



Confederated Tribes and Bands
of the Yakama Nation

Established by the
Treaty of June 9, 1855

November 6th, 2018

Mr. Jan Bovier
Office of River Protection
P.O. Box 450, MSIN H6-60
Richland, WA 99354

**RE: *Draft Waste Incidental to Reprocessing Evaluation for
Closure of Waste Management Area C at the Hanford Site***

Dear Mr. Bovier:

The Confederated Tribes and Bands of the Yakama Nation is taking the opportunity to provide comments regarding the above-entitled Department of Energy document dated March 2018 (DOE-ORP-2018-01) and issued for public comment on June 4, 2018 (Draft WIR). The Draft WIR provides the basis for the DOE to issue a determination that wastes generated during the reprocessing of spent nuclear fuel, which are by definition high-level radioactive waste (HLW) under current federal law, may instead be managed as low-level radioactive waste. This is the latest in a continuing effort by your agency, pursuant to DOE Order 435.1, to reclassify HLW being stored at Hanford. We appreciate that the Office of River Protection decided to extend the period for comment for an additional 60 days given the nature and importance of this document.

The Yakama Nation is deeply concerned about being left with the most dangerous wastes of the nuclear age on lands it has used for its subsistence and culture since time immemorial. The Hanford site was established on lands where the Yakama Nation has reserved hunting and gathering rights under the Treaty of June 9, 1855. In addition the Columbia River, which bisects the site, is home to anadromous fish species to which the Yakama people have also reserved treaty rights to harvest. The Federal government maintains a special trust relationship to the Yakama Nation with an enforceable fiduciary responsibility to protect its lands and resources, including those to which treaty rights attach outside the Yakama Reservation.

Since Order 435.1 was approved by the Office of Environmental Management in 1999, DOE has consistently argued that it has discretionary authority under the Atomic Energy Act to reclassify any HLW remaining in the Hanford storage tanks as "waste incidental to reprocessing." The Yakama Nation was a plaintiff in previous litigation regarding this issue and remains convinced that the rulings made in that case, though vacated by the Ninth Circuit Court of Appeals on ripeness grounds, are persuasive legal authority and directly relevant to the current Draft WIR determination. However, aside from this legal question, we are also firmly convinced that leaving such radioactive materials in an unstable shallow land disposal for many generations is simply bad policy. It will inevitably result in serious threats to the health of Yakama enrolled members and the public, both by direct exposure and through consumption of contaminated resources.

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Yakama Nation has reviewed the Draft WIR and is providing its comments regarding six overarching issues:

1. Legal Authority

The WMA C tank residual wastes comprise highly radioactive material resulting from the reprocessing spent/irradiated nuclear fuel, and contain fission products in sufficient quantities to qualify as high-level radioactive waste under definitions in the Nuclear Waste Policy Act (NWPA) or 10 CFR §60.2. DOE is now attempting to reclassify the wastes within the WMA C tanks from HLW to low-level radioactive waste based on purported criteria and authority provided in Order 435.1. These criteria contradict the clear congressional directive for deep geologic disposal of all HLW in the NWPA based on both its highly radioactive nature and its source, reprocessing of nuclear fuel in plutonium production. See *NRDC v. Abraham*, 271 F. Supp. 2d 1260, 1266 (D. Idaho 2003) (“NWPA does not delegate to DOE the authority to establish ‘alternative requirements’” for HLW).

2. Consistency with TCWM EIS/ROD

Implementation of the Draft WIR also circumvents several of the requirements, or their intent, of the 2013 Record of Decision (ROD) for the Final Tank Closure and Waste Management Environmental Impact Statement (TCWM EIS). Preferred Alternative 2B included retrieval of 99 percent of the tank waste by volume, separation of high- and low-activity radioactive waste, and potential soil removal or treatment in the vadose zone. Proposed changes made under the Draft WIR to the total volume of tank waste retrieved, handling of material currently classified as high-level radioactive waste, and future closure decisions will preclude implementation of the Preferred Alternative as described in the ROD.

3. Cumulative Effects

Due to the corrosive nature of the wastes stored, the WMA C tanks are associated with releases to the subsurface of radioactive waste from multiple generations of reprocessing chemistry. In 2016, the DOE estimated that the WMA C tanks had released approximately 201,000 gallons of radioactive waste to the vadose zone. Analysis performed in the Draft WIR and supporting Performance Assessment does not address these confirmed releases or the implications for future cleanup associated with grouting the WMA C tanks. Similarly, the WMA C is surrounded by other waste sites and tank farms; is within the boundary of impacts associated with production-period discharges to the subsurface; and is in the flow-path for several established groundwater plumes that are projected to exceed their applicable cleanup levels for decades or more. Future exposure to a member of the public or an inadvertent intruder is being evaluated on the basis of potential migration and/or exposure to residual tank wastes only, and does not include cumulative effects of these releases.

4. Impacts to Cultural Resources

The Yakama Nation has not been consulted by DOE to determine the effects on historic properties as required by the National Historic Preservation Act (NHPA). ER/WM also has not been provided an opportunity to review and comment on the DOE’s analysis of the anticipated

effects on historic properties. Decisions regarding final closure or remedial actions at each site should account for the impacts to traditional cultural properties. The Draft WIR does not include evaluation of the ultimate effect of general fate and transport of residual tank waste and vadose zone releases on exercise of reserved treaty rights to resources at Hanford.

5. Technical Approach

Based on data provided in the Draft WIR and the supporting Performance Assessment, concentrations of long-lived transuranic radionuclides in residual tank wastes exceed the maximum allowable concentrations identified by the Nuclear Regulatory Commission that are acceptable for near surface disposal. The Draft WIR presents a waste classification approach that includes revision to the classification calculations and sum of fractions evaluation to rely on the WMA C Performance Assessment Inadvertent Intruder Analyses. This modified approach does not address long-term protectiveness as intended under existing requirements for disposal.

6. Future Closure and Decision Making

Future closure relies heavily on implementation of institutional and engineering controls including surface barriers to ensure protection of human health and the environment. While such measures may be effective when properly implemented, a significant commitment of resources is required to ensure their success. The actions proposed by the Draft WIR, while relying on these measures, provide no assurances to ensure their effectiveness such as planning for degraded performance over time; incorporating clear and consistent maintenance and stewardship programs as part of proposed closure actions; and providing consistent, conservative, and advance funding for post-closure stewardship with assurances to maintain engineered barriers and access controls. Implementation of institutional and engineering controls also has significant implications for the Yakama Nation's members and the exercising of Treaty rights on the Hanford Site which should also be addressed.

The Yakama Nation supports clean closure, including maintaining a minimum of 99 percent retrieval for residual tank wastes to the maximum extent practicable. High-level waste and transuranic wastes derived from the reprocessing of spent nuclear fuel, including that which currently remains in the WMA C tanks, should be retrieved, segregated, and disposed of in accordance with current Federal law. Instead of implementing the Draft WIR, DOE should focus on meeting current cleanup requirements under federal law and previous Records of Decision that apply to the WMA C.

Please contact Julie Atwood at (509) 895-4866 if you have any questions or want to discuss these comments.

Sincerely,



Phil Rigdon,
DNR Superintendent, Yakama Nation

cc: Maria Cantwell, United States Senator
Patty Murray, United States Senator
Jay Inslee, Washington Governor
Ron Wyden, United States Senator
Jeff Merkley, United States Senator
Kate Brown, Oregon Governor
Sheryl Bilbrey, Director, Environmental Cleanup Office, U.S. EPA
Maia Bellon, Director, Department of Ecology
Anne White, Assistant Secretary for Environmental Management, U.S. DOE
Brian Vance, Office Manager, DOE-ORP
Doug Shoop, Office Manager, DOE-RL
Janine Benner, Director, Oregon DOE

INTRODUCTION

The Yakama Nation Environmental Restoration and Waste Management Program (ER/WM) has prepared the following comments on the *Draft Waste Incidental to Reprocessing Evaluation for Closure of Waste Management Area C at the Hanford Site*, DOE/ORP-2018-01 Draft D (Draft WIR) prepared by the U.S. Department of Energy (DOE) and dated March 2018.

The Draft WIR provides background information on previous waste removal from tanks located within Waste Management Area C (WMA C), planned closure activities, and the DOE's rationale for reclassifying residual tank waste from high-level radioactive waste (HLW) to low-level radioactive waste (LLW). The DOE's proposed reclassification appears to be a test case for the closure of additional tanks in the Central Plateau of the Hanford Site, all of which contain residual high-level radioactive waste. Successfully establishing the precedent set forth by the Draft WIR will apply a significantly less stringent set of requirements for the DOE to meet with regard to waste retrieval and environmental protection associated with final closure. The changes proposed by the Draft WIR are inconsistent and incompatible with the requirements identified in the Record of Decision for the *Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington* (TCWM EIS), DOE/EIS-0391.

Based on the information presented in the Draft WIR, ER/WM has serious concerns that:

- The reclassification of high-level waste as proposed in the Draft WIR is not supported under current federal law;
- The characterization of WMA C and the analysis performed in support of the proposed reclassification are deficient;
- The DOE has not properly accounted for or evaluated cultural impacts and future protection of human health and the environment; and
- The Draft WIR has been authored and presented in a piecemeal fashion to obfuscate the context in which the proposed WMA C tank closure will occur.

These deficiencies are discussed in the comments below. The Yakama Nation reiterates its opposition to the proposed reclassification, which appears to be designed with an ultimate objective of permanently disposing through shallow burial significant quantities of high-level

radioactive and hazardous waste in the Central Plateau vadose zone. Congress has not granted any legal authority to DOE to perform the proposed reclassification of the high-level radioactive waste remaining in the WMA C tanks to low-level radioactive waste.

LEGAL AND POLICY ISSUES

The Yakama Nation has identified a number of deficiencies with the Draft WIR with regard to the legal and policy basis on which the proposed reclassification and closure will be performed by the DOE.

Legal Authority

The Draft WIR applies to the WMA C tanks, which comprise 12 first-generation 530,000 gallon 100-series single shell tanks; 4 smaller 55,000 gallon 200-series single shell tanks; a 36,000 gallon catch tank; and four “integral” tanks totaling 120,000 gallons; as well as ancillary control and diversion structures. As described in the Draft WIR, the tanks received liquid radioactive wastes from spent nuclear fuel reprocessing and other operations in the 200 Area of the Hanford Site that included B-Plant strontium processing wastes; cladding wastes, self-boiling wastes, sludge supernates wastes, and thorium process wastes from the Plutonium Uranium Extraction and/or Reduction-Oxidation Plants; and hot semi-works waste. ER/WM concurs with the Hanford Advisory Board and Oregon Department of Energy that the DOE does not have the legal authority to reclassify the residual WMA C tank wastes from high-level radioactive waste to low-level radioactive waste, and that doing so would violate existing Federal law.

Classification and disposal schemes for radioactive waste at Hanford have been circumscribed by Congress. High-level waste is defined in the NWPA as “highly radioactive material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations,” or anything else the Nuclear Regulatory Commission (NRC) says “requires permanent isolation.” 42 U.S.C. §10101(12). Under the NWPA all HLW must be disposed of in a deep geologic repository. 42 U.S.C. § 10107 (requiring disposal in a repository), § 10101(18) (defining “repository”). When initially enacted, the NWPA gave the President the option of addressing disposal of defense HLW separately. 42 U.S.C. § 10107(b).

However, in 1985 President Ronald Reagan determined that a separate defense HLW repository was not required.

Low-level radioactive waste is defined in the NWPA and NRC regulations as: 1) any radioactive material that is not HLW, spent nuclear fuel, transuranic waste, or by-product material; and 2) anything NRC says is LLW. It must not exceed certain concentration limits. 42 U.S.C. § 10101(16); 10 CFR § 61.55. LLW is Class A, B or C with on-site, near surface disposal. If it exceeds Class C concentrations, it must go to a “geologic repository” unless NRC specifies otherwise. 10 CFR 61.55 (A, B and C disposal); 10 CFR 61.58 (NRC authority to reclassify). The term “waste incidental to reprocessing” in DOE Order 435.1 is not defined by any statute or regulations.

Regardless of the term used to describe it, the defense nuclear waste in WMA C is “highly radioactive material” left over from the nuclear weapons plutonium extraction process. The liquid waste in the tanks at WMA C was “produced directly in reprocessing” and is therefore governed by the NWPA’s requirements as “high-level waste.” As the Yakama Nation indicates in its comments below, concentrations of long-lived transuranic radionuclides in residual tank wastes exceed the maximum allowable concentrations identified by the NRC that are acceptable for near surface disposal. Indeed, in 2003 the U.S. District Court for the District of Idaho concluded that the waste in the tank farms at Hanford, including WMA C, “falls within the NWPA’s definition of HLW.” *NRDC v. Abraham*, 271 F. Supp. 2d 1260, 1265 (D. Idaho 2003). Moreover, the court also held that DOE in Order 435.1 improperly gave itself classification and disposal discretion which the statute did not permit:

DOE's Order 435.1 directly conflicts with NWPA's definition of HLW. NWPA's definition pays no heed to technical or economic constraints in waste treatment. Moreover, NWPA does not delegate to DOE the authority to establish “alternative requirements” for solid waste. Because Congress has spoken clearly on that subject, “that is the end of the matter,” leaving no room for “alternative requirements. Thus, DOE's Order 435.1 must be declared invalid under *Chevron*.

Id. at 1266. Although this decision was vacated by the Ninth Circuit Court of Appeals on ripeness grounds, its logic remains persuasive fifteen years later given the nature of the residual waste remaining in the tanks at WMA C.

More importantly, the Ronald W. Reagan National Defense Authorization Act (NDAA) for FY2005, enacted by Congress in 2004, created an exception to the NWPAs only for waste in Idaho and South Carolina. Under this statute DOE can dispose of that waste on-site, rather than in a geologic repository as otherwise required by the NWPAs. P.L. 108-375, § 3116(a). The NDAA defined the waste subject to the Section 3116 exception as that which “exceeds the concentration limits for Class C low level waste as set out in [10 CFR 61.55].” Congress specifically refused to extend the NWPAs exemption to waste in Washington, Oregon, or any other state. (§ 3116(c), (e)). Therefore, even assuming that DOE has congressional authority to reclassify HLW, that directive does not apply to any waste at Hanford.

Recommendation:

Residual tank wastes, as well as associated releases to the WMA C vadose zone should be classified based on the radioisotopes present and activity concentrations accordance with current Federal law. Waste that classifies as HLW under the NWPAs and its implementing federal regulations at 10 CFR §60.2 should be retrieved and disposed of in a deep geologic repository. Similarly, waste that classifies as transuranic waste under 40 CFR 191 should be segregated and disposed of in accordance with existing Federal requirements.

Compliance with Relevant Closure Requirements

ER/WM concurs with the Hanford Advisory Board that the proposed reduction in waste retrieval from the WMA C tanks does not comply with the formal Record of Decision for the TCWM EIS to retrieve 99-percent of Central Plateau tank wastes. As noted by the Hanford Advisory Board and others, the Draft WIR proposes to leave approximately 4-percent of residual tank wastes in place based on total volume of the tanks to be closed. However, on an individual basis, some tanks may have residual waste volumes as high as 6- to 9-percent of the total tank volume. WMA C falls within the scope of closure activities identified in the TCWM EIS; therefore proposed waste retrieval and tank closure activities described in the Draft WIR should be

consistent with the requirements identified by the TCWM EIS and associated Record of Decision.

The reclassification of high-level radioactive waste to low-level radioactive waste appears to be targeted towards facilitating landfill closure under the Resource Conservation and Recovery Act (RCRA). However, the actions proposed in the Draft WIR fail to comply with previous decisions made under the National Environmental Policy Act (NEPA) and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). DOE asserts the document was prepared in accordance with its own internal directive Order 435.1 and that Hanford does not fall under § 3116(a) of the NDAA for Fiscal Year 2005, but takes no position on how the authority exercised under its internal order applies to the established requirements for closure.

Recommendation:

Thoroughly review the Draft WIR to ensure that proposed closure actions and requirements, including total waste volumes retrieved, are consistent with the requirements of the TCWM EIS Record of Decision, and applicable NEPA and CERCLA requirements.

Evaluation of Cumulative Effects and Historical Releases

The WMA C Performance Assessment and Draft WIR do not include or consider cumulative impacts associated with radioactive or hazardous waste associated with other waste sites in the Central Plateau. The proposed plans for closure and protection of human health and the environment in the Draft WIR and WMA C Performance Assessment must consider the setting for WMA C, in addition to historical releases to the vadose zone and groundwater within the WMA C itself. The Hanford Advisory Board noted that the DOE previously issued a separate WIR determination for releases to the vadose zone in 2008; whether this WIR determination applies to historical releases has not been specified or confirmed by the DOE. The 2008 WIR determination was neither reviewed nor approved by the Washington State Department of Ecology, yet has significant implications for future closure under RCRA by downgrading high-level radioactive waste formerly requiring vitrification to low-level radioactive waste suitable for shallow burial. To present the Draft WIR for residual tank wastes with no acknowledgement of

the steps DOE has previously taken to leave previously released high-level radioactive and hazardous wastes in the subsurface is not acceptable.

Contamination within the Central Plateau is the result of extensive waste disposal activities during plutonium production that included liquid waste discharges into open bottom cribs and trenches; leakage from waste tanks; operation of the US Ecology Low-Level Radioactive Waste Dump; and other cleanup activities performed to date such as the construction of the Environmental Restoration and Disposal Facility (ERDF). High concentrations of technetium-99 and iodine-129 in groundwater were predicted as part of exposure modeling performed for the TCWM EIS.

However, evaluation of potential exposure to intruders and/or members of the public does not consider the potential contributions from surrounding waste sites to soil or groundwater, including confirmed releases to the WMA C vadose zone and deep groundwater. The Draft WIR notes specifically that the analysis performed does not address contaminated soil or groundwater associated with previous leaks, planned releases, or unplanned releases within the WMA C even though such releases are highly relevant to the exposure scenarios presented and whether the proposed closure is protective of human health and the environment overall. Although not explicitly stated, this statement implies cumulative effects from other waste sites are also excluded from consideration.

Recommendation:

Revise the Draft WIR to incorporate and address historical releases to the Hanford subsurface in WMA C and the surrounding environment. The revised Draft WIR should be consistent with the assumptions and level of protectiveness previously established under the TCWM EIS, and applicable RCRA requirements for closure, and should account for existing and future releases to the subsurface and groundwater associated with proximate waste sites and facilities.

CULTURAL RESOURCES

Yakama Nation has prepared the following comments with regard to future impacts to Yakama Nation cultural resources and compliance with the National Historic Preservation Act (NHPA) on the Hanford Site.

National Historic Preservation Act Compliance

Yakama Nation has not been consulted by DOE to determine the effects on cultural resources as required by the NHPA. ER/WM also has not been provided an opportunity to review and comment on the DOE's analysis of the anticipated effects on historical properties.

Recommendation:

Revise the Draft WIR to incorporate the required NHPA Section 106 review and results of the associated 36 CFR Part 800 consultation process to be performed with ER/WM.

Traditional Cultural Property Impacts

The Yakama Nation is in the process of completing a Hanford Site-wide traditional cultural property study. This study must be completed to fully understand the impacts of this project on traditional cultural properties across the Hanford Site. Decisions regarding final closure or remedial actions at each site should account for the impacts to traditional cultural properties as identified by the Yakama Nation.

Recommendation:

Revise the Draft WIR to incorporate appropriate evaluation of traditional cultural properties.

Area of Impacts Analysis is Deficient

The area of potential effects will include contamination left in the vadose zone or that will remain mobile in the environment. The area of potential effects to be evaluated under NHPA includes any location or land where the character or use may be altered by the proposed actions to be taken.

If the Yakama Nation determines, as part of consultation with the Tri-Party Agencies that there are, or will be, adverse effects to traditional cultural properties, those effects must

be avoided, minimized, or mitigated. The Draft WIR should include evaluation of not only general fate and transport of residual tank waste and vadose zone releases, but also the ultimate effect these residual wastes and releases will have on resources used by the Tribe. The evaluation should specifically address surface water, groundwater, vegetation, site fauna, landforms and view-sheds of cultural importance, and how long it is anticipated the effect will last.

Recommendation:

Perform the appropriate evaluation of potential impacts to the area of potential effects under NHPA and identify the corrective action that will be taken in the revised Draft WIR. The corrective actions should also be specified and documented in a Memorandum of Agreement per the requirements of 36 CFR § 800.6.

TECHNICAL COMMENTS

The Yakama Nation concurs with Hanford Advisory Board and Oregon Department of Energy that the DOE does not have the legal authority to reclassify the residual WMA C tank wastes from high-level radioactive waste to low-level radioactive waste (see previous section “Legal Authority”). However, ER/WM has reviewed the Draft WIR technical elements regardless of the legal basis on which the document has been advanced. ER/WM’s review found that substantial revisions to the Draft WIR will be necessary to result in final closure that is protective of human health and the environment.

Waste Classification Approach

Radionuclide concentration calculations presented in Section 6.0 (Radionuclide Concentrations of Stabilized Residual, Tanks and Ancillary Structures) are both difficult to verify, and do not appear to follow NRC guidance for classification of nuclear wastes. In particular the DOE has included the use of a Site Factor, defined on page 6-9 as:

$$Site\ Factor_i = \frac{Table_Value_i}{C_{PA}} \times \frac{Dose_i}{500\ mrem}$$

Where:

$Site\ Factor_i$ = Site-specific factor for radionuclide "i" at closure.

$Table\ Value_i$ = Class C concentration limit from 10 CFR 61.55 Table 1 or Table 2 for radionuclide "i".

C_{PA} = Concentration, based on the WMA C PA inventory at closure, of the drilled source for radionuclide "i" (Ci/m³ or nCi/g) [see Sections 6.4.2.1 and 6.4.2.2].

$Dose_i$ = Peak dose, based on results of the WMA C PA, that occurs beyond 100 years (for pipelines) or beyond 500 years (for waste tanks, catch tank C-301 and 244-CR vault) after closure, for radionuclide "i", units in mrem/yr.

Incorporation of the Site Factor into equations presented for waste concentration calculations cancels out the Class C concentration limit included in Tables 1 and 2 of 10 CFR 61.55. The reduced equations calculate the peak dose equivalent based on the previously estimated value presented in the WMA C Performance Assessment, scaled to reflect the change in radioisotope inventory realized during additional tank waste recovery divided by the annual allowable 500 millirem total effective dose for an inadvertent intruder.

The adjusted ratio of the DOE-modeled dose over the allowable total effective dose equivalent is not an appropriate metric to classify nuclear waste for disposal. The approach presented by DOE does not comply with that laid out in Section 3 of the Nuclear Regulatory Commission guidance document *NRC Staff Guidance for Activities Related to U.S. Department of Energy Waste Determinations* (NUREG-1854) and appears to purposefully sidestep classifying residual wastes based on the radionuclides present, which would rate them as unsuitable for shallow burial.

For example, the Draft WIR states WMA C tank C-107 contains 16 curies of plutonium-239 (Table 2-6) in a residual waste volume of 39.4 cubic meters (m³, Table 4-7). Using the DOE-estimated residual waste density of 2.05 grams per cubic centimeter (g/cm³) the waste contains approximately 198 nanocuries per gram (nCi/g) plutonium-239. The calculated concentration exceeds the applicable value in Table 1 of 100 nCi/g in 10 CFR §61.55 (3), and is therefore not acceptable for near surface disposal.

Recommendation:

Residual tank waste should be classified based on calculation of long- and short-lived radionuclide activity per unit mass using the approved, unmodified formulas identified by 10 CFR § 61.55 and NUREG-1854. Waste should be classified for disposal accordingly.

Evaluation of Historical Releases

Historical releases of tank wastes to the WMA C vadose zone are not addressed in the Draft WIR. The DOE-estimated total releases to the subsurface include more than 200,000 gallons of radioactive waste including approximately 39,000 curies of cesium-137, 18 curies of technetium-99, and 1.5 curies of cobalt-60, and 31 kilograms (kg) of uranium, as well as 40,000 kg of nitrate (RPP-RPT-42294). Additional radioactive and hazardous wastes associated with the tanks and the reprocessing waste streams that were stored there, including transuranic radionuclides such as plutonium, are likely present although not specifically quantified by the DOE.

The Draft WIR proposed closure will leave radioactive and hazardous waste in the vadose zone without any treatment, or any attempt to stabilize and recover those wastes. Leaked waste present in the WMA C vadose zone will remain in the subsurface where it may be further remobilized when encountered by lateral groundwater flow or future infiltration. Radionuclides released to the vadose zone are not accounted for in the exposure scenarios evaluated as part of the WMA C Performance Assessment (RPP-ENV-58782, Rev. 0) used to demonstrate how the proposed closure will remain protective of human health and the environment. The exposure scenarios presented in the WMA C only evaluate future doses associated with residual tank wastes, assuming that the surrounding environment is free of additional contamination; this is demonstrably false and brings the validity of the results presented into serious question.

Recommendation:

Revise the Draft WIR and associated WMA C Performance Assessment to address releases to the WMA C vadose zone and groundwater. Evaluate potential exposure pathways that include stabilized tank waste and contaminated vadose media as well as the potential for mobilization of residual tank waste and vadose zone contamination to groundwater.

Environmental Fate and Transport Analysis is Deficient

In addition to failing to account for releases and contamination associated with other waste sites and facilities in the Central Plateau, supporting documentation presented as part of the WMA C Performance Assessment relies on environmental transport modeling that requires significant simplification of the subsurface environment. Unsaturated transport models such as STOMP do not account for the fine-scale heterogeneities that are known to exist in the WMA C vadose zone and that may alter fate and transport of contaminated groundwater or migration of contaminants in the subsurface. Such preferential pathways may result in accelerating the migration of contamination to groundwater, particularly if lateral groundwater flow is present during snowmelt or other high-infiltration events. Furthermore, the analysis performed assumes pristine boundary conditions and does not account for contributions to groundwater or the vadose zone from historical operations or future releases at other proximate waste sites.

ER/WM concurs with the Hanford Advisory Board that the analysis performed by the DOE is deficient in its accounting and analysis of:

- Fine-grained silt or clay lenses that may results in anisotropic transport in the subsurface;
- Lateral groundwater flow associated with high groundwater elevations during active operations and/or future high-infiltration events associated with snowmelt or other unusual meteorological events;
- The substantial existing inventory of radioactive contamination in the subsurface including highly mobile technetium-99 associated with historical operations;
- Cumulative effects associated with multiple releases at the Central Plateau waste sites and facilities.

Recommendation:

Revise the Draft WIR and WMA C Performance Assessment to address the data gaps identified above and to address the considerable uncertainty they introduce to long term closure and stability of the WMA C. Plans for closure, barrier use, and waste retrieval should be appropriately conservative to ensure even large deviations from the DOE's modeled exposure scenarios do not result in risks to human health and the environment that exceed limits set by existing Federal requirements.

Stability of Residual Wastes

The proposed stabilization of the WMA C tanks with grout does not ensure uniform incorporation of residual wastes. The DOE previously estimated the density of the residual wastes to be approximately 2.05 g/cm³, approximately 1.4 times the typical density of wet grout (approximately 1.5 g/cm³). Based on the density differences between residual waste and wet grout and the absence of measures to ensure thorough incorporation, the proposed stabilization measures may result in pushing residual wastes to the tank edges rather than incorporating them into a stable physical form as specified by DOE's Order 435.1. The Draft WIR contains no provisions for evaluating whether uniform incorporation is achieved following addition of grout to the tanks, and does not present the results of a pilot demonstration test or other proof of concept that would suggest such an approach is likely to succeed.

Recommendation:

Revise the Draft WIR to include appropriate detail and performance assurances that residual wastes will be uniformly and completely incorporated into the grout introduced into the WMA C tanks. The revision should include substantiating documentation from a pilot test or similar application as appropriate.

Overreliance on Surface Barrier Performance

The Draft WIR relies on surface barriers in order to meet basic performance criteria for protection against inadvertent intruders and reductions in waste mobility. The DOE has generally adopted the position that using surface barriers for landfill closure of radioactive waste is appropriately conservative because the barriers will last longer than 500 years even in the absence of active maintenance measures. However, no substantive documentation has been presented by the DOE to support this assertion. Moreover, such assumptions are not conservative and are not consistent with published research which indicates that surface barriers that can reasonably be expected to degrade due to damage from desiccation, freezing, and thawing; differential settlement; deep root penetration by vegetation; and burrowing by animals. The National Research Council's report, *Long-Term Institutional Management of U.S.*

Department of Energy Legacy Waste Sites (2000), addressed the DOE's use of barriers as a tool for isolating and containing waste and concluded that:

- Physical barrier systems that keep hazardous wastes in isolation will require their own ongoing support from an institutional management system;
- Stewardship measures not likely to remain effective for as long as residual contamination presents risks without constant upkeep and attention;
- Given that decisions made at facilities such as WMA C are often made with considerable uncertainty the best approach is to plan for failure of engineered barriers, institutional controls and other stewardship measures, rather than rely on them.

The Draft WIR appears to rely on similar assumptions of exceptional performance with minimal upkeep as have been applied in other DOE analyses rather than realistically addressing the points above. Such reasoning is not appropriately protective when considering shallow burial of high-level radioactive waste.

Recommendation:

Revise the Draft WIR to include appropriate information regarding surface barrier maintenance and stewardship measures planned for the WMA C and Central Plateau. Revise proposed closure activities to minimize reliance on surface barriers to the maximum extent practicable.

Use of Institutional Controls and Surface Barriers

The Yakama Nation has consistently opposed the use of surface barriers and institutional controls as a primary means of ensuring the long-term safety and security of the Hanford Site. ER/WM reaffirms that opposition with regard to the proposed closure of tanks in WMA C as described in the Draft WIR. Institutional controls are incompatible with Tribal reserved rights recognized by the Treaty of 1855 and are unlikely to be effective or adequately protective of future populations, particularly over the timeframe required for residual tanks wastes to decay to safe levels.

As described by the 2000 National Research Council publication, application of institutional controls is susceptible to multiple unfavorable long-term factors including:

- Atrophy of vigilance, which results in growing complacency and predictable cost control concerns;
- Informal mission change, wherein activities regarded as peripheral to an agency's core function are cut back or otherwise reduced; and
- Lack of predictable and consistent funding.

Unfortunately, as noted above, the DOE has not demonstrated the commitment to long term stewardship and maintenance that will be required to ensure the safety of shallow disposal for HLW, such as:

- Incorporating clear, detailed, and consistent descriptions of the maintenance and stewardship measures to be enacted as part of closure;
- Encouraging and embracing cultural and technical commitments to vigilant stewardship; and
- Providing consistent and conservative funding with assurances in advance rather than through annual appropriations, required to maintain engineered barriers and access controls.

In many instances the DOE has already shown signs of atrophying vigilance and/or overly optimistic expectations of performance with both minimal funding and upkeep. Examples of these include:

- Assuming that an uninformed individual with no institutional memory would elect not to drill through a Hanford barrier due to the presence of visibly crushed rock;
- Assuming surface barriers will remain effective for individuals with no institutional memory and will not be mistaken as markers of potentially valuable materials;
- Frequently assuming, with no supporting evidence, that future members of the public with no institutional memory will remain outside of waste site buffer areas;
- Unrealistically favorable expectations for surface barrier performance and limited surface infiltration over periods of 1,000 years or more without consideration for 100-year or 1,000-year meteorological events or barrier damage that may compromise effectiveness;

- Consistently favoring expedient and/or inexpensive disposal options with an emphasis on surface barriers and institutional controls rather than waste reduction and removal that may negate the need for such measures;
- Planning for long term closure and institutional control in a disjointed and/or piecemeal fashion that does not consider cumulative effects from surrounding waste sites and/or other environmental factors that may compromise the margins of safety reported for each waste site on an individual basis.

Recommendation:

Thoroughly review the Draft WIR's proposed use of institutional controls and surface barriers as part of closure activities and the associated uncertainty in their performance. Revise the Draft WIR to minimize the application of both institutional and engineering controls to the maximum extent practicable through additional waste retrieval and other means of reducing waste toxicity, volume, and mobility. Clearly identify and confirm the funding that will be provided for those institutional and engineering controls that are used.

REFERENCES

Intera, Inc., CH2M Hill Plateau Remediation Company, Washington River Protection Solutions LLC, and TecGeo Inc. 2016. Performance Assessment of Waste Management Area C, Hanford Site, Washington (RPP-ENV-58782 Rev. 0). October 4.

National Research Council. 2000. Long-Term Institutional Management of U.S. Department of Energy Legacy Waste Sites. Washington, DC: The National Academies Press.
<https://doi.org/10.17226/9949>.

Nuclear Regulatory Commission. 2007. NRC Staff Guidance for Activities Related to U.S. Department of Energy Waste Determinations, Draft Final Report for Interim Use (NUREG-1854). August.

U.S. Department of Energy. 2012. Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington (DOE/EIS-0391). Prepared by the U.S. Department of Energy, November.

U.S. Department of Energy. 2018. Draft Waste Incidental to Reprocessing Evaluation for Closure of Waste Management Area C at the Hanford Site (DOE/ORP-2018-01 Draft D). Prepared by the U.S. Department of Energy, March 29.

Washington River Protection Solutions, LLC. 2016. Hanford Waste Management Area C Soil Contamination Inventory Estimates (RPP-RPT-42294 Rev. 2). Prepared for the U.S. Department of Energy.