Attachment
23-TF-0023

TBI LDR Variance Petition

(27 Pages Including Cover Sheet)

Table of Contents

LIST OF TABLES

I. PETITIONER INFORMATION

The U.S. Department of Energy ("DOE") submits this variance to the U.S. Environmental Protection Agency ("EPA") pursuant to 40 C.F.R. §268.44(a).

Petitioner and Facility Owner/Operator:
U.S. Department of Energy, Office of River Protection
P.O. Box 450
Richland, WA 99354

Facility Location:
Hanford Facility
200 West Area, Double Shell Tank 241-SY-101
Benton County
Richland, WA 99354
RCRA ID No.: WA7890008967

Facility Contact:
Name: Brian Vance
Title: Manager, Office of River Protection
Telephone No.: (509) 376-7395
Fax No.: (509) 372-0712

II. STATEMENT OF INTEREST IN THE PROPOSED ACTION

DOE's Hanford Site currently stores approximately 54 million gallons of waste in underground storage tanks, in part, from the reprocessing of spent nuclear fuel.[1] The wastes consist of both radioactive and hazardous components, referred to as "mixed waste." DOE regulates certain radioactive materials, including the radioactive portion of mixed waste at Hanford, pursuant to its sole authority under the Atomic Energy Act of 1954 ("AEA"), 42 U.S.C. §§ 2011, *et seq*. The hazardous portion of the mixed waste is managed pursuant to the Resource Conservation and Recovery Act ("RCRA") and the regulations promulgated thereunder.

Previously, in 2013, DOE updated its decision to separate tank wastes with low levels of long-lived radionuclides (referred to low-activity waste or "LAW") from other tank waste, and to vitrify some of the LAW at the Hanford Tank Waste Treatment and Immobilization Plant ("WTP").[2] The vitrified waste form will be disposed of onsite at Hanford's Integrated Disposal Facility. However, the WTP was designed to treat only a portion of the LAW from the Hanford tanks. For the remaining LAW, DOE did not select a treatment method and found it would be "beneficial to study further the potential cost, safety, and environmental performance of supplemental treatment technologies."[3]

In order to evaluate the feasibility of a supplemental treatment technology that may accelerate and reduce costs associated with the disposition of Hanford tank waste, DOE proposed the Test Bed Initiative ("TBI") Demonstration. The TBI Demonstration involves: (1) the onsite separation and pretreatment[4] of supernate from Tank SY-101, located in the 200 West Area on the Central Plateau of the Hanford Site[5]; (2) transport of the pretreated liquid waste to an offsite treatment facility for treatment using stabilization/solidification (grouting); and (3) disposal of the grouted waste form at an off-site commercial disposal facility. An overview of the proposed TBI Demonstration is illustrated below in Figure 1.

---

[1] The Plutonium Uranium Extraction ("PUREX") Facility was shut down in December 1988. A stabilization campaign was then performed between November 1989 and March 1990 to reduce the special nuclear material inventory at the PUREX Facility. During the stabilization campaign, the last spent fuel was processed at Hanford at the PUREX Facility; thus March 1990 was the date spent fuel was last processed at Hanford. After spent fuel processing ceased, DOE placed the PUREX Facility in standby mode and the facility was subsequently deactivated. See WHC-SP-1147, Revision 1, *PUREX/OU3 Facilities Deactivation Lessons Learned History*, Westinghouse Hanford Company (September 1996).

[2] See DOE, *Record of Decision for the Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richard, Washington*, 78 F.R. 75913 (Dec. 13, 2013).

[3] See 78 F.R. 75916.

[4] Separation and pretreatment involve in-tank settling, followed by decanting, filtration of solids, and use of a crystalline silicotitanate ion exchange media to capture and remove key radionuclides (primarily cesium (Cs-137) strontium (Sr-90)) from the supernate.

[5] Tank SY-101 consists of two layers: the supernate, which comprises approximately 81% of the tank volume, and an undissolved salt cake layer beneath the supernate. Tank SY-101 supernate can be considered further stratified based on density, with an upper supernate layer that comprises over 60% of total tank volume and a lower supernate layer comprising approximately 20% of tank volume. While Tank SY-101 contains only salt cake and supernate layers, other tanks at Hanford also consist of a sludge layer below the salt cake and supernate.

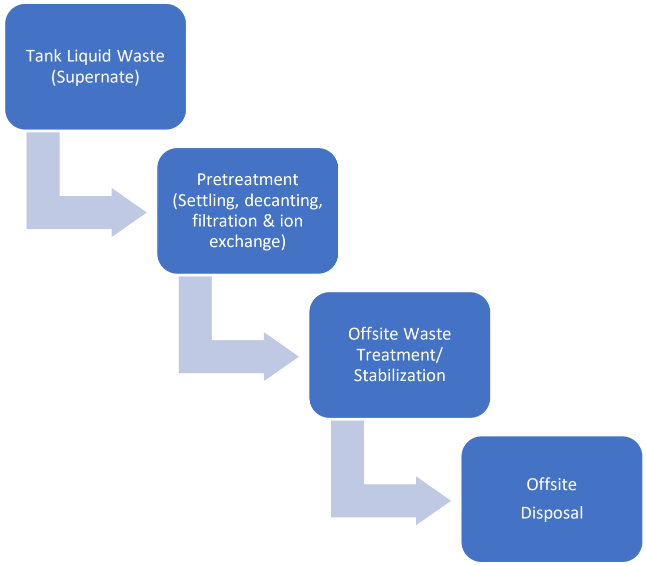

Figure 1: Test Best Initiative Demonstration Overview (source: TBI Environmental Assessment)

In 2017, DOE completed a laboratory-scale test of the TBI approach (also referred to as the "3-gallon TBI Demonstration") with a three-gallon sample of LAW consisting of a composite of several Hanford tank waste samples, in accordance with RCRA's treatability study provisions. The pretreated sample was transported to and successfully grouted at the Perma-Fix Northwest ("PFNW") facility in Richland, Washington, and disposed of at the Waste Control Specialists ("WCS") Federal Waste Facility near Andrews, Texas.

DOE now proposes to implement the TBI Demonstration on an engineering-scale with approximately 2,000 gallons of Tank SY-101 supernate (also referred to as the "2,000-gallon TBI Demonstration"). In accordance with DOE Order 435.1 Chg 2(AdminChg), *Radioactive Waste Management* and DOE Manual 435.1-1 Chg 3(LtdChg), *Radioactive Waste Management Manual*, DOE completed a Waste Incidental to Reprocessing ("WIR") Evaluation for the 2,000-gallon TBI Demonstration in March 2023.[6] Based on the WIR Evaluation, DOE determined that the pretreated waste from tank SY-101 is waste incidental to the reprocessing of spent nuclear fuel, is not high-level waste, and is to be managed as low-level waste.[7]

DOE also completed a Final Environmental Assessment ("Final EA") for the 2,000-gallon TBI Demonstration in accordance with the National Environmental Policy Act ("NEPA"), and DOE's NEPA implementation regulations, 10 CFR Part 1021[8] In the Final EA, DOE analyzed the environmental impacts associated with the following four alternatives for the treatment (grouting) and disposal of the pretreated 2,000 gallons of liquid waste from Tank SY-101:

---

[6] *Final Waste Incidental to Reprocessing Evaluation for the Test Bed Initiative Demonstration* (hereinafter, "WIR Evaluation") (March 2023); see 88 F.R. 16615 (March 20, 2023).

[7] *Waste Incidental to Reprocessing Determination for the Test Bed Initiative Demonstration at the Hanford Site, Washington* (hereinafter, "WIR Determination") (March 16, 2023); see 88 F.R. 16615.

[8] *Final Environmental Assessment of the Test Bed Initiative Demonstration*, DOE/EA-2086 (March 2023).

- Alternative 1: Treatment at PFNW, located in Richland, Washington
- Alternative 2: Treatment at Perma-Fix DSSI Facility, located in Kingston, Tennessee
- Alternative 3: Treatment and Disposal at WCS, located in Andrews County, Texas
- Alternative 4: Treatment and Disposal at Energy*Solutions*, located in Clive, Utah

Under Alternatives 1 and 2, disposal of the grouted waste form would take place at either WCS in Texas or Energy*Solutions* in Utah. Thus, for the 2,000-gallon TBI Demonstration, all the treatment facility options are offsite and located outside the State of Washington, with the exception of PFNW, and all disposal facilities are located outside the State of Washington.

The process totes used to transport the pretreated liquid waste offsite for treatment will meet all applicable U.S. Department of Transportation ("USDOT") requirements under 49 CFR Subchapter C. If Alternative 1 or 2 is selected, the grouted waste will then be containerized in 55-gallon drums and shipped in compliance with USDOT requirements to the commercial facility in either Andrews County, Texas or Clive, Utah for disposal.

Based on the Final EA, DOE did not find any significant impacts for any of the alternatives that were evaluated, and accordingly issued a Finding of No Significant Impact ("FONSI") on March 16, 2023. DOE did not have a preference among the various alternatives considered in the Final EA.

As discussed in the Final EA, the 2,000-gallon TBI Demonstration will accomplish the following near-term objectives:

- Demonstrate the capability to separate and pretreat approximately 2,000 gallons of low-activity supernate from tank SY-101, using in-tank settling, followed by decanting, filtering, and ion exchange ("IX") media in an In-Tank Pretreatment System (ITPS);
- Demonstrate IX performance to remove most of the cesium from the liquid waste stream;
- Verify the ability for the pretreated waste to meet the waste acceptance criteria for an offsite, commercial, permitted treatment facility and a permitted and licensed commercial disposal facility;
- Demonstrate the efficiency, cost-effectiveness, and feasibility for potential full-scale application;
- Establish that all activities can be performed safely and will protect human health and the environment.[9]

In parallel to this treatment variance petition, DOE is obtaining a Research Development & Demonstration ("RD&D") Permit to perform the pretreatment activities from the State of

[9] See Final EA, p. 1-4 – 1-5; see, also, Final WIR Evaluation, p. 4-20 – 4-21.

Washington Department of Ecology ("Ecology").[10] Additional objectives of RD&D activities associated with the 2,000-gallon TBI Demonstration include:

- Obtain chromium treatment data to develop inorganic retention factors for predicting nonwastewater ("NWW") universal treatment standards ("UTS") compliance in stabilized waste;[11]
- Use pretreated waste from the process totes to develop an improved laboratory preparatory method for future use to lower method detection limits for LDR organic constituents in Hanford tank waste. LDR organic method detection limit improvements are being developed for semi-volatiles (SW-846 method 8270), volatiles (SW-846 method 8260), and polychlorinated bi-phenyls (SW-846 method 8082).[12]

The 2,000-gallon TBI Demonstration will also allow DOE to evaluate the regulatory pathways by which pretreatment, stabilization/solidification (grouting), and offsite disposal could be implemented for full-scale operations. Regulatory uncertainty associated with requirements of the RCRA Land Disposal Restrictions ("LDR") Program, discussed in greater detail below, is one issue that must be addressed in order to: (i) implement the 2,000-gallon TBI Demonstration; and (ii) implement future alternative treatment by stabilization of additional LAW from Hanford tank waste, and dispose of the grouted waste form at an offsite commercial facility (hereinafter, referred to "Alternative Treatment"). Through discussions with EPA and the State of Washington, a treatment variance under 40 C.F.R. § 268.44(a) was evaluated as one potential regulatory mechanism for addressing that uncertainty (without a need to resolve the underlying differences in regulatory interpretation regarding the applicability of LDR treatment standards) for both the 2,000-gallon TBI Demonstration and future Alternative Treatment. Any treatment variance for Alternative Treatment would be submitted as a separate petition at a later date, as appropriate.

---

[10] ORP-67633, *2,000-Gallon Test Bed Initiative Demonstration Research, Development, and Demonstration Permit Application*, Revision 0 [June 8, 2023] (hereinafter, "RD&D Permit Application"), as amended or supplemented.

[11] See Section IV.b, below, for a more detailed discussion on chromium.

[12] Organics analysis of Hanford tank waste supernatant presents difficulties due to its matrix and radioactivity. Hanford is thus exploring a new laboratory preparation method to lower the detection limit of organics. One such method, Stir Bar Sorptive Extraction, uses a stir bar coated with a non-polar material that adsorbs organic compounds from a liquid or the headspace above a liquid. The stir bar is removed, rinsed, placed in a thermal desorption unit, and analyzed by gas chromatography/mass spectrometry. The use of Stir Bar Sorptive Extraction is one element of the RD&D permit application.

III. DESCRIPTION OF THE PROPOSED ACTION AND NEED FOR VARIANCE

This Petition seeks to establish a regulatory framework and path forward for effectuating the 2,000-gallon TBI Demonstration. Based on the results of the 2,000-gallon TBI Demonstration, DOE plans to develop an LDR treatment standard compliance strategy for future Alternative Treatment options using stabilization/solidification as a treatment technology for the final waste form.

a. The Standard Requested – STABL

This Petition seeks to establish STABL as the treatment standard for the 2,000-gallon TBI Demonstration. The EPA-approved STABL treatment technology is described as "[s]tabilization with the following reagents (or waste reagents) or combinations of reagents: (1) Portland cement; or (2) lime/pozzolans (e.g., fly ash and cement kiln dust)…" 40 C.F.R. § 268.42. To comply with STABL, the offsite commercial treatment facilities are required to use the appropriate stabilization methods that meet EPA requirements in accordance with the facilities' waste permits and radioactive material licenses, as applicable.

As mentioned above, a primary driver for this variance petition is DOE and Washington's differing interpretations of certain LDR requirements as they apply to separated and pretreated tank waste (i.e., tank waste from which key radionuclides have been removed), resulting in regulatory uncertainty with respect to use of a cementitious matrix for treatment and subsequent disposal of that waste. A key difference between DOE and Ecology's interpretations relates to the applicability of the HLVIT LDR treatment standard. Under RCRA and authorized Washington regulations, treatment by HLVIT applies to the subcategory of radioactive high-level wastes generated during the reprocessing of fuel rods and bearing the waste codes D002 and/or D004 through D011.[13] 40 C.F.R. §§ 268.40, 268.42.[14]

DOE's interpretation of LDR requirements is that, following separation of high- and low-level waste fractions (as in the case of pretreated Tank SY-101 supernate under the 2,000-gallon TBI Demonstration), the low-level waste fraction is not subject to the HLVIT treatment standard and thus is not required to be vitrified. Washington interprets the LDR requirements such that HLVIT would remain attached to the separated, pretreated low-level fraction of the tank waste, and would need to be removed through some regulatory vehicle, such as a treatment variance, in order for that waste to be grouted.

As a threshold matter, it is critical to DOE that this Petition, and any resulting variance issued by EPA, do not represent a concession that the HLVIT standard applies to any mixed waste

---

[13] Washington has indicated that the disagreement stems primarily from how RCRA's "point of generation" principle applies to Hanford tank waste. For Washington's statements describing its position, see, e.g., Government Accountability Office ("GAO"), GAO 22-104365, p. 41, *Actions Needed to Enable DOE Decision That Could Save Tens of Billions of Dollars* (2021) ("According to Ecology officials, RCRA regulations require mixed low activity waste that has been reclassified from mixed HLW to be vitrified because the applicable land disposal treatment standards remain attached to the waste until the applicable treatment standards, or alternative standards established through a treatability variance, have been met.").

[14] See, also, WAC 173-303-140, which incorporates by reference 40 CFR 268 at WAC 173-303-140(2)(a).

that is the subject of this Petition, or to any low-level waste fractions that may be addressed in the future under a separate petition for Alternative Treatment. Rather, DOE is submitting this 2,000-gallon TBI Demonstration Petition to facilitate both the 2,000-gallon TBI Demonstration and potential future Hanford tank waste Alternative Treatment notwithstanding the Parties' differing interpretations of RCRA requirements. DOE fully reserves its rights to contest the applicability of the HLVIT treatment standard and other LDR Program requirements in any future administrative or judicial context or proceeding.

This Petition does not request that EPA resolve DOE and the State's differing interpretations of LDR requirements, or that EPA reach its own conclusions on the issue; rather, this Petition simply requests a variance to STABL as the treatment standard for all applicable waste codes, *regardless of whose interpretation forms the starting point of a variance analysis*. In addition, DOE notes that establishing the regulatory pathway for a technology-based standard will be critical to evaluating future alternative and supplemental treatment options for supplemental LAW.

b. Post-Treatment Sampling

A table of hazardous constituents based on the Double-Shell Tank ("DST") Part A waste codes and Underlying Hazardous Constituents ("UHCs") in Tank SY-101 upper layer supernate,[15] along with their corresponding NWW numerical treatment standards under 40. C.F.R. § 268.40 and 268.48, as applicable, is provided in **<u>Table 1</u>**, attached.

As a general matter, treatment and disposal facilities are required to conduct post-treatment sampling to determine whether LDR standards have been met, unless the applicable treatment standard is a specific technology, such as STABL. Thus, while there would typically be no post-treatment sampling where STABL is the LDR standard, DOE will need the treatment and/or disposal facility to perform post-treatment sampling regardless, in the *limited* context of the 2,000-gallon TBI Demonstration to support and inform the development of Alternative Treatment, and to verify immobilization of inorganic constituents.

Accordingly, in this Petition DOE is proposing a unique approach that is distinct to the 2,000-gallon TBI Demonstration, whereby the variance would establish STABL as the treatment standard but with the additional condition that no treated waste shall be land disposed unless the

[15] The waste codes in Table 1 are the EPA waste codes identified in the Double-Shell Tank System Dangerous Waste Permit Application, Part A Form, Rev. 4, December 15, 2009, with the exception of F039 (because the DST System has not accepted waste bearing that waste code). The data provided in Table 1 is derived from the *Final Analytical Report for Tank 241-SY-101 TBI Grab Sampling 2018*, RPP-RPT-61303 Rev. 05 (October 2020).

Tank SY-101 supernate displays the characteristic for only a limited subset of the waste codes listed on the DST System Part A Form. See RD&D Permit Application, Sec. 4.1.2 and Table 4-1. However, all waste codes that appear on the DST System Part A Form (with the exception of F039 for the reason above and Washington-only waste codes) are included in this Petition. With respect to D001 and D003 in particular, Tank SY-101 supernate does not exhibit the characteristics of ignitability and reactivity before or after pretreatment, and it is highly possible the DST System has never received waste exhibiting those characteristics. However, even if Tank SY-101 received such waste, DOE considers the D001 and D003 characteristics to have been deactivated in storage in the tanks. Moreover, there would be no need to separately address UHCs associated with the D001 and D003 waste codes since UHCs are accounted for by the corrosivity and toxicity characteristics.

post-treatment sampling conducted by the treatment/disposal facility shows that the final waste form also meets the NWW numerical standards at § 268.40 and, as applicable, at §268.48. The LDR notification/certification required by 40 CFR § 268.7(a) will be prepared using the NWW UTS since the pretreated liquid waste requires treatment offsite, and will reflect the final grouted waste form to be certified for disposal by the offsite commercial treatment facility.

For clarity, DOE is not proposing that post-treatment sampling results be the basis for certifying that LDR requirements have been met since the LDR treatment standard requested is a technology-based standard. However, for purposes of this small-scale demonstration of a potential treatment pathway, the treatment facility will ensure that if, in the extremely unlikely event post-treatment sampling shows exceedances above the NWW numerical standards, the waste will be treated (grouted) until those standards are met before the waste is land disposed.

c. Approach for the 2,000-gallon TBI Demonstration Treatment Variance

The scope of this Petition is limited to 2,000 gallons of Tank SY-101 supernate under the TBI Demonstration, and the commercial treatment and disposal facilities that DOE assessed as part of the Final EA and resulting FONSI, discussed in Section II above. DOE may also in the future seek a variance to a technology-based standard for stabilization/solidification of all waste codes relating to Alternative Treatment of Hanford tank waste, but without the post-treatment sampling that is a distinct aspect of this 2,000-gallon TBI Demonstration Petition.[16]

The 2,000-gallon TBI Demonstration will allow DOE to build and document its basis for future full-scale Alternative Treatment operations and a potential technology-based treatment standard in connection with those operations. DOE is not in this Petition requesting that EPA determine the appropriateness of a technology-based standard for potential future tank waste Alternative Treatment; any information provided concerning potential Alternative Treatment is intended solely to provide context and additional background. In addition, it is critical to DOE that this Petition and any resulting variance do not in any way limit DOE's treatment and disposal

[16] See *Follow-on Report of Analysis of Approached to Supplemental Treatment of Low-Activity Waste at the Hanford Nuclear Reservation*, SRNL-STI-2023-00007, Revision 0, January 2023 (hereinafter, "2023 FFRDC Follow-On Report"), Vol I p. 29, Vol II p. A-18, C-6 and C-14, for discussion of a "sample and send" approach as part of the Hanford tank waste alternative treatment LDR strategy. The term "sample and send" refers broadly to the sampling of a feed candidate tank to confirm the pretreated waste meets the waste acceptance criteria of the treatment facility, and that the final grouted waste form would meet LDR NWW numerical treatment standards. For the 2,000-gallon TBI Demonstration, the process totes are analogous to the "feed candidate tank" for "sample and send" because the process totes contain the pre-treated waste. If DOE in the future elects to request a variance for Alternative Treatment, a variance based on "sample and send" would seek to establish compliance with LDRs through a technology-based standard to eliminate, as a general matter, the need for post-treatment sampling in view of considerations such as minimizing exposures to mixed waste under the principle of As Low As is Reasonably Achievable ("ALARA").

Crucially, however, "sample and send" and the establishment of a technology-based standard are not intended to allow for land disposal of grouted waste that would otherwise exceed the NWW numerical treatment standards; rather, it is expected that if a variance will be requested for Alternative Treatment, it would allow for use of a technology-based standard, subject to pretreated liquid waste meeting certain concentration-based parameters (to be established) that would ensure constituent concentrations in the grouted waste form meet the NWW numerical standards. A calculation method would need to be developed to convert organic levels in pretreated liquid tank waste to predicted concentrations in stabilized/solidified waste.

options in the future for Alternative Treatment to those that are addressed and discussed in this Petition for the 2,000-gallon TBI Demonstration. The treatment program for future Alternative Treatment is under development, and any DOE determinations and decisions concerning alternative treatment of Hanford tank waste will be subject to, for example, the requirements of NEPA and DOE Orders and Manuals, as applicable.

d. Treatment and Disposal Facility(ies) Selected

As discussed above, DOE considered several commercial facilities for offsite treatment and disposal in its Final EA and did not find any significant impacts for any of the alternatives that were evaluated. DOE subsequently selected both WCS in Andrews County, Texas and Energy*Solutions* in Clive, Utah for the 2,000-gallon TBI Demonstration.[17] Approximately half of the pretreated liquid waste will be transported to Energy*Solutions* for treatment and disposal, and the other half will be transported to WCS for treatment and disposal at its Federal Waste Facility.[18]

IV. JUSTIFICATION

a. Technically Inappropriate – 40 C.F.R. § 268.44(a)

Pursuant to 40 C.F.R. § 268.44(a)(2)(i), a variance may be approved if it is technically inappropriate to treat the waste to the level specified in the treatment standard, or by the method specified as the treatment standard, even though such treatment is technically possible.

Under the LDR program, EPA has recognized grouting as an effective and acceptable treatment for inorganic constituents. When EPA established the UTS in 1994, EPA reviewed historical Best Demonstrated Available Technology ("BDAT") determinations for inorganic and organic treatment standards and discussed a variety of treatment technologies.[19] However, that effort did not specifically address mixed waste. For mixed waste, the most comprehensive discussion can be found in EPA's promulgation of the Third Third Rule in 1990, in which EPA found the following:

> The Agency believes that for treatment of metals in low level mixed wastes and for some TRU mixed wastes containing low radioactive components, chemical precipitation will remove the metals in wastewaters, and stabilization technologies will reduce the leachability of the metal constituents in nonwastewater matrices.

[17] See *Memorandum: Approval of Exemption of Use of Non-U.S. Department of Energy Facilities for the 2,000-Gallon Test Bed Initiative Demonstration* (June 8, 2023).

[18] EPA had indicated to DOE that, in evaluating a petition for a variance, EPA may require additional information regarding the stabilization methods or technologies utilized by the specific treatment facility(ies) selected. Energy*Solutions* and WCS provided information directly to EPA concerning their treatment processes and use and/or development of grout formulations, to the extent available, on June 26 and June 28, 2023, respectively.

[19] See, e.g., 59 F.R. 47982 (September 19, 1994).

> These are the same technologies that are applicable to nonradioactive wastes containing metals.
>
> DOE submitted data demonstrating the applicability of stabilization as a treatment technology for the low level waste fractions that are separated from the high level waste generated during the reprocessing of fuel rods. As used by one particular facility, a stabilization process called grout stabilization involves blending commercially produced cement based reagents with the liquid low level waste fraction. The material sets up as a solid mass, immobilizing the waste. The performance data indicate[d] that stabilization provides immobilization of the characteristic metal constituents and radioactive contaminants for this low level radioactive waste, and that it is possible to stabilize the RCRA hazardous portions to meet the treatment levels for the characteristic metals.
>
> [55 F.R. 22626-2627 (June 1, 1990).]

Accordingly, DOE is proposing to use stabilization through grouting (STABL) to immobilize the characteristic metal constituents in the pretreated, low-level mixed waste under the 2,000-gallon TBI Demonstration.

While under the LDR program grouting is generally not considered an adequate form of treatment for organics, the very low levels of organics present in the supernate layer of Tank SY-101 make the 2,000-gallon TBI Demonstration a perfect candidate to demonstrate the regulatory pathway for a technology-based treatment standard for grouting under the approach discussed herein. As shown in Table 1, sampling results from Tank SY-101 supernate show that only one LDR organic (1-butanol, a UHC also referred to as n-Butyl alcohol) has a laboratory detection limit (2.78 mg/L) slightly above the NWW concentration-based standard (2.6 mg/kg). Given the detection limit, it is entirely possible that 1-butanol is below this standard. All other LDR organics were detected at levels at least one order of magnitude below the NWW concentration-based treatment standards. Since the organics concentrations in the pretreated liquid waste are below, or in the case of 1-butanol, essentially below, the NWW standards, it would be technically inappropriate to require targeted organics destruction or removal in addition to grouting. <u>See</u> **<u>Table 1</u>**, attached, for a detailed list of LDR organic constituents in Tank SY-101 supernate and the sampling result for each constituent.[20, 21]

---

[20] Table 1 contains many LDR organics because the November 2018 Tank SY-101 upper layer sample results were compared to the LDR WW Universal Treatment Standards ("UTS") for purposes of demonstrating method detection limits ("MDL"). Thus, constituents either were detected above the WW standards or reported at the MDL when the MDL exceeds the WW UTS appear in Table 1. The Hanford 222-S Laboratory was generally able to demonstrate MDLs below the WW UTS for volatile constituents. Demonstrating MDLs below WW UTS for semi-volatiles was more difficult, which is why semi-volatile constituents dominate the list of organic constituents in Table 1.

[21] Additionally, EPA previously issued and solicited comments on a draft interpretative memorandum regarding stabilization of organics for purposes of LDR compliance. Although the memorandum does not appear to have been

DOE expressly reserves its arguments and bases for any future variance petition that may be submitted in connection with future alternative treatment of Hanford tank waste. Thus, DOE requests EPA's confirmation that any variance issued pursuant to this Petition for the 2,000-gallon TBI Demonstration not bind or otherwise preclude DOE from raising – or EPA from granting a variance based upon – any legal or technical arguments or bases for future alternative treatment, particularly, for example, in view of the difficulties of treating mixed waste streams.

Moreover, while DOE is not conceding by submittal of this Petition that the HLVIT requirement applies to pretreated Tank SY-101 supernate for the 2,000-gallon TBI Demonstration, under Washington's interpretation of LDR requirements it would also be technically inappropriate to require vitrification.

In promulgating the Third Third Rule that established the HLVIT treatment standard, EPA expressly recognized the effectiveness of grouting for immobilizing inorganic hazardous constituents in low-level radioactive waste, as discussed above. See 55 F.R. 22626-2627.

EPA also recognized that high- and low-level waste fractions could be separated using various separation technologies, and that by separating those waste fractions, the amount of waste requiring vitrification could be reduced:

> DOE provided information to support that vitrification is an applicable technology for their high-level wastes generated from the reprocessing of fuel rods. Treatment can be accomplished by using either direct vitrification or a more complex treatment process which includes a series of chemical steps that separate the low-level radioactive waste fractions from the high-level radioactive waste. The high-level radioactive portion is then vitrified. When using separation technologies such as precipitation followed by settling or filtration, the bulk of the radioactivity can be incorporated into a high-level liquid waste containing up to 99 percent of the radioactivity of the original irradiated fuel rods. By separating high-level and low-level mixed wastes, the amount of high-level waste that may require vitrification treatment can be reduced. (emphasis supplied).
>
> [55 F.R. 22627.]

Thus, the efficacy of grout for immobilizing the inorganic hazardous components of mixed waste has long been recognized.

---

finalized, it does illustrate some of EPA's concerns at the time regarding stabilization of organics, as well as EPA's recognition that stabilization is acceptable for organics treatment in some situations. EPA specifically identified several situations constituting examples of impermissible dilution of organics, and none of those situations identified by EPA is present with respect to the grouting of pretreated Tank SY-101 supernate. This further supports that requiring pretreatment of organics prior to offsite stabilization/solidification would be technically inappropriate. See 62 F.R. 52918, October 18, 2001, announcing the draft September 2001 *Interpretative Memorandum on the Stabilization of Organic-Bearing Hazardous Wastes*.

In view of the efficacy of grout, vitrification of pretreated Tank SY-101 waste would be technically inappropriate since vitrification would result in additional secondary impacts, requires significantly more time to implement, and is significantly more costly.

Specifically, when LAW is vitrified, the water present in LAW is not incorporated into the glass matrix as part of the treatment process. Thus, the water content initially present in the LAW, as well as any water produced as part of the treatment process (primarily from operations of the offgas system), must then be recycled back into the vitrification system or managed as a liquid secondary waste, which would contain low levels of radionuclides and hazardous constituents not otherwise immobilized or destroyed by the glass-forming step. In contrast, when pretreated LAW is grouted, the water content is incorporated into the cementitious matrix. Vitrification also generates a high quantity of secondary waste streams (such as high-efficiency particulate air filters, carbon adsorber beds, spent or failed melters, and melter components including thermowells, level detectors and consumables, bubblers, and spout assemblies), whereas grouting generates minimal secondary wastes.[22] Furthermore, vitrification is a high temperature process that, as mentioned above, generates offgas that requires management and treatment for worker and public protection, whereas grouting takes place at much lower temperatures and is less energy-intensive than vitrification.[23] Therefore, for LAW, which can be adequately treated by stabilization, vitrification presents unnecessary secondary and environmental impacts. These considerations are consistent with EPA guidance in relation to 40 C.F.R. § 268.44(a)(2)(i) that treatment may be technically inappropriate when it is "unsuitable or impractical from a technical or environmental standpoint."[24]

In addition, vitrification would be inappropriate because it would result in a longer tank cleanup mission and delay or prolong the retrievals of tank waste from single-shelled tanks ("SST") at the site. A total of 149 SSTs were constructed and entered service at Hanford between the 1940s and 1960s. Double-shell tank ("DST") space in West Area is needed to allow for the receipt of waste retrievals from the aging SSTs. The availability of DST space is thus integral to DOE's cleanup mission at Hanford. Grouting supplemental LAW would allow DOE to remove and treat waste from DSTs sooner, facilitating DOE's ability to meet its SST retrieval schedule, and allow DOE to complete its cleanup mission in less time than vitrification.[25] In a peer-reviewed report issued in 2019, the Federally Funded Research and Development Center ("FFRDC") found that grouting supplemental LAW would take 8 to 13 years to implement. In contrast, vitrification

---

[22] See, 2023 FFRDC Follow-On Report, Vol. I, App. B.

[23] See, 2023 FFRDC Follow-On Report, Vol. I, p. 3-4.

[24] See, EPA, EPA530-R-01-007, *Land Disposal Restrictions: Summary of Requirements* (Revised August 2001).

[25] See GAO 22-104365, p. 44-45; GAO, GAO 21-73, *Hanford Cleanup, DOE's Efforts to Close Tank Farms Would Benefit from Clearer Legal Authorities and Communication* (January 2021). See, also, 2023 FFRDC Follow-On Report, Vol. 1, p. 9-11 (finding, for example, that every two years of WTP vitrification operations without LAW supplemental treatment adds one year to the overall mission).

would take 10 to 15 years to implement.[26] DOE also reported to Congress in 2020 that grouting supplemental LAW could shorten Hanford's tank cleanup mission by at least a decade.[27] Thus, retrievals from aging SSTs could proceed more quickly if supplemental LAW from DSTs in West Area could be retrieved and treated sooner through grouting, resulting in significant benefits to human health and the environment.

Lastly, vitrification of tank waste would also be significantly more costly to implement. The 2019 FFRDC Report found that grouting supplemental LAW would cost $2 to $8 billion, while vitrification would cost $20 to $36 billion. In its 2020 report to Congress, DOE also indicated that grouting supplemental LAW could reduce the overall costs of Hanford's tank cleanup mission by $73 to $210 billion. The 2023 FFRDC Follow-On Report further indicates that large cost and schedule savings can be achieved by grouting,[28] and concludes that grouting is clearly executable at benchmark funding levels and has the highest probability of successful completion.[29] For all the reasons above, vitrification would be technically inappropriate.

Since RCRA regulates only the hazardous portion of a mixed waste, the radioactive portion is outside the scope of this Petition.[30] However, for purposes of providing additional context, DOE also notes that the Final WIR Evaluation for the 2,000-gallon TBI Demonstration demonstrates that pretreatment of the supernate from Tank SY-101 effectively removes the key radionuclides to the maximum extent technically and economically practical. Based on Best-Basis Inventory ("BBI") estimates, more than 99% of the curies attributable to key radionuclides in tank SY-101 will be removed by settling, decanting, filtration, and IX. The pretreated supernate will contain approximately 0.001% of the key radionuclides in the total waste (saltcake and supernate) stored in tank SY-101. Based on grab sample data, approximately 98.8% of the curies from key radionuclides (including Cs-137 and its daughter, Ba-137m) in the SY-101 supernate will be

---

[26] See Savannah River National Laboratory, *Report of Analysis of Approaches to Supplemental Treatment of Low-Activity Waste at the Hanford Nuclear Reservation* (October 18, 2019) (hereinafter, "2019 FFRDC Report"); see, also, GAO 22-104365.

[27] See DOE, *Evaluation of Potential Opportunities to Classify Certain Defense Nuclear Waste from Reprocessing as Other than High-Level Radioactive Waste* (December 2020).

[28] See, e.g., 2023 FFRDC Follow-On Report, Vol. I, p. 48, Table 5-1 (finding that vitrification has a very low probability of successful completion for supplemental treatment of LAW due to resource intensity whereas grouting would have a high to very high likelihood of successful completion).

[29] See 2023 FFRDC Follow-On Report, Vol. I, p. 50.

[30] EPA and DOE have recognized that because mixed wastes contain a hazardous component subject to RCRA and a radioactive component subject to the AEA, such wastes are managed under a dual regulatory framework for purposes of the LDR program. The RCRA definition of "solid waste" expressly excludes source, special nuclear, or byproduct material as defined by the AEA. 42. U.S.C. § 6903(27). Thus, it is also well-established that only the hazardous components of by-product material set forth in Section 11e(1) of the Act are subject to RCRA, while DOE manages the radioactive components of mixed waste at DOE facilities pursuant to its exclusive authority under the AEA. See 54 F.R. 48372 at 48492 (November 22, 1989); 55 F.R. 22520, at 22626 (June 1, 1990); see, also, 52 F.R. 15937 (May 1, 1987).

removed by pretreatment in the proposed 2,000-gallon TBI Demonstration.[31] Approximately 1.8 curies will remain in the pretreated liquid waste that will be shipped offsite for solidification.[32]

DOE's WIR Evaluation for the TBI Demonstration further demonstrates that the waste will be managed to meet safety requirements comparable to the Nuclear Regulatory Commission's ("NRC") performance objectives at 10 CFR 61, Subpart C for disposal of LLW. The performance objective requirements for licensed MLLW disposal facilities in the Texas Administrative Code and the Utah Administrative Code mirror and are comparable to the NRC's performance objectives, as discussed in detail in the 2,000-gallon TBI Demonstration Final WIR Evaluation.[33] The Final WIR Evaluation further demonstrates that pretreated and solidified waste meets the Waste Acceptance Criteria of both of the WCS and Energy*Solutions* facilities for disposal of the grouted MLLW form.[34] Again, while radionuclides are outside the scope of this Petition, the Final WIR Evaluation and WIR Determination show that the pretreated and solidified waste is expected to not only be below concentration limits for Class C LLW, as required by DOE Manual 435.1-1, but is also expected to meet Class A LLW concentrations limits,[35] will be managed as LLW, and disposed of in accordance with the Texas and Utah licenses and permits governing disposal of LLW at the WCS and Energy*Solutions* facilities, respectively.[36]

b. Minimize Threats to Human Health and the Environment - 40 C.F.R. § 268.44(m)

RCRA regulations also require a demonstration that compliance with a proposed treatment standard is sufficient to minimize threats to human health and the environment posed by land disposal of the waste. 40 C.F.R. § 268.44(m).

Utilization of STABL satisfies the above criterion because STABL is an established technology under 40 C.F.R. § 268.42. As a general matter, the protectiveness of grout as a treatment method for MLLW is also well-established, and grouting is a common, proven, and recommended treatment method.[37] Furthermore, STABL will be performed by the treatment

---

[31] Both BBI estimates and grab sample data were assessed as part of the WIR Evaluation. BBI is an inventory database that provides estimates of tank waste content for 46 radionuclides and 24 chemicals. Inventories are established using waste sample data (where available), process knowledge, surveillance data, and modeled waste stream composition information. BBI is considered best available information to estimate tank waste compositions. In the WIR Evaluation, DOE used both BBI estimates and 2018 grab sample analytical data for key radionuclides in Tank SY-101 supernate to then determine the radionuclide inventory that would remain in 2,000 gallons of supernate following pretreatment.

[32] See WIR Evaluation, p. 4-15 – 4-16; 4-18.

[33] See WIR Evaluation, p. 5-1 – 5-2.

[34] See WIR Evaluation, p. 5-6 – 5-8.

[35] The NRC regulations at 10 C.F.R. § 61.55 provide radionuclide concentrations for Class A, B and C LLW that are considered suitable for near-surface disposal, with Class A containing the lowest concentrations of radionuclides.

[36] See WIR Determination.

[37] See 55 F.R. at 22626-22627.

facilities in accordance with their hazardous waste permits, which specify that stabilization must be performed consistent with the requirements at 40 C.F.R. Part 268.

With respect to inorganic constituents in Tank SY-101 supernate, chromium has been detected at 95.8 mg/L. Available data on chromium in relation to DOE's Cast Stone formulation[38] indicate that the retention factor for chromium is between 3.3×10^{-5} and 1.3×10^{-4} $(mg_{Cr}/L_{leachate})/(mg_{Cr}/kg_{solid})$, which corresponds to an EPA SW-846 Method 1311 Toxicity Characteristic Leaching Procedure ("TCLP") concentration of between 9.9×10^{-4} and 3.9×10^{-3} $(mg_{Cr}/L_{leachate})$. In contrast, the NWW treatment standard for chromium is 0.6 $(mg_{Cr}/L_{leachate})$. Thus, the TCLP leachate concentration for the grouted waste form is expected to be two or three orders of magnitude less than the NWW numerical standard, and there is no concern that stabilization at an offsite commercial treatment facility will satisfy LDR requirements for chromium.[39] All other metals and cyanide will be below the NWW UTS. With respect to metals specifically, all constituents besides chromium will be below the NWW UTS (mg/L TCLP) based on their measured total concentrations in Tank SY-101, assuming 100% leaching resulting from applying the "rule of 20" concept from the TCLP method.

With respect to organic constituents, the use of STABL will also minimize threats to human health and the environment because the Tank SY-101 2018 grab sample results show that all organic constituents are below or essentially below the NWW UTS.

In addition, because post-treatment sampling will be conducted as a distinct part of the 2,000-gallon TBI Demonstration to support and develop Alternative Treatment, the stabilized waste form may not be land disposed until that sampling confirms the NWW numerical standards have been met. In view of all the above, compliance with STABL is sufficient to minimize threats to human health and the environment in accordance with 40 C.F.R. § 268.44(m).

DOE notes that the transport of the pretreated supernate to off-site facilities for stabilization/solidification and disposal will also comply with all applicable requirements, including Department of Transportation ("DOT") regulations, which will minimize any risks associated with the transport of the TBI waste.[40] In the Final EA, DOE assessed at length the impacts associated with the transport of pretreated liquid waste in process totes to the treatment

---

[38] Cast Stone consists of dry ingredients composed of 8 percent-by-weight (wt%) Portland cement, 47 wt% blast furnace slag, and 45 wt% fly ash, and would be mixed with pretreated tank supernate at a water-to-dry mix weight ratio of between 0.4 and 0.6. This grout recipe could be used as a starting point by the selected offsite commercial treatment facility but would in no way limit the facility's use of its own specific grout formulation for the 2,000-gallon TBI Demonstration.

[39] As discussed in Section II, above, post-treatment sampling data from the 2000-gallon TBI Demonstration will also be used to further refine the retention factor for chromium.

[40] The packaging and transportation of MLLW in commerce must meet DOT's requirements under 49 CFR Subchapter. LLW is also subject to radioactive material packaging standards set by DOT and the NRC (10 CFR Part 71), and DOE shipment requirements (DOE Order 460.2A and 460.1D). See Final EA; see, also, 2023 FFRDC Follow-On Report, Vol. I, App. D; Vol. II, App. H.

In FY2020, DOE transported approximately 3,200 hazardous materials shipments over six million miles without any DOT-recordable incidents. See Final EA; see, also, GAO 22-104365, at 28.

facilities and of the stabilized waste form in appropriate containers for transfer to the disposal facilities.[41] Additionally, following pretreatment of the SY-101 supernate, DOE will verify that it meets all requirements for receipt by the commercial treatment facility. That facility will then certify treatment through STABL, with confirmation that the treated waste also meets the relevant NWW numerical standards, prior to final disposal.[42]

Furthermore, the treatment and disposal facilities considered as alternatives under the 2,000-gallon TBI Demonstration Final EA were selected based on their abilities to accept and treat TBI waste successfully, in compliance with their existing licenses and permits. The grouted waste form will be disposed of outside the State of Washington, at either Energy*Solutions* in Utah or WCS in Texas, both of which are commercial facilities that are RCRA-permitted and licensed by the applicable state authorities pursuant to their agreement with the NRC to accept mixed waste in accordance with their Waste Acceptance Criteria. Those licensed facilities are subject to regulations and conditions that ensure the protection of public health and safety and the environment.

The disposal facilities were also specifically selected based on their location, geology, hydrogeology, and experience in receiving comparable waste types for disposal. The Energy*Solutions* facility is located in a remote area of Utah with low-permeability clay soils. The precipitation levels in the area are also low, thus minimizing the potential for releases via any surface water pathway. Public exposures via the groundwater pathway are also minimized due to naturally poor groundwater quality at the site.[43] All of those characteristics make the site well-suited for the disposal of TBI MLLW. Similarly, the area surrounding the WCS Federal Waste Facility is sparsely populated with no drinking water aquifers and receives low levels of rainfall. Furthermore, the geologic features of the area include thick red clay beds that form natural barriers.[44]

While radionuclides are not regulated by RCRA and are outside the scope of this Petition, the management, treatment, and disposal of the radioactive components of the TBI waste will also ensure protection of public health and safety and the environment for the reasons discussed in detail in Section IV.a, above, and summarized below:

- Based on BBI estimates, more than 99% of the curies attributable to key radionuclides in SY-101 tank waste will be removed by settling, decanting, filtration, and IX. Based on grab sample data, approximately 98.8% of the curies from key radionuclides in the SY-101 supernate will be removed by pretreatment in the 2,000-gallon TBI Demonstration.

---

[41] See, e.g., Final EA.

[42] In the Final EA, DOE identified no environmental justice or socioeconomic adverse impacts in connection with the USDOT-compliant waste shipments for the 2,000-gallon TBI Demonstration, using existing roadways in accordance with their constructed design and intended purpose. For a more in-depth discussion, see Final EA, p. 3-2; B-19.

[43] 2023 FFRDC Follow-On Report, Vol. I, p. D-9, 12.

[44] 2023 FFRDC Follow-On Report, Vol. I, p. D-13-14, D-16.

- The treatment facilities evaluated by DOE under each alternative in the Final EA operate under radioactive material licenses and hazardous waste permits issued by their respective state regulators.

- Because the performance objectives set forth in the Utah and Texas Administrative Codes mirror the NRC performance objectives for low-level radioactive waste disposal in 10 C.F.R. Part 61, Subpart C, disposal of the grouted waste at the off-site facilities in either Utah or Texas will meet or exceed the NRC safety requirements and performance objectives comparable to the NRC performance objectives.

- The grouted waste will not exceed Class C LLW concentration limits and is expected to meet Class A LLW concentration limits.[45]

Accordingly, treatment of the pretreated TBI waste using STABL minimizes any threats to human health and the environment posed by land disposal of the waste.

Based on the above, DOE believes that this Petition satisfies the criteria at 40 C.F.R. §268.44(a)(2) and (m), under either DOE or Washington's interpretation of LDR treatment requirements. Accordingly, EPA need not opine on or resolve the differing interpretations to grant this Petition; DOE believes that this Petition allows EPA to conclude that regardless of whether DOE or Washington's interpretation of LDR requirements forms the starting point of the variance analysis, DOE has established that a variance to the STABL treatment method should be granted in relation to the separated and pretreated tank waste from the 2,000-gallon TBI Demonstration.

---

[45] See Final WIR Evaluation, p. 4-17; 4-24; Sec. 6.0.

V. PROPOSED MODIFICATION TO TABLE AT 40 C.F.R. § 268.44(O) FOR THE 2,000-GALLON TBI DEMONSTRATION PETITION

Wastes Excluded from The Treatment Standards Under § 268.40							
				Wastewaters		Nonwastewaters	
Facility Name and address	Waste Code	See also	Regulated hazardous constituent	Concentration (mg/L)	Notes	Concentration (mg/L)	Notes
United States Department of Energy (Energy), Richland, WA [17]	F001-F005 D001-D003, D004-D011, D018, D019, D022, D028-D030, D033-D036, D038-D041, and D043[18]	NA	For waste codes F001-F005, the constituents are limited to those associated with spent solvent activities at the Facility documented through process knowledge. For constituents, as appliable, associated with D waste codes under the "Waste Code" column, see 40 C.F.R. § 268.40.	NA	NA	STABL[19, 20]	NA

[17] – The STABL treatment standard applies to the separated and pretreated tank waste under the 2,000-gallon TBI Demonstration.

[18] – The EPA waste codes included in this column are those identified on the current version of the Dangerous Waste Permit Application Part A Form for the Hanford Double Shell Tank System, Rev. 04 (December 14, 2009) except for F039 which has not been accepted into the Double-Shell Tanks.

[19] – Sampling after treatment will be conducted at the treatment facility for the purpose of assessing the extent of treatment performance against the NWW numerical standards at § 268.40 and, as applicable, at §268.48. Waste treated using STABL may not be land disposed until LDR constituents are below the non-wastewater numerical standards at 40 C.F.R. § 268.40 and § 268.48.

[20] – Treatment using the STABL treatment method shall be performed at off-site commercial treatment facilities. The treated waste shall also be disposed of at off-site commercial disposal facilities (Energy*Solutions* in Clive, Utah, and Waste Control Specialists in Andrews County, Texas).

VI. CERTIFICATION STATEMENT

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this petition and all attached documents, and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

Brian T. Vance Digitally signed by Brian T. Vance
Date: 2023.08.01 17:33:21 -07'00'

Brian T. Vance, Manager
Office of River Protection
U.S. Department of Energy

Date

Table 1

Hazardous Waste Chemical Properties for Tank SY-101 Supernatant

Waste Code	Analyte	CAS#	Concentration (mg/L)	Non-Wastewater Treatment Standard (mg/kg, unless noted)
Listed waste				
F001	1,1,1-Trichloroethane	71-55-6	< 3.21E-03	6.0
F002	Methylene Chloride	75-09-2	< 3.93E-03	30
F003	Acetone	67-64-1	0.124	160
F003	Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	108-10-1	< 5.38E-03	33
F004	o-Cresol (2-Methylphenol)	95-48-7	< 0.63	5.6
F004	m-Cresol (3-Methylphenol)	108-39-4	< 0.56	5.6
F004	p-Cresol (4-Methylphenol)	106-44-5	< 0.56	5.6
F004	Cresols mixed isomers and cresylic acid (Total Methylphenols)	1319-77-3	< 1.19	11.2
F005	Methyl Ethyl Ketone (2-Butanone)	78-93-3	< 7.42E-03	36
Physical Property				
D001	Ignitability (No subcategory)	N/A	N/A	DEACT and meet § 268.48 standards
D002	pH (no units)	N/A	13	DEACT and meet § 268.48 standards
D003	Reactivity (Reactive cyanides subcategory): Cyanide	57-12-5	2.96	590 (total) 30 (amenable)
Characteristic Metals				
D004	Arsenic (As)	7440-38-2	0.648	5.0 mg/L TCLP and meet § 268.48 standards
D005	Barium (Ba)	7440-39-3	< 0.5	21 mg/L TCLP and meet § 268.48 standards
D006	Cadmium (Cd)	7440-43-9	< 0.5	0.11 mg/L TCLP and meet § 268.48 standards
D007	Chromium (Cr)	7440-47-3	95.8	0.60 mg/L TCLP and meet § 268.48 standards

Waste Code	Analyte	CAS#	Concentration (mg/L)	Non-Wastewater Treatment Standard (mg/kg, unless noted)
D008	Lead (Pb)*	7439-92-1	1.54	0.75 mg/L TCLP and meet § 268.48 standards
D009	Mercury (Hg) ^	7439-97-6	< 8.8E-04	0.025 mg/L TCLP and meet § 268.48 standards
D010	Selenium (Se)	7782-49-2	1.04	5.7 mg/L TCLP and meet § 268.48 standards
D011	Silver (Ag)	7440-22-4	0.0152	0.14 mg/L TCLP and meet § 268.48 standards
Characteristic Organics				
D018	Benzene	71-43-2	< 4.42E-03	10 and meet § 268.48 standards
D019	Carbon Tetrachloride	56-23-5	< 3.14E-03	6.0 and meet § 268.48 standards
D020	Chlordane	57-74-9	NTF	0.26 and meet § 268.48 standards
D021	Chlorobenzene	108-90-7	< 3.23E-03	6.0 and meet § 268.48 standards
D022	Chloroform	67-66-3	< 3.76E-03	6.0 and meet § 268.48 standards
D023[1]	o-Cresol	95-48-7	See F004	5.6 and meet § 268.48 standards
D024[1]	m-Cresol	108-39-4	See F004	5.6 and meet § 268.48 standards
D025[1]	p-Cresol	106-44-5	See F004	5.6 and meet § 268.48 standards
D026[1]	Cresol	1319-77-3	See F004	11.2 and meet § 268.48 standards
D027	1,4-Dichlorobenzene*	106-46-7	< 0.68	6.0 and meet § 268.48 standards
D028	1,2-Dichloroethane	107-06-2	< 4.27E-03	6.0 and meet § 268.48 standards
D029	1,1-Dichloroethylene	75-35-4	< 2.68E-03	6.0 and meet § 268.48 standards
D030	2,4-Dinitrotoluene	121-14-2	< 0.365	140 and meet § 268.48 standards
D031	Heptachlor (and its epoxide)	76-44-8	NTF	0.066 and meet § 268.48 standards
D032	Hexachlorobenzene ǂ	118-74-1	< 0.54	10 and meet § 268.48 standards
D033	Hexachlorobutadiene	87-68-3	< 0.75	5.6 and meet § 268.48 standards

Waste Code	Analyte	CAS#	Concentration (mg/L)	Non-Wastewater Treatment Standard (mg/kg, unless noted)
D034	Hexachloroethane*	67-72-1	< 0.7	30 and meet § 268.48 standards
D035[1]	Methyl Ethyl Ketone	78-93-3	See F005	36 and meet § 268.48 standards
D036	Nitrobenzene*	98-95-3	< 0.61	14 and meet § 268.48 standards
D037	Pentachlorophenol*	87-86-5	< 0.285	7.4 and meet § 268.48 standards
D038	Pyridine*	110-86-1	< 0.73	16 and meet § 268.48 standards
D039	Tetrachloroethylene	127-18-4	< 3.45E-03	6.0 and meet § 268.48 standards
D040	Trichloroethylene	79-01-6	< 3.37E-03	6.0 and meet § 268.48 standards
D041	2,4,5-Trichlorophenol*	95-95-4	< 0.685	7.4 and meet § 268.48 standards
D042	2,4,6-Trichlorophenol*	88-06-2	< 0.665	7.4 and meet § 268.48 standards
D043	Vinyl Chloride	75-01-4	< 7.72E-03	6.0 and meet § 268.48 standards
Underlying Hazardous Constituents – Inorganic				
N/A	None	N/A	N/A	N/A
Underlying Hazardous Constituents – Organic				
N/A	4-Nitroaniline	100-01-6	< 0.635	28
N/A	4-Nitrophenol	100-02-7	< 0.365	29
N/A	4-Bromophenylphenyl ether	101-55-3	< 0.415	15
N/A	2,4-Dimethylphenol	105-67-9	< 0.345	14
N/A	1,4-Dichlorobenzene	106-46-7	< 0.68	6
N/A	4-Chloroaniline	106-47-8	< 0.69	16
N/A	Cyclohexanone	108-94-1	< 0.65	0.75 mg/L TCLP
N/A	Phenol	108-95-2	< 0.605	6.2

Waste Code	Analyte	CAS#	Concentration (mg/L)	Non-Wastewater Treatment Standard (mg/kg, unless noted)
N/A	Bis(2-chloroethyl)ether	111-44-4	< 0.65	6
N/A	Bis(2-Chloroethoxy)methane	111-91-1	< 0.67	7.2
N/A	Bis(2-ethylhexyl)phthalate	117-81-7	0.681	28
N/A	Di-n-octylphthalate	117-84-0	< 0.235	28
N/A	Anthracene	120-12-7	< 0.31	3.4
N/A	1,2,4-Trichlorobenzene	120-82-1	< 0.69	19
N/A	2,4-Dichlorophenol	120-83-2	< 0.66	14
N/A	Dimethyl phthalate	131-11-3	< 0.425	28
N/A	Benzo(ghi)perylene	191-24-2	< 0.265	1.8
N/A	Indeno(1,2,3-cd)pyrene	193-39-5	< 0.13	3.4
N/A	Benzo(b)fluoranthene	205-99-2	< 0.31	6.8
N/A	Benzo(k)fluoranthene	207-08-9	< 0.3	6.8
N/A	Acenaphthylene	208-96-8	< 0.75	3.4
N/A	Chrysene	218-01-9	< 0.325	3.4
N/A	Benzo(a)pyrene	50-32-8	< 0.27	3.4
N/A	2,4-Dinitrophenol	51-28-5	< 0.65	160
N/A	4,6-Dinitro-o-cresol	534-52-1	< 0.15	160
N/A	Dibenz[a,h]anthracene	53-70-3	< 0.225	8.2
N/A	Benzo(a)anthracene	56-55-3	< 0.28	3.4
N/A	4-Chloro-3-methylphenol	59-50-7	< 0.635	14

Waste Code	Analyte	CAS#	Concentration (mg/L)	Non-Wastewater Treatment Standard (mg/kg, unless noted)
N/A	N-Nitrosomorpholine	59-89-2	< 0.545	2.3
N/A	N-Nitroso-di-n-propylamine	621-64-7	< 0.68	14
N/A	N-Nitrosodimethylamine	62-75-9	< 0.62	2.3
N/A	1-Butanol	71-36-3	< 2.78	2.6
N/A	Hexachlorocyclopentadiene	77-47-4	< 0.13	5.6
N/A	Acenaphthene	83-32-9	< 0.225	3.4
N/A	Diethylphthalate	84-66-2	< 0.36	28
N/A	Di-n-butylphthalate	84-74-2	< 0.19	28
N/A	Phenanthrene	85-01-8	< 0.295	5.6
N/A	Butylbenzylphthalate	85-68-7	0.59	28
N/A	2-Nitroaniline	88-74-4	< 0.5	14
N/A	2-Nitrophenol	88-75-5	< 0.63	13
N/A	Naphthalene	91-20-3	< 0.615	5.6
N/A	1,2-Dichlorobenzene	95-50-1	< 0.675	6
N/A	2-Chlorophenol	95-57-8	< 0.59	5.7

1 Constituent is tracked under listed waste “F” code and not the characteristic “D” code based on 40 CFR 268.9(b).

* Reported as UHC because concentration is below waste designation level for “D” code.

ǂ Process knowledge shows that hexachlorobenzene cannot exist above the waste designation level of 0.13 mg/L and is not a D032 characteristic nor a UHC to be reported on the LDR notification form.

^ Low Mercury Subcategory (contains less than 260 mg/kg total mercury and is not residue from RMERC).

CAS# Chemical Abstract Service number

N/A Not applicable

NTF Not tested for. No knowledge to indicate possible presence of constituent because it is a pesticide, herbicide, or insecticide. This also applies to waste codes D012 through D017 not listed in the table.

mg/L milligrams per liter

Bold font indicates the EPA waste code is identified on the Double Shell Tank System Dangerous Waste Permit Application Part A Form (Revision 4, December 14, 2009). Waste code F039 is not included in the table because F039 waste has not been accepted into the Double-Shell Tank System.