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NUCLEAR REGULATORY COMMISSION

[NRC-2011-0022]

Concentration Averaging and Encapsulation Branch Technical Position

AGENCY: Nuclear Regulatory Commission.

ACTION: Branch technical position; issuance.

SUMMARY: The U.S. Nuclear Regulatory Commission (NRC) is issuing Revision 1 of the Branch Technical Position on Concentration Averaging and Encapsulation (CA BTP). This guidance provides acceptable methods that can be used to perform concentration averaging of low-level radioactive waste (LLW) for the purpose of determining its waste class for disposal.

DATES: The Branch Technical Position referenced in this document is available on **[INSERT DATE OF PUBLICATION]**.

ADDRESSES: Please refer to Docket ID NRC-2011-0022 when contacting the NRC about the availability of information regarding this document. You may access publicly-available information related to this document using any of the following methods:

- **Federal Rulemaking Web Site:** Go to http://www.regulations.gov and search for Docket ID NRC-2011-0022. Address questions about NRC dockets to Carol Gallagher; telephone: 301-415-3463; e-mail: Carol.Gallagher@nrc.gov. For technical questions, contact

the individual(s) listed in the FOR FURTHER INFORMATION CONTACT section of this document.

- **NRC's Agencywide Documents Access and Management System (ADAMS):** You may obtain publicly available documents online in the ADAMS Public Documents collection at http://www.nrc.gov/reading-rm/adams.html. To begin the search, select "ADAMS Public Documents" and then select "Begin Web-based ADAMS Search." For problems with ADAMS, please contact the NRC's Public Document Room (PDR) reference staff at 1-800-397-4209, 301-415-4737, or by e-mail to pdr.resource@nrc.gov. The ADAMS accession number for each document referenced in this notice (if that document is available in ADAMS) is provided the first time that a document is referenced. The revised Branch Technical Position on Concentration Averaging and Encapsulation consists of two volumes. Volume 1 (ADAMS Accession No. ML12254B065) contains the staff technical positions on averaging and certain other information. Volume 2 (ADAMS Accession No. ML12326A611) contains staff responses to stakeholder comments on the May 2012 draft (ADAMS Accession No. ML121170418) and the technical bases for the staff positions.

- **NRC's PDR:** You may examine and purchase copies of public documents at the NRC's PDR, Room O1-F21, One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852.

FOR FURTHER INFORMATION CONTACT: Maurice Heath, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555-0001; telephone: 301-415-3137; e-mail: Maurice.Heath@nrc.gov.

SUPPLEMENTARY INFORMATION:

I. Introduction.

The NRC is issuing Revision 1 of the CA BTP. This revision provides updated guidance on the interpretation of § 61.55(a)(8) of Title 10 of the *Code of Federal Regulations* (10 CFR), "Determination of concentrations in wastes," as it applies to the classification (as Class A, B, or C waste) of a variety of different types and forms of LLW. Paragraph 61.55(a)(8) states that radionuclide concentrations can be averaged over the volume of the waste or its weight if the units are expressed as nanocuries per gram. The average radionuclide concentrations are compared with the waste classification tables in 10 CFR 61.55 to determine the class of the waste. The waste class determines the minimum safety measures to be applied in order to provide reasonable assurance of safe disposal of the waste.

The previous version of the CA BTP, published in 1995 (ADAMS Accession No. ML033630732), was issued before the NRC adopted its risk-informed and performance-based regulatory policy. The revised CA BTP has been informed by that policy. The revised CA BTP also contains new guidance related to blending of LLW, as directed by the Commission in its Staff Requirements Memorandum for SECY-10-0043, "Blending of Low-Level Radioactive Waste," (ADAMS Accession No. ML102861764).

II. Background.

To provide protection for individuals who inadvertently intrude into a waste disposal facility, radioactive waste proposed for near-surface disposal must be classified based on its hazard to the intruder. The NRC's regulation, "Licensing Requirements for Land Disposal of

Radioactive Waste," 10 CFR Part 61, establishes a waste classification system based on the concentration of specific radionuclides contained in the waste. This system is one of the key components in ensuring protection of an inadvertent intruder. In determining these concentrations, the regulation states, in 10 CFR 61.55(a)(8), that radionuclide concentrations can be averaged over the volume of the waste or its weight if the units are expressed as nanocuries per gram.

Although 10 CFR Part 61 acknowledges that concentration averaging for the purposes of classifying waste for disposal is acceptable, it does not specify limitations on the implementation of concentration averaging. The staff published a technical position on radioactive waste classification, initially developed in May 1983 (ADAMS Accession No. ML033630755), that provided guidance on concentration averaging. This 1983 technical position describes overall procedures acceptable to NRC staff which could be used by licensees to determine the presence and concentrations of the radionuclides listed in 10 CFR 61.55, and thereby classify waste for near-surface disposal. Section C.3 of the 1983 technical position provided guidance on averaging of radionuclide concentrations for the purpose of classifying the waste.

In 1995, the NRC staff updated a portion of the 1983 technical position, publishing as a separate document the "Branch Technical Position on Concentration Averaging and Encapsulation," (60 FR 4451, January 23, 1995). The 1995 CA BTP significantly expanded and further defined Section C.3 of the 1983 technical position dealing with concentration averaging, specifying a number of constraints on concentration averaging.

The current update to the CA BTP is necessary due to the significant number of changes in the LLW program since the CA BTP was published in 1995. First, the Commission reviewed the 1995 CA BTP's position on blending of LLW in 2010 and directed the staff to revise it to be more risk-informed and performance-based. The 1995 version constrained the concentration of

certain waste types put into a mixture (e.g., ion exchange resins) to within a factor of 10 of the average concentration of the final mixture. The Commission directed the staff to replace this position and to implement a risk-informed, performance-based approach for LLW blending that made the hazard (i.e., the radioactivity concentration) of the final mixture the primary consideration for averaging constraints. Second, the NRC adopted a risk-informed, performance-based regulatory approach for its programs in the late 1990's, after the 1995 CA BTP was published. The revised CA BTP more fully reflects that approach, not just for the blending position, but for other topics as well. One example is for concentration averaging of sealed radioactive sources. The 1995 CA BTP significantly constrained disposal of sealed sources. Many sources have no disposal path because of the constraints recommended in the 1995 BTP. Licensees must store sealed sources for potentially long periods of time if there is no disposal option, and the sources are subject to loss or abandonment. The staff has re-examined the 1995 assumptions underlying the radioactivity constraints on their disposal. The CA BTP's revised positions are based on different, but conservative assumptions and will allow for the safe disposal of more sealed sources than the 1995 CA BTP. The revised position will enhance national security by ensuring that the safest and most secure method for managing sealed sources (i.e., permanent disposal in a licensed facility) is available to licensees.

III. Overview of Public Comments.

Revision 1 of the CA BTP has been developed after consideration of public comments on three drafts. The first draft (ADAMS Accession No. ML103430088) was noticed in the *Federal Register* on January 26, 2011 (76 FR 4739). The second draft (ADAMS Accession No. ML112061191) was made available to the public in September 2011, in advance of a public workshop held in Albuquerque, New Mexico, on October 20, 2011. The third draft (ADAMS

Accession No. ML121170418) was noticed in the *Federal Register* for public comment on June 11, 2012, (77 FR 34411). Information about obtaining these documents is available in the ADDRESSES section of this document.

Fifteen organizations representing a variety of interests submitted comments on the drafts. They included Federal and State agencies and organizations, a nuclear power plant research organization, disposal and waste processing facility licensees, industry professional organizations, an advocacy group, and a waste services company. These comments have been considered by the NRC staff in developing this revision to the CA BTP. An overview of the changes to the 1995 CA BTP is presented below. Detailed responses to each of the public comments are available in Vol. 2 of the revised CA BTP and in the drafts referenced above.

IV. Overview of Revisions.

The major changes to the 1995 CA BTP are summarized below. Appendix B of Volume 1 of the revised CA BTP has a more complete list of changes. The staff responses to individual public comments are contained in Section 3 of Volume 2 of the CA BTP. Finally, a summary of the changes to the May 2012 version published for public comment is available in ADAMS Accession No. ML14157A227.

Increase in cesium-137 sealed source activity limits. In the revised CA BTP, the staff has increased the limits for disposal of cesium-137 (Cs-137) sealed sources, using an improved technical basis and a reasonably foreseeable but conservative intruder scenario. Cesium-137 is used in sealed sources for research, medical, and industrial purposes. The recommended constraint on the size of these sources for disposal has been increased from 1.1 TBq (30 Ci) to 4.8 TBq (130 Ci), based on new, more risk-informed analysis. The revised CA BTP also

specifies a process that licensees should use to request review by Agreement State regulators of proposed disposals of larger activity sources.

Demonstration of adequate mixing in blended LLW. The revised CA BTP also addresses the Commission direction to "develop a clear standard for determining homogeneity" of blended waste. The 1995 CA BTP constrained the concentrations of inputs to a mixture of blended waste and therefore did not need to address the homogeneity of the final mixture. It included a "Factor of 10" concentration limit on waste blending which limited blending of waste streams with radionuclide concentrations to within a factor of 10 of the average concentrations in the blended product. The revised CA BTP specifies certain thresholds on radionuclide concentrations of waste streams that are blended together. Above these thresholds, licensees should demonstrate waste is adequately blended. Considerations for this demonstration are also discussed. The thresholds for demonstrating adequate blending and the guidance on demonstrating waste is adequately blended are based on a probabilistic dose assessment. This revision is risk-informed because of the method used to establish the threshold for the homogeneity demonstration. It is also performance-based because the position no longer constrains concentrations of *inputs* to a blending process but instead specifies criteria that the *output* (i.e., blended waste) must meet to protect an inadvertent intruder from potential hot spots in the waste.

Alternative Approaches. Another revision to the CA BTP is the addition of specific guidance for licensees to use in proposing site- or waste-specific averaging approaches, rather than the generic approaches specified in the body of the CA BTP. This revision is consistent with NRC's performance-based regulatory policy because it facilitates the use of other averaging approaches to meet the 10 CFR Part 61 performance objective of protecting an inadvertent intruder. The 1995 CA BTP stated that alternative approaches for averaging should be approved under NRC's regulation in 10 CFR 61.58. By referencing a provision in the

regulations that applies to alternatives to the *requirements* in 10 CFR Part 61 (and not NRC staff guidance like the CA BTP), performance-based approaches to intruder protection were in effect discouraged. In addition, not all regulatory authorities in Agreement States that license disposal sites have this provision in their regulations, and so the regulatory mechanism for obtaining approval of alternatives was not available to all licensees. That is, some regulators could not authorize deviations from the 1995 CA BTP under that provision, even though site-specific features may have justified other averaging approaches. The revised CA BTP acknowledges that site-specific and other approaches may be used, and deviations from staff guidance in the CA BTP do not need the 10 CFR 61.58 approval that was previously specified. Instead, the regulatory authority may approve another approach in the same manner used for deviations from other NRC guidance.

Risk-informed treatment of cartridge filters. In the 1995 CA BTP, cartridge filters, a waste type generated during the operation of nuclear power plants, were defined as discrete objects subject to certain averaging constraints on each filter. Each filter had to be radiologically characterized and fit within the specified averaging constraints of the 1995 CA BTP. While that default position remains in place, the revised CA BTP also allows for the treatment of such filters as blendable waste, with a documented justification. Characterizing the overall blendable waste mixture and classifying the mixture based on its total radioactivity, rather than individual items, is permitted for many other waste types in the revised CA BTP. This more risk-informed position is justified because in practice many filters do not present a gamma hazard to an intruder, based on their actual radionuclide concentrations.

Risk-informed averaging of other discrete waste items. The 1995 CA BTP constrained the averaging of discrete items with its Factors of 1.5 (which applied to primary gamma emitters) and 10 (which applied to other radionuclides). The factors applied to the *average* radionuclide concentrations in a mixture of certain discrete items, such as activated metals, such that the radionuclide concentrations in all items in a mixture had to be within those factors for the average of the mixture. These factors ensure uniformity of radionuclide concentrations in mixtures of items, but such mixtures could be uniformly low in concentration and risk. Thus, there is no relationship between the 1995 CA BTP position and acceptable risk (or dose). The revised CA BTP ties the averaging factors to the class limit for radionuclide concentrations (not the average of the mixture), which has a relationship to risk because the class limits are based on a dose of 5 mSv/yr (500 mrem/yr) exposure to an inadvertent intruder. The staff also revised the Factor of 1.5 to 2, since the uncertainty associated with intruder protection does not justify the precision implied by the first factor.

In developing the revised CA BTP, the staff identified one issue that may need further clarification. One of the categories of discrete wastes that are subject to special concentration averaging constraints is “contaminated materials.” The 1995 CA BTP defines contaminated materials as components or metals on which radioactivity resides on or near the surface in a fixed or removable condition. To demonstrate compliance with these averaging constraints, the radiological characteristics and volumes of individual items are typically determined. However, items with surface contamination may also be categorized as radioactive trash which is not subject to any special averaging constraints. Items in radioactive trash do not need to be individually characterized. Instead, a container of radioactive trash can be surveyed to determine its overall radioactivity and its classification determined by dividing the overall activity by the waste volume. Neither the 1995 CA BTP nor draft revisions published for public comment provided guidance for categorizing items as either contaminated materials or

radioactive trash. In addition, the staff received no comments from stakeholders on this issue. The staff will consider whether additional guidance, such as a Regulatory Issue Summary (RIS), is warranted for distinguishing contaminated materials from radioactive trash. The staff may also formally clarify or supplement other positions in the CA BTP at a later time, as necessary.

V. Congressional Review Act

This CA BTP is a rule as defined in the Congressional Review Act (5 U.S.C. 801-9808). However, the Office of Management and Budget has not found it to be a major rule as defined in the Congressional Review Act.

VI. Implementation

The revised CA BTP describes and makes available to NRC and Agreement State licensees, Agreement States, and the public, methods that the NRC believes are acceptable for implementing specific parts of the Commission's regulations. The positions in this document are not intended as a substitute for regulations, and compliance with them is not required. Agreement States may use this information in establishing waste acceptance criteria for their licensees who are operating waste disposal sites. Applicants and licensees may use the information in the revised CA BTP when developing applications for initial licenses, amendments to licenses, or requests for NRC regulatory approval. Licensees may use the information in the revised CA BTP for actions (i.e., in determining average radionuclide concentrations in waste) that do not require prior NRC review and approval. Licensees may also use the information in the revised CA BTP to assist in attempting to resolve regulatory or

inspection issues. Agreement States and current licensees may continue to use the previous guidance for complying with the concentration averaging provision in 10 CFR 61.55(a)(8) (i.e., the January 23, 1995, "Final Branch Technical Position on Concentration Averaging and Encapsulation"). Current licensees may also voluntarily use positions in this revised CA BTP.

In addition to the guidance in the revised CA BTP, licensees that ship waste for disposal in a 10 CFR Part 61 or Agreement State equivalent facility should ensure that the waste meets the concentration averaging provisions in the land disposal facility license. Where there are conflicts with this guidance, the land disposal facility license conditions issued by the regulatory authority (i.e., the Agreement State) must be met.

VII. Backfitting

The revised CA BTP revision describes a voluntary method that the NRC staff considers acceptable for complying with the regulation in 10 CFR 61.55(a)(8), regarding averaging of radionuclide concentrations for the purpose of determining waste classification. Compliance with the revised CA BTP is not an NRC requirement, and licensees and applicants may choose this or another method to achieve compliance with this provision in the 10 CFR Part 61. In particular, current licensees may continue to use the averaging positions in the 1995 CA BTP. The revised CA BTP does not require a backfit analysis, as described in 10 CFR 50.109(c), because (1) it does not impose a new or amended provision in the NRC's rules, (2) does not present a regulatory staff position that interprets the NRC's rules in a manner that is either new or different from a previous staff position; and (3) does not require the modification of, or

addition to, the systems, structures, components, or design of a facility, or the procedures or organizations required to design, construct, or operate a facility.

Dated at Rockville, Maryland, this 30th day of January, 2015.

For the Nuclear Regulatory Commission.

Larry W. Camper, Director,
Division of Decommissioning, Uranium Recovery
and Waste Programs,
Office of Nuclear Material Safety and Safeguards.

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