2015 Concentration Averaging Branch Technical Position

Implementation Questions and Answers

October 30, 2015
(Update 1: February 18, 2016)
(Update 2: March 2, 2016)
(Update 3: August 22, 2016)

1. **Is there a significant difference between the guidance in Revision 1 of the Concentration Averaging Branch Technical Position (CA BTP) on when to apply the Factor of 2, which replaced the 1995 CA BTP Factor of 1.5, and the 1995 CA BTP guidance on when to apply the Factor of 1.5?**

   The 1995 CA BTP guidance for activated metals, components incorporating radioactivity in their design, contaminated materials, and cartridge filters stated that the Factor of 1.5 should be applied to primary gamma emitting radionuclides when the primary gamma-emitting radionuclides "dictate the classification of the waste." Similarly, for these waste types, Revision 1 of the CA BTP states that the Factor of 2 should be applied to primary gamma-emitting radionuclides, "If the primary gamma-emitting radionuclides are classification-controlling." Revision 1 also states the Factor of 2 should be applied to sealed sources that are not encapsulated. In addition, the 1995 BTP stated that the Factor of 1.5 should be applied to cartridge filters in all cases, whereas Revision 1 only applies the Factor of 2 to cartridge filters when they are treated as discrete items instead of blendable waste.

   Revision 1 of the CA BTP provides a step-by-step process to determine whether the primary gamma-emitting radionuclides are classification-controlling, based on the process for determining waste classification in 10 CFR 61.55. The U.S. Nuclear Regulatory Commission (NRC) staff finds no significant difference between the phrases "dictate the classification of the waste" and "classification-controlling." However, some stakeholders have noted that the step-by-step process outlined in Revision 1 of the CA BTP may be slightly different from common practice in determining when primary gamma-emitting radionuclides dictate the classification of the waste.

2. **There is a provision in both the 1995 BTP and the revised BTP that if a container is at least 90 percent full, the nominal internal volume of the container can be used for averaging. This provision is included in Section 3.2.1, "Concentration Averaging for a Single Blendable Waste Stream," of Revision 1 of the CA BTP, but is not repeated in Section 3.2.2, "Concentration Averaging for Multiple Blendable Waste Streams." Does the provision apply to waste discussed in Section 3.2.2?**

   Section 3.2.1 of Revision 1 of the CA BTP addresses concentration averaging for a single blendable waste stream. There are three topics addressed in Section 3.2.1: 1.) using the nominal fill volume for containers filled to at least 90 percent; 2.) the averaging volume for absorbed liquids; and 3.) the treatment of small check sources. For efficiency, these provisions were not repeated in Section 3.2.2, "Concentration Averaging for Multiple Blendable Waste Streams." However, each of these three provisions also is applicable to blended waste (*i.e., mixtures of two or more blendable waste streams*) if the additional constraints in Section 3.2.2 are met. Similarly, each of these three provisions are applicable

to mixtures of multiple blendable waste types if the constraints of both Sections 3.2.2 and 3.4 are met.

3. **Section 3.4 of Revision l of the CA BTP addresses mixtures of two or more different waste types. However, for blendable waste, it only discusses physical and chemical compatibility of the waste types, it does not provide averaging constraints. What are the averaging constraints for mixtures of two or more blendable waste types?**

   Section 3.2.2 of Revision 1 of the CA BTP addresses blending of different waste streams within the same waste type. The phrases "of the same waste type" or “of a single waste type” were used in several places in Section 3.2.2 because additional constraints are recommended for blending waste streams of different waste types in Section 3.4 of the guidance. The guidance on blendable waste in Section 3.4 applies in addition to the guidance in Section 3.2.2. For efficiency and clarity, the guidance in Section 3.2.2 was not repeated in Section 3.4; however, the guidance in Section 3.2.2 is applicable to blending waste streams of different waste types, provided the additional constraints in Section 3.4 are met.

4. **If a generator pours resin into a HIC containing cartridge filters, and the cartridge filters are justified as being treated as blendable waste, does the operational efficiency clause apply?**

   Cartridge filters and resins are different waste types, even if the cartridge filters are justified as being treated as blendable waste. Therefore, as discussed in response to Question No. 3, the guidance in Section 3.2.2 and Section 3.4 is applicable to such a case. The generator determines if combining the waste types was done for operational efficiency, occupational safety, or occupational dose reduction. The NRC staff encourages licensees to communicate with disposal site State regulators on acceptable averaging practices; however, because this language in the 2015 CA BTP is very similar to language in the 1995 CA BTP, this provision should not result in a significant change in current practice. Because the resins and cartridge filters are different waste types, at least one of which is blendable, the licensee should document the physical and chemical compatibility of the waste types and make the documentation available for inspection.

5. **Given that Revision 1 of the CA BTP relies on the Uniform Waste Manifest (UWM) to identify waste types, can anion and cation exchange resins be considered a single waste type even though they are listed on the UWM separately?**

   Yes. Anion and cation resins need not be treated as separate waste types for the purposes of the CA BTP. Anion and cation resin are considered a single waste type for the purposes of the CA BTP just as primary and secondary resins are considered a single waste type (*but still different waste streams*). Similarly, for the purposes of the CA BTP, a bed of mixed ion exchange media is considered a single waste type (*even when charcoal is a constituent of the mixed bed*). Staff will look into further clarifying the UWM, which is currently undergoing revision.

6. **Revision 1 of the CA BTP provides guidance for single blendable waste streams, mixtures of two or more blendable waste streams of the same waste type, and mixtures of two or more blendable waste streams from different waste types. What guidance applies to single waste streams from multiple waste types?**

   As defined in the CA BTP, a waste type has a "unique physical description" and a waste stream has both "relatively uniform radiological and physical characteristics." Under the CA BTP, waste streams are subsets of waste types. That is, a waste type could contain separate waste streams, but a single waste stream would not include more than one waste type. Stakeholders have noted that there appears to be a different standard for physical uniformity applied to waste types as compared to waste streams, noting "a unique physical description" could be interpreted to be a more stringent standard than "relatively uniform" physical characteristics. Under the CA BTP, there is no distinction between these two phases. The term "unique physical description" was used for consistency with the definition of waste type in 10 CFR Part 20. For the purposes of the CA BTP waste types are not more physically uniform than waste streams.

   Other stakeholders asked specifically if mixed-bed resins represented a single waste stream that contains more than one waste type. For the purposes of the CA BTP, the purpose of distinguishing blendable waste types from one another is to determine when physical and chemical compatibility should be documented. In this case, because the different physical materials in a mixed bed resin are used in contact with one another, the physical and chemical compatibility are generally apparent, and the mixed bed resin can generally be treated as a single waste type for the purposes of the CA BTP.

7. **If a waste container is approximately 80 percent full, it is common practice to add non-radioactive material so that it reaches 85 percent full, which is a Waste Acceptance Criterion (WAC) at Barnwell. What happens if non-radioactive material is added to make the container 90 percent full? Can averaging then be used over the entire internal volume? Guidance in Revision 1 of the CA BTP says that added material should have a purpose other than lowering the classification. However, adding material to meet a WAC of 85 percent could be considered "necessary," and adding more non-radioactive material would make the waste package more stable (i.e., less void space), and would therefore have a purpose other than lowering the classification.**

   In general, it is not clear why licensees would add non-radioactive materials to containers to achieve an 85 percent - 90 percent fill volume when they could add radioactive material, which would likewise reduce void space. However, staff does not believe an increase of 5 percent constitutes an extreme measure; therefore, averaging could be used over the entire internal volume.

8. In the encapsulation guidance (Section 3.3.4), the CA BTP specifies that containers "up to" 9.5 m^3 may be used. Did staff mean to state "up to and including" 9.5 m^3?

Yes, as found in the CA BTP, staff interprets "up to" to mean the same as "up to and including."

9. If a generator has two partially filled waste containers, and combines them to fill void space and reduce the number of containers for disposal, is that "operational efficiency?"

In general, yes, this would be considered operational efficiency for the purposes of the CA BTP.

10. What does staff interpret as "extreme measures" to avoid when performing solidification, encapsulation, or thermal processing?

The term "extreme measures" is used in the 1995 BTP. As in the 1995 CA BTP, the staff interprets the phrase to mean that any non-radioactive material added to the waste should have a purpose other than lowering the waste classification (e.g., stabilization or thermal process control). Revision 1 of the CA BTP does not change the meaning of the term "extreme measures." As in the 1995 CA BTP, the staff has not specified any particular numerical constraints, and instead has chosen to allow State regulators flexibility in their determination of what constitutes "extreme measures."

11. Absent a specific numerical standard for "extreme measures," can the 14 percent waste loading criterion used for encapsulation in containers larger than 0.2 m^3 also be used for solidification and thermal processing?

The 14 percent waste loading value used in the encapsulation guidance is based on a topical report* for an encapsulation process submitted to the NRC and is not necessarily transferrable to solidification or thermal processing. The key factor in determining whether or not a particular waste loading would be appropriate for another process is to determine whether the material added has a purpose other than changing the waste classification. If a particular waste loading is the highest waste loading that allows for a solidified waste form to have the necessary properties to meet stability requirements (or other waste acceptance criteria) that waste loading would generally not be considered an extreme measure. Similarly for thermal processing, if the material added is needed for process control or to control some property of the final waste form, it would generally not be considered an extreme measure. The NRC staff encourages communication with disposal State regulators on these issues.

* Letter from Essig, Thomas H., Branch Chief, to Charles E. Jensen, President, Diversified Technologies Services, Inc., December 30, 1999, Agencywide Documents Access and Management System (ADAMS) Accession No. ML003672170.

12. Section 1.5 of the revised CA BTP states that the scope of this revised CA BTP is limited to the averaging of concentrations of radionuclides for the purpose of determining the classification of waste being shipped for disposal, as provided for by 10 CFR 61.55(a)(8). Does that mean that the CA BTP does not apply to waste being shipped for processing? How will NRC Regional Inspectors ensure concentration averaging is performed appropriately on waste sent to processors?

The CA BTP does not apply to waste being shipped from a waste generator to a waste processor. The CA BTP applies to waste after it is in final form and is being shipped directly to a licensed waste disposal facility for disposal. However, other NRC guidance and regulations (e.g., transportation guidance and regulations) apply to shipment of waste from a waste generator to a waste processor.

Radioactive material waste processors are licensed radioactive material facilities, and inspection of licensing requirements such as concentration averaging methods is evaluated as part of the processor's licensed activities. In Agreement States, the licensing authority for waste processors is the Agreement State, which conducts inspections. In non-Agreement States, the NRC is the licensing authority that conducts inspections.

13. If the CA BTP only applies to waste being shipped in final form for disposal, how does an inspector ensure accurate reporting of material shipped to processors that is ultimately destined for disposal in a licensee's annual reporting of waste shipments? If a licensee's Process Control Program states that the licensee will ship material to a processor and that processor will ultimately ship that material for disposal as waste, doesn't the NRC regional inspector have a responsibility to ensure concentration averaging is applied appropriately to that waste?

If waste is being shipped from an NRC licensed facility (i.e., the waste generator) to a waste processor, then such waste is not in final form for disposal. Therefore, an inspector will verify that the radioactive material shipment complies with the NRC and U.S. Department of Transportation (DOT) regulations for the transfer and shipment to a licensed waste processor. The regulator for the waste processor reviews the processor's concentration averaging to ensure that it is appropriate. This regulator may be the same entity as the generator's regulator (e.g., for materials licensees both regulated by the same Agreement State) or the regulators may be different (e.g., if the generator is an NRC licensee and the processor is regulated by an Agreement State). In either case, the responsibility for verifying correct application of the CA BTP belongs to the regulator for the licensee shipping the waste for disposal.

14. Will the revised CA BTP, and specifically the provisions for blendable waste, increase the practice of releasing material into the environment under Agreement State free release programs?

The CA BTP applies to classification of LLRW as Class A, B, or C. If a processor segregates waste into a stream that meets an Agreement State's free release program and a stream to be disposed of as LLRW, the CA BTP applies to the stream being sent for disposal as LLRW. The revision of the CA BTP is not expected to affect this segregation of waste streams because the revised CA BTP, like the 1995 CA BTP, is applicable to waste being sent for disposal as LLRW only.

Neither the 1995 CA BTP, nor the revised CA BTP are applicable to waste being sent for processing or to material released under an Agreement State's free release program.

15. Would a reactor vessel (e.g., the Trojan reactor vessel) be considered a "discrete item" under the revised CA BTP?

The revised CA BTP guidance on encapsulating discrete items limits the encapsulation volume to 9.5 m^3. Concentration averaging could be applied to a reactor vessel under an Alternative Approach as described in Section 3.8.4 of the revised CA BTP.

16. When cartridge filters are shredded and solidified, should the original or shredded volume of the filter be used to determine waste loading?

In the revised CA BTP, waste loading is only considered with respect to encapsulation. The revised CA BTP allows concentrations to be averaged over the final solidified waste form and does not constrain averaging with a numerical waste loading threshold. Thus, the NRC staff expects the generator or processor would use appropriate measurements (e.g., volume or mass) needed for adequate process control. The revised CA BTP specifies that any non-radioactive material added to the waste should have a purpose other than reducing the waste class. As in the 1995 CA BTP, the staff has chosen to give state regulators flexibility in their evaluation of the amount of non-radioactive material used to solidify waste.

17. Section 3.3.2.1 of the revised CA BTP provides a screening value of 1 mCi for discrete items. Can this value be interpreted to mean "up to and including" 1 mCi?

Yes, as found in the CA BTP, "up to" means the same as "up to and including."

18. Section 3.3.2.2 of the BTP states that for comparison to Table 2 values, items smaller than 280 cm^3 (0.01 ft^3) should be grouped together. Does that mean all items in the package smaller than 280 cm^3 should be included in a single sum, or can objects be grouped into smaller subsets that each meet the Table 2 values?

The technical basis for the revised CA BTP Table 2 values is the small-item carry-away scenario. In this scenario, a waste package is breached, and an intruder picks up and carries multiple small items (i.e., < 280 cm^3) from the package. Thus, for comparison to Table 2 activity limits, all items smaller than 280 cm^3 in a single waste package must be included in the sum. Alternatively, the licensee has the option of applying the Factor of 2 or 10, per Section 3.3 of the CA BTP, to each item individually.

19. Is Figure 5 of the revised CA BTP correct in showing 9.4 m^3 as an upper limit of encapsulation? The volume limit provided in the text is 9.5 m^3.

The value used in Figure 5 should have been 9.5 m^3.

The text of the revised CA BTP makes an incorrect conversion between 331 ft^3 and 9.5 m^3. The correct conversion for 331 ft^3 is 9.4 m^3. Because the difference between these values is less than 2 percent, and is much smaller than typical uncertainties in waste characterization data, the NRC staff determined this difference is not risk-significant and has chosen to use 9.5 m^3.

20. The first of four methods of waste characterization listed in Section 3.1.4 of the revised CA BTP is "compliance through materials compatibility". Should this be "materials accountability", which is the term used in the NRC 1983 BTP on waste classification?

Yes, this should read "materials accountability."

21. Section 3.3.4 of the revised CA BTP lists stability as one of the benefits encapsulation can provide but does not address stability in the averaging constraints for encapsulated items. Should Section 3.3.4 of the revised CA BTP list meeting stability requirements as a constraint to be met before concentrations can be averaged over encapsulating material?

As the questioner notes, Section 3.3.4 of the revised CA BTP does list stability as a potential benefit of encapsulation. However, neither the 1995 nor the revised CA BTP lists meeting stability requirements as a constraint for averaging over the encapsulated volume.

Class B and C waste must meet the stability requirement of 10 CFR 61.56(b). This requirement may be met by the encapsulating medium or by other means, such as disposing of waste in a high integrity container. In either case, a separate averaging constraint based on stability for Class B and C waste was unnecessary because stability is required by 10 CFR part 61.

For encapsulated waste forms that are disposed as Class A waste, 10 CFR part 61 does not require stability. As described in Section 4 of Volume 2 of the revised CA BTP, the NRC staff did not assume waste stability in calculating hypothetical intrusion doses. Instead, intrusion was assumed to occur at the end of the active institutional control period (i.e., 100 years after site closure), and the intruder was assumed to come into direct contact with the encapsulated waste (i.e., encapsulation was assumed to have failed). Therefore, the staff determined that changing the CA BTP guidance to state encapsulated Class A waste should provide stability like the 10 CFR 61.56(b) requirements for Class B and C waste was unnecessary.

22. Section 3.2.1 of the CA BTP states that if blendable waste fills 90 percent or more of a package, average radionuclide concentrations can be based on the entire interior volume of the container. If a resin liner has the fill bar (inlet connection point) at the 85% full mark, could the liner be filled with other "blendable" radioactive material to achieve a volume of 90 percent full, thereby allowing the concentration to be based on the entire internal volume?

Yes, if the final package meets the disposal site waste acceptance criteria, the liner could be filled to 90 percent full with other blendable radioactive waste and the concentration could then be based on the entire internal volume. As discussed in the response to Question 7, small amounts of non-radioactive material also could be used.

The CA BTP states containers of blendable waste should be at least 90% full to take credit for the entire internal volume of the container in averaging. Alternately, the waste volume or mass should be used. This guidance is similar to the 1995 CA BTP position for soils and contaminated trash. It was extended to all blendable waste in the 2015 CA BTP for simplicity, so that there would be one position for blendable wastes. NRC staff notes that 10 CFR 61.56(b)(3) requires licensees to minimize void spaces within waste (and between waste and its package) to the extent practical.

23. Section 3.2.3 of the CA BTP states that if multiple waste streams of a single waste type generated at a licensee's facility are aggregated for the purposes of operational efficiency, occupational safety, or occupational dose reduction, the aggregated waste can be treated as a single waste stream for the purposes of the CA BTP. Does this mean that multiple waste streams (e.g., primary resin and secondary resin) placed in the same liner could be considered to be a single waste stream, thereby allowing the 90 percent fill provision of Section 3.2.1 to be used?

Yes, if primary and secondary resins are combined at a generating facility for operational efficiency, occupational safety, or occupational dose reduction, they can be treated as one waste stream and the 90 percent fill provision of Section 3.2.1 of the 2015 CA BTP can be applied.

24. Does the treatment of multiple waste streams as a single waste stream discussed in Question 23 contradict the definition of a waste stream as defined in Section 1.1.1 of the 2015 BTP?

No. The 1995 CA BTP allowed waste streams aggregated at a generating facility for the purposes of operational efficiency or occupational dose reduction to be combined without being subject to any 1995 CA BTP constraints on "mixing". The corresponding provision in the 2015 CA BTP is very similar to the text of the 1995 CA BTP except that it adds

“occupational safety” (i.e., non-radiological industrial safety considerations) as an acceptable basis for applying the provision. The provision does not contradict the definition of a waste stream. Rather, it recognizes that different waste streams are being combined but allows them to be averaged as if they are a single waste stream if they are combined for specific purposes (i.e., operational efficiency, occupational safety, or occupational dose reduction).