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Cindy Bladey
Chief Rules, Announcements, and Directions Branch
Office of Administration
Mail Stop: TWB-05B01M
US NRC
Washington D.C. 20555-0001

Subject: Comments in response to Docket ID NRC-2011-0022- Notice of Public Meeting and Request for Comments on Potential Revision of the Branch technical Position on Concentration Averaging and Encapsulation, January 26, 2011

Dear Ms. Bladey,

On behalf of EPRI, thank you for the opportunity to participate on the February 24th, 2011 NRC discussion panel on the Branch Technical Position on Concentration Averaging (CA BTP). The BTP revision now in process offers a rare opportunity to address not only issues related to blending, but also issues in other areas where technical justifications exist that warrant consideration. The ultimate goal of any revision is to provide guidance that is risk informed, performance based, and protective of the public.
The purpose of this correspondence is to provide some general comments on the BTP and submit written feedback for consideration in the revision process.

- Enclosure 1 contains specific feedback related to the waste blending approach described in the recently published clarification of the BTP.
- Enclosure 2 includes comments related to providing a technical basis for areas of the BTP that should be considered for revision. These recommendations are based on two EPRI technical reports: 1016761, *Proposed Modification to the NRC Branch Technical Position on Concentration Averaging and Encapsulation*, and 1021098, *Options for Improved Low Level Waste Disposal using 10CFR61.58*. The technical basis for the points called out in this enclosure can be found in the referenced documents.
- Enclosure 3 provides responses to some of the Federal Register questions that were posted related to the BTP panel discussion held on March 24th, 2011.

It should be noted that EPRI published its work on the BTP in 2008. At that time, EPRI did not envision that a revision to 10CFR61 was on the horizon. As such, it was assumed during the

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development of EPRI's recommendations that the underlying assumptions provided by Part 61 and the associated Environmental Impact Statement (EIS) would remain in place and proposed modifications would need to remain consistent with the information contained in these documents. During the February panel discussion, references were made to introducing new intruder scenarios. The introduction of site-specific intruder scenarios that are realistic and protective will be an important advancement in the development of more risk informed regulation. Introduction of new scenarios, however, should open the door to debate on other assumptions in the EIS and 10CFR61, such as the timelines associated with inadvertent intrusion. Inadvertent intrusion immediately following removal of institutional controls may not be risk informed or a realistic assumption. Both the intruder scenarios and the timelines assumed for intrusion are critical to performance objectives. EPRI believes that both the intruder scenarios and the timelines should be closely examined to ensure standards are developed that are both protective and risk informed. However, to revise these assumptions, a new EIS should be completed and that effort should occur during the revision process to Part 61.
Based on extensive examination of shipping records and waste characteristics, EPRI recommends that four main areas be addressed in the revision process: constraints on averaging homogenous materials, treating dewatered cartridge filters in the same context as Dry Active Waste due to their physical and chemical similarities, differences between activated metals and sealed sources, and constraints on averaging irradiated hardware.

Thank you for the opportunity to participate in this important process, and for including EPRI's work in your deliberations. If you have any questions related to the information contained in this letter or the enclosures, please contact me at 469-586-7468 or at ledwards@epri.com.

Sincerely,

Lisa Edwards
Program Manager

Enclosure 1 - Comments on the Draft Document Providing Clarification of the Branch Technical Position
Enclosure 2 - Branch Technical Position (BTP) Changes that Should be Considered in the Revision Process
Enclosure 3 - BTP WORKSHOP FEBRUARY 24, 2010

cc: Larry Camper
Maurice Heath
Jim Kennedy
Greg Suber

ENCLOSURE 1

Comments on the Draft Document Providing Clarification of the Branch Technical Position

The clarifications included in the revised Branch Technical Position (BTP) on Concentration Averaging and Encapsulation provide important clarifications to the BTP as originally published. Particularly important is the clarification recognizing the need for continuing to allow plant (generator) practices to proceed toward best practices for maintaining operational and ALARA efficiencies. We understand that the intent of the draft document is to provide clarification of the provisions of the original document and not to substantively change the existing provisions. However, **some** of the clarifying language could invoke changes to current practices that may be contrary to the intent.

1) There is some confusion over what is "classification controlling" or what it actually means. The original BTP and the updated position cites the same language in defining classification controlling, but the updated position omits an important caveat. That is, that a nuclide may be significant for reporting purpose but not necessarily "dictate" or control classification. Effectively nuclides that are classification controlling should be those in which the activity of that nuclide in one or more components in the averaging group exceeds the class limit so that it would actually be subject to averaging to meet the class limits. Consider a scenario with two components where Cs-137 values are 5 and 10 μCi/cc and Ni-63 in the two components are 50 and 100 μCi/cc. By the draft definition, both radionuclides are "classification controlling" but in the case of Cs-137 both values are within the Class B limit and in the case of Ni-63 one value exceeds the Class B limit. In this case the Cs-137 does not "dictate" the classification as required in the original BTP paragraph 3.3.1. Basically this condition is only applicable if the averaging is done over a classification boundary.

2) Activity limits provided in Table A are only applicable to discrete items less than 0.01 ft^3 (0.00028m^3). The maximum Cs-137 activity that would be allowed in such an item encapsulated in a 200 liter drum would be about 1/5 of 4600 curies, or 920 curies. The intruder scenario in Appendix B assumes intrusion into the Class C waste at 500 years and that the intruder will encounter the source. 1) The postulated scenario is not risk informed and runs contrary to the general drive toward risk informed regulation. 2) The concept of an unaware intrusion of a discrete item after 500 years is somewhat of a contradiction. At this point waste should be indistinguishable from soil and generally available for alternative use. If it is assumed that the source is intact, then the disposal is outside of the range of materials postulated in the development of the classification hierarchy. Also, if a material is indistinguishable at 500 years, the dilution scenarios

should apply. If the item is still intact, then the intruder should be aware of encountering something unusual and would be presumed to perform an investigation. A drilling scenario that postulates encountering a discrete item after 500 years should include a realistic portrayal of drilling operations. Our understanding of drilling indicates that if a drilling operation encounters a solid block of concrete the drilling would be stopped or fail if it is not stopped. In the case where drilling encounters a disintegrated source, it should be assumed that mixing volume includes not only the volume of soil above the source, but also the volume of soil below the source to the point of interest (water/oil/mineral).

3) The intrusion scenario annexed to the BTP assumes a discrete item (0.00028 m^3) with 30 curies of Cs-137. The initial concentration for this item would be over 100,000 Ci/m^3. It requires a factor of 23 dilution to meet Class C limits. The BTP limits the range of averaging for gamma isotopes to a factor of 1.5 for the treatment of larger items and cartridge filters and then substantially relaxes this criteria for small discrete items. The BTP then turns around and applies this criteria to cartridge filters and larger pieces of activated hardware which would never reach such concentrations. This is a general inconsistency imposed by the attempt to treat sealed sources within the system of classification rather than treating them as a discrete stream.

4) Section 2 of the draft revision to the BTP states that it does not provide separate guidance for classification of activated metals as its intent is to provide more uniform guidance. However, the draft fails to recognize an important concept in the 1995 BTP regarding averaging of activity in activated metals over the "component" as placed into a disposal container and instead makes consistent reference to "items." This wording seems to imply that averaging would apply to the individual cut pieces of an irradiated component once placed into a disposal container. As written, it does not clarify or maintain consistency with the 1995 BTP. In general, it does not make sense to classify a piece of irradiated hardware one way if it remains intact as a 12 foot long component contained in a single package and classify it differently if the same component is segmented for packaging efficiently, but all of the segmented pieces or placed into a single container. When time limits expire that allow for inadvertent intrusion, it is assumed that whether the original material is segmented or not, the content of the container will be available for mixing with surrounding soil.

5) Section 4 of the draft revision to the BTP is titled "Initial Waste Classification." This wording is inconsistent with NRC stated direction that waste classification occurs at the time waste is offered for disposal and not in interim steps prior to. This part of the process should be more appropriately termed "Initial Characterization" to avoid any inference that waste has a "classification" at some point prior to shipment for disposal.

ENCLOSURE 2

Branch Technical Position (BTP) Changes that Should be Considered in the Revision Process

Research conducted by EPRI in 2007 through 2010 and published in technical report 1016761, *Proposed Modification to the NRC Branch Technical Position on Concentration Averaging and Encapsulation*, and 1021098, *Options for Improved Low Level Waste Disposal using 10CFR61.58,* provide several recommendations for proposed changes to the BTP to facilitate safe disposal of LLRW, including:

- Eliminate the constraints on averaging homogeneous materials
- Treat dewatered cartridge filters as homogeneous wastes in the same context as DAW
- Recognize difference between activated metals and sealed sources
- Remove constraints on averaging irradiated hardware including eliminating the factor of 1.5 for averaging niobium 94

These changes have been discussed in meetings with NRC staff and in other forums. Please reference EPRI Technical Reports 1016761 and 1021098 for the supporting technical basis of each of these recommendations.

II. Questions Related to Branch Technical Position Federal Register Notice Vol. 76, No. 17, Page 4641 (Including EPRI Responses)

1. **NUREG-1854, "NRC Staff Guidance for Activities Related to U.S. Department of Energy Waste Determinations - Draft Final Report for Interim Use," issued August 2007," contains extensive guidance for site-specific evaluations of intruder protection. The approach in the NUREG was endorsed by NRC's Advisory Committee on Nuclear Waste and Materials, who also recommended that the staff evaluate a broader application of the new concentration averaging methodology to wastes other than "waste incidental to reprocessing." How could approaches in that guidance be used in revising the CA BTP?**

   The draft guidance in NUREG-1854 allows credit to be taken for existing conditions such as greater depth and obstructions or barriers. It also allows limited blending with grout material for stabilization and allows for mixing of TRU in excess of limits defined in 10CFR61. This approach assesses the risk associated with disposal of specific volumes of waste based on site specific characteristics and environmental conditions, the activity of the disposed waste, and the combined impact of the waste form, waste containers and natural, intrinsic and engineered barriers. It also allows site specific intruder scenarios that are appropriate for the specific disposal facility. For instance, based on site specific environmental conditions, an agricultural intruder scenario may be appropriate for some but not all disposal facilities.

   This approach could be used in revising the CA BTP by providing guidance associated with using site specific performance assessments to demonstrate how a particular waste (from discrete items up to and including the entire disposal trench inventory) meet the established performance objectives for a specific disposal site. The guidance could include information on intruder scenarios and the basis used to determine if they apply to a particular site. The disposal site's Waste Acceptance Criteria (WAC) could be used to capture the general requirements associated with the disposal of waste at that site, but the disposal site operator would bear the burden of ensuring the waste is disposed of in a manner that meets the limits placed upon that site The use of the disposal site performance assessment could be used as the preferred basis to determine package specific disposal requirements based on expected local inventory and activity ranges.

2. **Part 61 limits the disposal of Cs-137 to 4,600 Ci/m^3, yet the CA BTP guidance for disposal of discrete Cs-137 sources recommends a limit of 30 Ci in 0.2 m^3 (150 Ci/m^3). Given the large disparity between the CA BTP guidance and the Part 61 regulation, and given the need to dispose of large Cs-137 sources, should NRC consider revising the 30 Ci in 0.2 m^3 recommendation found in the CA BTP?**

Yes. Abandoned sources have been identified as a security concern by the Department of Homeland Security. The risk associated with creating guidance that results in large numbers of these sources being orphaned should be weighed against the risk associated with responsible and regulated disposal of the sources even if it means creating separate rules or performance objectives for this waste stream.

In general, the CA BTP should recognize the difference between discrete sources and other waste streams. High activity sealed sources should be treated as a separate waste stream with its own WAC and commensurate disposal requirements and performance assessment.

In addition, the source limit identified in the CA BTP is equivalent to the Class B limit in 10 CFR Part 61.55. Part 61 requires that wastes containing higher concentrations of activity are intruder protected. Therefore the limit set by the CA BTP would result in a discrete item that is disposed as Class B or C waste with the associated, more stringent requirements for stability and isolation. Most of the surrounding waste would be near or above the 150 Ci/m^3 and the source would be indistinguishable from the surrounding waste. No obvious protection is achieved by imposing this additional limit on sealed sources disposed in Class C conditions.

This reinforces the original intent of the CA BTP to address discrete items in waste that are not intruder protected. It also implies a broader average range for discrete items than was allowed for homogeneous materials. In addition, the higher concentration limit cited in Part 61 recognizes that there is no intruder incentive to gather or collect the bulk material containing the higher concentrations Given the requirement for intruder protection of the smaller quantity, source concentration should be at least as high as the general requirement – with appropriate commensurate protection.

3. **The rulemaking for unique waste streams (see SECY-08-0147 and the Staff Requirements Memorandum for this SECY) will protect the inadvertent human intruder by requiring a waste- and site-specific assessment. The current CA BTP defines acceptable practices for applying the Part 61.55 tables, to insure that inadvertent human intruder is protected (as intended in the draft and final EIS for Part 61). Given the NRC's move towards site- and waste-specific analyses to demonstrate protection of the intruder – is the CA BTP necessary, or could it be eliminated?**

The CA BTP should be kept as an **interim** step until Part 61 is revised. The Part 61 revision process should address the concerns outlined in the CA BTP and the future need for the CA BTP should be eliminated. The revision of the BTP should be conducted as part of a larger process that includes both the unique waste stream rulemaking currently in progress and ultimately leads to the revision of Part 61 and the elimination of the CA BTP.

That being said, if the CA BTP is kept it should not introduce new or expanded requirements that are not supported by the original rule or the original EIS. During the panel discussions new scenarios were introduced that are not supported by the Part 61 EIS. If new scenarios are introduced, then all assumptions contained within the EIS should be open to challenge. For instance, the credibility of the assumption that a radioactive waste disposal site could be 'inadvertently' intruded upon should be reconsidered. Within the US (and certainly abroad), many people live in homes, and work in buildings that are greater than 100 years old. The assumption that somehow a radioactive disposal site is no longer identifiable in 100 years and that land use records are no longer available can no longer be considered credible. If the site is identifiable and land use records are available, then the risk of an inadvertent intruder should be re-evaluated. While intruder scenarios and timelines need to be addressed in the long term, doing so would necessitate the need to perform a new performance assessment. That effort should be undertaken during the revision to Part 61.

The CA BTP is built on the premise of disposal in accordance with the EIS model and waste form requirements of 10 CFR Part 61.56. The CA BTP guidance should focus on original concerns related to disposal requirements for high activity sealed sources. Discrete sources were later identified as a unique waste form not specifically evaluated in the EIS. The CA BTP sought to integrate requirements to control the disposal of high activity sealed sources into the 10CFR61 framework without addressing them in a broader rulemaking. This resulted in guidance that attempts to manage what is inside the package, and applies restrictions for high activity sealed sources to other waste streams such as irradiated hardware and filters that are not technically justified. As such, the existing CA BTP guidance goes well beyond the basis provided by the rule and the associated EIS. Disposal requirements should be based upon the disposal setting and apply to a much larger environment than the package. The use of site-specific performance assessments as described in response to question 1 above should be adopted as the preferred model. Guidance for implementation of this approach should be captured in the 'interim 'CA BTP. When the rule is revised this CA BTP guidance should be contained within the rule and the need for the CA BTP should be eliminated.

4. **The volume over which waste concentrations are averaged has a significant effect on waste classification. The current CA BTP addresses averaging over a waste package. Others have suggested that averaging occur over the volume of waste that an inadvertent intruder would be exposure to, or the volume of a disposal trench. What are the pros and cons of these alternative approaches?**

Averaging at the Package Level	Average over larger Volume
Pros:	Pros;
1)Assures that each package meets the disposal requirements	1)Conforms to disposal basis of the EIS and larger volume classification would still

2) Requires no knowledge of neighboring packages 3)All classification can be completed prior to shipment	ensure that performance objectives are met 2) Reduces need to classify individual packages 3)-Reduces the need for separate waste classes 4) Reduces the potential for orphaned waste
Cons:	Cons:
1)Implies need to average components within the package – over-reaches on issue addressed in the BTP 2) Results in waste unnecessarily orphaned in the process 3) Not necessary to constrain averaging below the package level based upon the EIS work and EPRI research	1) Requires monitoring for classification by the disposal site operators 2)Requires infrastructure for tracking incoming shipments

5. **For blending homogenous waste types, the NRC will be requiring a site- and waste-specific intruder analysis, so as to be risk-informed and performance-based. In requiring a site- and waste-specific analysis for homogeneous waste types, the NRC is moving away from the CA BTP's "factor of 10 rule" for individual contributors to a mixture of homogenous waste types. Should NRC also move away from the "factor of 10 rule" for non-primary gamma emitters and away from the "factor of 1.5 rule" for primary gamma emitters?**

   Yes:

   a. The factor of 10 rule is especially unnecessary for miscible components within a package for both primary and non-primary gamma emitters. This requirement is outside of the demonstrations that are required for 10CFR61 compliance. In addition EPRI research indicates that a larger volume (232 m^3) than that of the package is appropriate and protective as evaluated by the 10CFR61 EIS. Therefore the concern related to homogeneity is not based upon the contents of a single package, but the content of a much larger volume that is assumed to be subject to mixing with surrounding materials and soil.
   b. Material will be mixed by the intruder in any reasonable scenario
   c. The "Factor of 1.5" should have little bearing on waste classification as the three nuclides targeted (Co-60, Cs-137, Nb-94) have impact at different time frames. Co-60 is dominant early in the disposal period and is primarily a risk to generator and disposal site personnel during waste handling and emplacement. It decays quickly and is not significant after 100 years. Cs-137 dominates direct exposure in most post-closure intruder scenarios after Co-60 has decayed, but is not significant after 500 years. Nb-94 is a **Table 1** radionuclide and is assumed to be the longer-term hazard. The production of Nb-94 is speculative in that it is not a

fission product and is produced from trace elemental contamination in metals in contact with reactor coolant.

d. Long term impacts are already assessed on the basis of the factor of 10 difference between Class A and C. By regulation, all class C material is intruder protected.

6. **What limits on the types of LLW that can be blended should be specified in the CA BTP? Specifically, should blending of cartridge filters and sealed sources to form homogeneous mixtures be addressed in the CA BTP?**

High activity sealed sources should be treated as a separate stream (as has been done with depleted uranium). It is not reasonable to try to fit them into the classification system of 10CFR61. However, certain low activity sealed sources that meet the limits of 10CFR61 without averaging or meet the limits for general licensing in 10CFR30 should be acceptable for disposal with DAW, e.g. smoke detectors, lightning rods, and instrument check sources).

This constraint should not be applied to cartridge filters. The application of this concept to cartridge filters in the CA BTP over states the importance of filters in the overall risk equation. There is no similarity in waste form or activity content between activated metal (or sealed sources) and filters, and therefore, no comparison in response in the disposal environment. Filters are physically, chemically, and radiologically more like DAW and can be treated in a manner equivalent to DAW or as part of the overall DAW stream. Cartridge filters account for a comparatively small volume and activity contribution to the overall source term. Achieving disposability through processing has little impact on disposal site risk or in the total activity received. Total annual activity generation for all cartridge filter accounts for only about half of the amount of activity annually disposed of in Class A resins prior to the closure of Barnwell. Disposal volumes typically account for few hundred cubic meters per year.

7. **In the Commission's October 13, 2010, decision on LLRW blending, it stated that ". . . GTCC waste is a Federal responsibility and . . . should not be made into a State responsibility, even if the waste has been blended into a lower classification." What unique guidance will GTCC waste require in the BTP, given this direction? For example, when should waste be classified? (Waste is currently not required to be classified until it is shipped for disposal).**

Waste classification applies to the disposed waste. Classification should be based on the final disposal form, and should not be classified before it is offered for disposal. In fact EPRI Research indicates that classification over a larger volume (232 m^3) than that of the package is appropriate and protective as evaluated by the 10CFR61 EIS.

The earliest point that waste should be classified is when it is packaged for disposal. If at that point the determination is made that the waste is GTCC, then it should be handled accordingly from that point forward. As the DOE embarks upon developing a waste site for commercially produced GTCC waste, any incentive that is perceived to exist to handle and process this waste stream to reduce its classification will be removed. Current and past practice provides abundant evidence that the industry aggressively pursues waste management practices that all but eliminate the generation of GTCC waste.

Attempts to develop guidance to classify waste prior to disposal to ensure that is not GTCC will most likely have unintended consequences. For instance, current and past practice within the industry shows that significant effort is exerted when irradiated hardware is classified to ensure that all requirements are met, and that GTCC is segregated from the lower activity waste and not packaged or shipped for disposal. The potential impacts of any new guidance in this area will need to closely examine for potential impact on current practices related to irradiate hardware packaging.

If required, one method that could be used to address the GTCC blending concern is for plants to document a process control program that is used to preclude the generation of GTCC for various waste streams within their plant. This requirement should only be imposed on waste that is offered for large scale blending. It should **not** be imposed on waste streams that are not being offered for large scale blending processes. Compliance with the program could be used to satisfy the concern and eliminate the need to 'pre-classify' waste at some point prior to the waste reaching its final form.

8. **How should NRC consider heterogeneity in waste concentrations in the site-specific intruder analysis? Does there need to be guidance on how to interpret intruder analysis results with respect to waste heterogeneity?**

The applicability of intruder scenarios should first be evaluated on a site specific basis. If the combination of the site attributes--- including site characteristics, engineered barriers, and waste forms and containers combine to provide stability and depth of cover then the intruder scenarios would not apply. If it is determined that one or more intruder scenarios do apply then heterogeneity should be considered in the context of the averaging volume for the intruder scenario (232 m^3 in the case of NUREG-0782). Assuming that the intruder scenario is still operable, waste should be distributed within the disposal site such that a non-compliant volume (i.e. one that would violate the performance criteria) cannot be excavated within the defined scenario. Individual packages do not define the long term risk to the intruder. Non-uniformity of activity within the container (e.g. hot spots) is addressed in container handling and shipping processes, these are generally irrelevant to intruder protection. In addition, current disposal practices at all operating commercial LLW Disposal sites exceed the intruder protection requirements envisioned in NUREG-0782 as they include deeper cover and or rock or concrete barriers that essentially meet the intruder prevention measures for Class Band C waste and obviate the

need for the intruder scenario that is the basis for Class A waste. Sealed sources should be considered a separate waste stream with appropriate commensurate measures required in the disposal environment.

9. **NRC's regulations, 10 CFR 61.55(a)(8), allows for averaging of waste concentrations in determining the classification of waste. Such averaging should continue to protect an inadvertent intruder in a waste disposal facility, one of the four performance objectives in 10 CFR Part 61.**

   - **How do other programs for managing and disposing of waste treat protection of an inadvertent intruder?**
   - **Do they allow for averaging, and if so, what are the constraints?**

   Could or should NRC harmonize its approach with these other programs? If so, would changes need to be made to NRC regulations, or could they be made in guidance?

   In the direct intruder scenario, the intruder excavates a quantity of material whose activity is randomly distributed throughout the excavated material. Current disposal practices at all operating commercial LLW Disposal sites exceed the intruder protection requirements envisioned in NUREG-0782 as they include deeper cover and or rock or concrete barriers that essentially meet the intruder prevention measures for Class B and C waste and obviate the need for the intruder scenario that is the basis for Class A waste. Application of the inadvertent intruder concept in Class B and C disposal trenches before 300 or 500 years is not technically justified. The basis of the increased cover depth and stability requirements is to ensure that the waste is entombed in a manner that precludes inadvertent intrusion during the defined time period.

   The formulation of alternate intruder scenarios that are more reasonable for the expected disposal conditions and methods has already been accepted by NRC and Agreement States (ex. DOE sites and WCS in TX). IAEA guidance leaves the formulation of scenarios for the development of protective performance goals up to the disposal host authority. NRC should seek to formulate a rational program that will extend the understanding of disposal risks and provide a regulatory structure to address the risks.

   Harmonizing with DOE regulations:
   The Department of Energy is required to conduct disposal operations in a manner compatible with NRC regulations. This includes following guidance published by the NRC such as the BTP on CA. In lieu of following the classification system in 10 CFR 61.55, DOE conducts a site specific performance assessment following the exception allowed by 10 CFR 61.58. DOE has the advantage in this approach in having internal resources to conduct the evaluation and full accounting for the sources destined for a particular site. Adoption of a similar approach for commercial disposal facilities will be risk informed and performance based, but should address the need to

develop waste acceptance criteria for 'anticipated waste' and later account for actual waste disposed.