a maximum disposal site inventory based on the characteristics of the disposal site may be established to limit potential exposure."

NRC has made clear that container integrity and waste form is key to controlling higher activity Class B and C waste, in that (1981 NRC DEIS, Vol. 1, p. 31)::

> *"The waste form (coupled with site design and operating practices) is probably the most significant factor contributing to site instability -- a factor containing the paradox that much if not most of the problems with site instability and high maintenance costs is caused by the wastes containing the least activity. Most of the waste sent to LLW disposal facilities consists of very low activity material such as trash which is frequently easily degradable. In the past, some of this waste has been packaged in easily degradable packages such as cardboard boxes. Most of the waste, however, is currently packaged in longer lasting, but still degradable, rigid containers such as wooden boxes and 55-gallon steel drums. Large void spaces can also exist within waste packages and the disposal cells after waste disposal. As the waste material degrades and compresses, a process which is accelerated by contact by water, additional voids are produced. This leads to settlement of the disposal cell contents, followed by subsidence or slumping of the disposal cell cover. This increases the percolation of water into disposal cells, accelerating the cycle. This slumping and subsidence is frequently quite sudden."* (emphasis added)

Accordingly, the 1995 BTP assumed that steel drums corrode leaving only the encapsulation matrix to control the sealed source nuclides (1995 BTP, Appendix C, p. 22). As discussed above, the NRC staff appear to take a "deep time" point of view in the CAE BTP, and assume both the drum and encapsulation matrix degrade to become soil-like, leaving only the stainless steel cladded source behind to be "discovered" (CAE BTP, p. B-2). As discussed above, this view appears to be in direct conflict with those of the ACRS. This disagreement must be resolved before NRC moves forward to either a new rule or guidance on waste concentration averaging.

H. NRC/ACRS

1. **Evolution of NRC Intruder Scenario Assumptions: Sealed Source Disposal** – the NRC intruder scenarios on the acceptability of sealed source disposal, and appropriate activity limits for sources at disposal have varied significantly over the past 30 years.

   Recently the Advisory Committee on Reactor Safeguards (ACRS) recognized this and suggested NRC staff reconsider their approach by using *"...the same scenarios used to develop 10 CFR Part 61 without creating additional unrealistic scenarios to determine allowable concentrations or amounts of LLRW to be disposed."* (12/13/11 ACRS letter, p. 2). This would indicate that the ACRS is

encouraging the NRC to also reverse its 1995 BTP intruder scenario assumptions, which applied the 0.02 mR/hr contact dose limit to the steel drum (upon discovery / intrusion). If this is indeed their intent, then it would appear that NRC staff would need to revert to the intruder scenario described in the 1982 FEIS.

The ACRS also stated that the CAE BTP sealed source intruder scenario was overly conservative, did not recognize the depth of burial, and that the "carry-away" scenario had already been ruled unlikely in the Final EIS. Further, they concluded that the most appropriate scenario for sealed source disposal was the "discovery-scenario" in the 1982 Final EIS (12/13/11 ACRS letter, p. 3-4); which is actually an abbreviated version of the dwelling construction scenario in the 1982 FEIS (Vol. 1, p. 4-14). The "discovery scenario" assumes the drum and encapsulation media remain intact; thus denying the possibility of a habitation / agricultural scenario that may be more applicable under "deep time" considerations.

The ACRS also went on to say: "*...the use of overly conservative scenarios "for inadvertent intrusion into presumably abandoned, unmarked, and unsecured LLRW' disposal facilities can change the focus of the facility design from the protection of the health and safety of the public during the period of operation of the facility (and a reasonable period thereafter), to the protection of hypothetical intruders many thousands of years in the future.*" Unfortunately, the ACRS provided no definition of what it considered a "reasonable period" after disposal.

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- Short Lived Waste Assumption – that LLRW will experience significant decay in 100 (Class A), 300 (Class B), and 500 years (Class C) after disposal. Unfortunately, the current NRC rule fails to acknowledge long-lived isotopes, known to exist in LLRW and power plant wastes, e.g., Tc-99 (half-live = 211,000 years), that will not significantly decay in 500 years or less.
- Opposite Behavior of Depleted Uranium – where long term ingrowth of decay products increase the risk to the public. This was the mission the NRC staff were charged with by the Commission, as a means to reconcile the Louisiana Energy Services lawsuit.

So a disparity exists between the NRC staff and the ACRS, that is critical to reconcile before any final NRC rule is revised, adopted, and final guidance issued. From the ACRS letter, it appears the advisory group prefers a shorter 1,000 year period of performance (POP), as is the case with current DOE policy for waste disposal. In contrast, longer time periods are being considered by NRC staff in response to SECY-08-0147.

I. Waste Acceptance Criteria (WAC)

1. Not all disposal sites have detailed WAC to constrain waste physical and chemical form, leachability, etc., before land disposal.

2. The proposed guidance relies on disposal site WAC's (founded on site-specific PA analysis) to guide generators in the waste classification process. This added complexity for generators (and their regulators) could lead to increased errors in waste preparation, packaging, and classification for disposal.

3. When disposal states lack legal reach on generators, such errors can increase potential jeopardy for disposal state public health and environment.

4. Disposal states should have the ability to promulgate rules that are more stringent than NRC to protect their public health and environment.

5. In deciding compatibility categories for new rules, NRC must provide flexibility in order to allow disposal states to afford this protection to its citizens.

J. Agreement State Compatibility Categories

1. Disposal states should have the ability to promulgate rules that are more stringent than NRC to protect their public health and environment.

2. In deciding compatibility categories for new rules, NRC must provide flexibility in order to allow disposal states to afford this protection to its citizens.

K. Action Items

1. Guidance alone is not sufficient to ensure that long-term public health and the environment will be protected in the disposal States; especially under "deep time" conditions. Therefore, after NRC promulgates new federal rules regarding LLRW blending and DU disposal, etc., the agency will need to define compatibility categories for purposes of IMPEP. This is critical for at least two reasons:

   - Generator State Implementation – the compatibility category assigned to the new rule(s) must be substantial so as to mandate the generator State implement equivalent rules on how LLRW is to be classified before shipment for disposal. This is important for trans-boundary reasons. However, if the NRC assigns an insignificant compatibility category (e.g., Category D) the purpose of the new rule would be defeated from the disposal States' viewpoint. As a result, in assigning a compatibility category NRC must seek out and resolve disposal State input.
   - Disposal State Flexibility – in assigning a compatibility category for the new rule(s), the NRC must allow disposal States flexibility to establish

LLRW disposal rules that are not only equal, but also more protective of public health and the environment than minimum requirements set by the NRC. Failure to allow this flexibility, would relegate disposal States to a lower degree of standing than generator States, and further exacerbate the imbalance between disposal State long-term protection of public health and the environment in lieu of short term needs of generator States who enjoy the benefits of modern technology; but have chosen not to host a LLRW disposal site.

2. In light of the January 19, 2012 NRC Staff Requirements Memorandum, where the Commission directed the NRC staff to re-evaluate its approach to the proposed limited rulemaking at 10 CFR 61 (and guidance), it is clear that the compatibility determinations will need to be revisited (see 9/30/11 NRC letter, Enclosure 1, p. 54). Utah and other sited states will need to reserve an opportunity to re-assess the proposed compatibility categories, until after the revised NRC staff position / rules are provided.