



Oregon

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Committee on Supplemental Treatment of Low-Activity Waste
at the Hanford Nuclear Reservation
Nuclear and Radiation Studies Board
Division on Earth and Life Studies
The National Academies of Sciences, Engineering, and Medicine
500 Fifth Street, NW
Washington, DC 20001

June 10, 2022

To the Committee,

Oregon appreciates this opportunity to comment once again on the National Academies of Sciences, Engineering, and Medicine (NAS) ongoing study of options for Supplemental Treatment of Low-Activity Waste (LAW) at the Hanford Nuclear Reservation. The State of Oregon retains a long-term interest in the safety and value of the Columbia River, which stands to be directly affected by the final end-state of Hanford wastes disposed on-site. Oregon is also invested in the safe transportation of radioactive materials through our state.

Oregon has been involved in the NAS study of Supplemental LAW options since its beginning¹, and the question of greatest concern to us continues to be whether Hanford LAW may be safely disposed as a grouted waste form on-site. Our technical reviews have highlighted the uncertainties that still must be resolved before we perceive the state of the science to support an onsite grout alternative. Our comments during the first study focused predominantly on the potential risk from long-lived key radionuclides that would be present in a grouted Supplemental LAW waste form.²

In this second study, Oregon has again kept its focus trained on those potential risks that would remain on-site under each alternative. We have been active participants during the three public NAS Committee meetings to date, providing both technical observations and Oregon's policy perspective as the study developed.^{3,4,5,6,7} Please consider these prior presentations as part of Oregon's formal comment on the Federally Funded Research and Development Center (FFRDC) report, to inform the Committee's review.

¹ <https://energyinfo.oregon.gov/blog/2018/03/07/odoes-ken-niles-weighs-in-on-hanford-waste-treatment-we-must-remain-vigilant-informed-and-involved>

² <https://www.oregon.gov/energy/safety-resiliency/Documents/NAS-Supplemental-LAW-study-Aug-2019.pdf>

³ <https://www.oregon.gov/energy/safety-resiliency/Documents/2021-07-15-NAS-ODOE-Remarks.pdf>

⁴ <https://www.oregon.gov/energy/safety-resiliency/Documents/2021-07-15-NAS-PPT.pdf>

⁵ <https://www.nationalacademies.org/event/10-20-2021/review-of-the-continued-analysis-of-supplemental-treatment-of-low-activity-waste-at-the-hanford-nuclear-reservation-meeting-3-open-session>

⁶ <https://www.nationalacademies.org/event/04-26-2022/docs/D1D5485813E0F259131C047AF33BD475AAE5A4C8CB3D>

⁷ <https://www.nuclearenergytv.com/Events/NAS-220426/Videoid/1952/840am-oregon-department-of-energy>

We continue to stand behind the technical observations we made during the prior study, and we did not find that this latest FFRDC report adds compelling new evidence to support the claims of long-term grout performance beyond what was presented during the first study. In addition, we have grown increasingly focused on the potential hazards associated with non-radiological constituents in the LAW – nitrate and nitrite in particular – which have presented technical challenges to an onsite grout alternative since the early days of the tank waste treatment mission and which ultimately caused DOE to turn away from grouted waste forms in the early 1990s.⁸

However, the most recent FFRDC report that is the subject of this letter has put forward a potentially acceptable alternative strategy to manage the effects of these uncertainties and reduce the final risk inventory of the Central Plateau while the science of grout performance continues. We do not arrive at this conclusion lightly, nor without reservation as described in our technical comments below.

As was stated in the remarks from Department staff at the April 28, 2022 NAS meeting, we are nearly convinced by the FFRDC's latest report that the Hanford tank waste mission would be overall best served by incorporating an offsite grout pathway for a portion of the low activity tank waste. We see value in reducing the overall risk budget burden for the Hanford Central Plateau – most notably from the key radionuclides Tc-99 and I-129 and the hazardous chemicals nitrate and nitrite – while continuing to improve and verify the recent advancements in grout performance. Further, any reduction in the total inventory of risk-significant constituents disposed on the Hanford Central Plateau serves to reduce the consequences of those onsite grout performance uncertainties that remain. We also appreciate the operational efficiencies gained by early creation of double-shell tank space, which will allow more rapid single-shell tank (SST) retrievals and faster completion of both the LAW and HLW vitrification activities.

From a precautionary standpoint, Oregon would prefer that if offsite grout disposal is pursued via the Grout 4B option, that offsite disposal would continue throughout the mission, rather than eventually transform into the hybrid Grout 6 alternative that conceives of large grout volumes disposed onsite. This preference is supported by a desire to reduce the cumulative risk burden of the Hanford Central Plateau to the maximum extent possible, given that the results of site-wide cumulative risk assessments are still pending at this time. This risks making a decision for onsite grouted waste for investment purposes before the necessary grout performance studies have reached a satisfactory conclusion. We also acknowledge the long-held expectation of the Yakama Nation, as reiterated at the April 2022 NAS meeting, that the Hanford tank waste would be vitrified if disposed on site.

Despite this preference, Oregon is not beyond convincing that a hybrid grout alternative presents an overall lower risk when considering the lesser offsite transportation miles and the increased operational certitude provided by a third disposal option in addition to the two offsite facilities. The FFRDC has the opportunity to refine their comparison of risk and other intangible factors between these two alternatives in their final report.

In the cost- and time-constrained environment we face at Hanford, the two grout alternatives presented in the FFRDC analysis may actually achieve the management trifecta of making the tank waste mission

⁸ Hanford Challenge, 2021. "Why Grout Failed at Hanford: Chronology of the Failed Grout Program". Page 16 discusses nitrate and nitrite technical challenges from a 1998 options analysis that recommended calcination to destroy nitrate. <https://static1.squarespace.com/static/568adf4125981deb769d96b2/t/60f9b2bdb9480b7aeb6cbe15/1626976958173/2021+06.15+Why+Grout+Failed+at+Hanford.pdf>

faster, cheaper, and better for the region. Once the long-term remedy for low activity waste treatment and disposal has been selected, USDOE can re-focus on finalizing and communicating how the treatment and disposal of high-level waste (HLW) will proceed. Oregon would like to see renewed urgency in addressing Hanford's HLW, including the highly radioactive radionuclides extracted from the LAW using the TSCR system. To the extent that a grouted SLAW alternative can improve our capabilities to address these larger needs and prevent the release of more tank waste to the environment, Oregon is willing to support the effort.

Sincerely,

A handwritten signature in purple ink that reads "Maxwell Woods". The signature is written in a cursive style and is positioned below the "Sincerely," text.

Maxwell Woods
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Specific Technical Comments on the FFRDC Report

(Supplementing or reiterating comments made during the April 28, 2022 NAS public meeting)

Completing the Decision Strategy

Prior to making a decision to pursue a Hybrid Grout 6 alternative, it is imperative to conduct additional long-term performance assessment for all constituents and waste forms disposed on-site. Without such information, a final accounting of the risk budget cannot be made. We note that the FFRDC report does not attempt to conduct this analysis, instead deferring it to future efforts.

The Grout 6 alternative description includes an assumption that the onsite grout alternative will have matured to a point sufficient to invest in the onsite grout treatment capability sometime prior to 2040. The report does not seem to include an assumed deadline when a “go/no go” decision must be made to pursue Alternative Grout 6 instead of continue with Grout 4B to the end of the mission. Additional information regarding this future decision should be provided in the final analysis, including key maturation steps, critical analytical and regulatory documentation schedules, and a stakeholder concerns satisfaction strategy.

Additionally, the analysis should identify and consider fallback options at future points in the mission if a decision is made in the near-term to pursue an offsite grout path. For example, the report assumes that if offsite grout is pursued, it could be online as early as 2027. What is the fallback option if we reach 2027 and the offsite path cannot proceed as expected, or if it is delayed? The report should evaluate how a decision made today might affect or narrow the available options later in the mission.

Refining the Risk Budget Tradeoffs

We request additional information regarding the total number of Curies of Tc-99 and I-129 disposed onsite vs. offsite under each alternative, as well as the form in which those Curies are disposed. Table 3.3-3 in Volume I compares Alternative 4B (offsite grout) against a “Delayed Vitrification” alternative to make the case that an offsite grout alternative would result in more Curies of Tc-99 removed permanently from the Central Plateau. While this may be true, we view this analysis to be incomplete.

Table 3.3-3 and Table 3.3-4 should be expanded to include the following comparative information:

- Include the Grout 6 Hybrid alternative in the Table 3.3-3 comparison of Curies disposed onsite vs. offsite, given that this is the FFRDC’s preferred alternative.
- Specify the associated waste form for any Curies disposed onsite. For example, while the “Delayed Vitrification” may result in a greater number of Curies disposed onsite than the 4B alternative (16,300 vs. 6,800), they would be predominantly retained in a superior glass matrix (actual ratio dependent on the capture efficiency for Tc-99 and I-129 in glass). By contrast, a larger proportion of the Curies disposed onsite under a Hybrid Grout 6 alternative (unquantified) would be in a grouted form and subject to greater long-term performance uncertainty.
 - Note: Table 3.3-4 contains cumulative Curie treatment quantities by alternative. Based on information in that table, we estimate the Grout 6 alternative would result in

approximately 5,500 Curies disposed onsite in a primary grout waste form (from 2040 to mission end), in addition to the 6,800 Curies disposed in a mix of glass and grouted secondary waste from the primary LAW vitrification facility.

- Include other key constituents in the quantitative risk budget analysis (discussed below)
- In Table 3.3-4, please clarify whether the “Vitrification 1” alternative presented is the same as the “Delayed Vitrification” alternative discussed in this section.

Key Constituents Used for Comparative Analysis

All of the comparative long-term performance analyses base themselves on Technetium-99 as the conservative tracer. As was shown in the Phase 1 study, however, the Iodine-129 grout performance uncertainty was actually the more sensitive parameter for future drinking water standard compliance. Further, our analysis and comments to the Committee in the July 2021 meeting highlighted the importance of the nitrate and nitrite inventories and performance. While this uncertainty is acknowledged in Volume II of the report, the relative inventories of these hazardous constituents are not accounted for in the semi-quantitative comparative analyses of alternatives. Additional discussion of the relative inventories of nitrate, nitrite, and chromium should be included in the “risk budget” analysis presented in Sections 3 and 4.

Retention of Tc-99 and I-129 in LAW glass

As discussed in our presentation during the October 2021 public meeting and by the FFRDC in April 2022, the retention efficiency of the key radionuclides Tc-99 and I-129 in the vitrified waste form is still uncertain. Estimates range from <20% to 96% for I-129, and the FFRDC presentation from April 2022 stated that as a result of the offgas “flywheel” recycling process, 75% of the Tc-99 will partition to the Supplemental LAW feed. We request a clearer discussion in the revised FFRDC report regarding the total quantities of Tc-99 and I-129 expected to be in a grouted primary or secondary waste form under each alternative.

Examining the Resilience of the Preferred Alternative

As noted in Oregon’s remarks at the April 2022 public meeting, the FFRDC report describes cost and schedule savings from the Grout 4B and Grout 6 alternatives as deriving from the near-term double-shell tank space created by offsite grouting. This in turn reduces the total number of HLW canisters produced in the mission due to the ability to use the extra DST space for HLW caustic leaching to reduce the volume of aluminum headed for high-level vitrification. Further discussion of this anticipated mission savings is warranted – particularly the resilience of the grout alternatives to mission disruptions such as additional DST failures. The analysis might also consider the potential risk mitigation benefits associated with adding new operational tank space to each of the alternatives, including the grout alternatives.

Acknowledging and Integrating the Remaining Onsite Grout Uncertainties

We appreciate and want to emphasize the effort this FFRDC report has taken to characterize the current state of uncertainty regarding long-term performance of a grouted LAW waste form. However, we

perceive a confusing lack of agreement in the report regarding the expected performance and remaining uncertainties associated with an onsite grout alternative. On one hand, Volume I makes assertions that the FFRDC believes all alternatives can meet the groundwater protection criteria for onsite disposal with “higher confidence”, yet Volume II acknowledges significant remaining uncertainties. For example, in the case of non-pertechnetate, the report states: “*Because it is not known how much non-pertechnetate is present in tanks and whether it would be sequestered in a grout waste form, at this time, there is significant risk in selecting on-site disposal of this a grouted waste form without additional analysis.*”

The FFRDC characterization of remaining uncertainty, and the basis for confidence that the Grout 6 alternative could meet onsite disposal safety criteria, requires further integration and support in the revised report. This integrated assessment could form the basis for a grout maturation study plan, which in turn would improve the decision strategy schedule and key considerations in a revised analysis.

Nitrate/Nitrite Considerations

FFRDC Volume II, Page E-16 states that nitrate and nitrite are not regulated under RCRA, and no release limits for NO₃ or NO₂ are available. This statement fails to acknowledge the potential regulation of nitrite as an “extremely hazardous waste” under RCW 71A.300.070 and 173-303-100. The Land Disposal Restrictions in WAC 173-303-140 prohibit the land disposal of extremely hazardous waste within the state unless certain provisions are met.

Related to the point above regarding remaining grout long-term performance uncertainty, we note that the FFRDC’s discussion of nitrate and nitrite risk under an onsite disposal alternative is incomplete. We accept this to be by design due to the scope of the alternatives carried forward in the analysis (i.e., no alternatives propose disposing of nitrate/nitrite-laden grout in the near-term); however, the FFRDC expresses a confidence in future grout performance that does not appear to be adequately supported.

The FFRDC references a recent PNNL report (PNNL-28992⁹) to support an assertion that some grout formulations, “can retain nitrate/nitrite more effectively and estimate peak concentrations below the compliance standard,” but we would caution the FFRDC and the Committee that the named report is not based on a compliance standard but instead proposes the use of a performance metric for purposes of rapid assessment during grout testing. We note also that while the FFRDC characterizes the results in Figure 4-3 as showing “leach testing results are close to meeting maximum contaminant levels in groundwater for nitrate,” our review of that figure shows many recent results that are one to two orders of magnitude above the screening diffusivity measure. The PNNL report also offers no discussion of the potential mechanism for the few results that were below the derived metric, and it explicitly did not include a metric for nitrite. Finally, this report contains the following disclaimer:

It should be noted that these simulations only consider the contribution from the SLAW inventory and not any contribution to the overall release rate from the primary LAW inventory. As a result, the R values that achieve the target concentrations would be an underestimation of the full LAW inventory release. The performance metric is not intended for use in regulatory decision-making.

⁹ <https://www.osti.gov/servlets/purl/1569475>

Oregon supports the ongoing research of grout performance specific to nitrate and nitrite retention if DOE wishes to pursue the Grout 6 alternative, provided that the costs of additional research do not outstrip the benefits compared to continued offsite disposal. Such research could be beneficial if incorporated in a long-term performance assessment intended to support regulatory decision-making.

Considering the Vitrification 2 Alternative

We look forward to the Committee's review of the Vitrification 2 alternative contained in Volume II of the FFRDC report. Our read of this section suggests that completing the tank waste treatment mission with no or minimal supplemental LAW treatment is possible, even feasible, provided that certain system upgrades are able to be realized and combined. Unfortunately, the FFRDC report did not carry this alternative forward into a cost or throughput analysis as was done with the standard Vitrification 1 alternative.

We request that the Committee and the FFRDC consider whether a Hanford decision-maker has been provided enough information to know why they should select the Vitrification 1 alternative over the Vitrification 2 alternative, or on what basis the billions of dollars required for the grout alternatives are a better investment than an upgraded primary LAW vitrification facility with some amount of offgas grouted for offsite disposal, which may prove to be a significantly lower-cost option. We ask the Committee to provide their thoughts regarding whether additional engineering study, process optimization, and cost estimation is worthwhile to fully evaluate this alternative.

Managing the Sludge

Please refer to our remarks during the April 2022 meeting for additional discussion of this topic. The FFRDC report does not contain a detailed discussion of the sludge management considerations that accompany each of the supplemental LAW alternatives. We are concerned that the increased pace of SST liquid and saltcake retrieval envisioned in the grout alternatives – particularly in the 200W area – may lead to sludge capacity issues in the double-shell tanks. Consequently, we are concerned that acceptance of an accelerated grout treatment alternative for Supplemental LAW could lead to the unexpected consequence that tanks may be closed in place without retrieving the sludge waste. We consider this to be an unacceptable tradeoff based on the analysis provided.

The FFRDC report should include an expanded discussion of sludge management logistics and challenges under each alternative, including the results of TOPSIM modeling and an assessment of the risk to retrieval efforts if the process must be halted at multiple tank farms due to sludge capacity limits. This discussion should also include an assessment of the status and outlook regarding the cross-site slurry transfer line.

Qualifying Extraordinary Claims

In multiple locations in the report, the FFRDC makes claims about the Hanford climate creating a situation in which waste buried at the IDF would have no driving force from infiltrating water, and that,

“. . . lack of driving force due to minimal flow of water in the unsaturated vadose zone, preventing it from actually contacting subsurface aquifers.” (Vol I, C-51, emphasis added)

Given the timeframes involved and changing weather patterns associated with global climate change, as well as uncertainty regarding long-term landfill cap performance, the volume of water driving flow in the vadose zone at Hanford is not well constrained. The presence of multiple groundwater contamination plumes resulting from past practices, and the results of several site performance assessment models of future contaminant migration from burial grounds and closed tanks, would suggest that there is adequate driving force to move contaminants to groundwater over both short and long timescales. Extraordinary claims require extraordinary evidence.

We request that the FFRDC support or qualify its statements regarding long-term migration potential in the IDF and Central Plateau. Similarly, the FFRDC should qualify its statements regarding a lack of a pathway in an offsite disposal context, clarifying that no currently known or expected future pathway exists.

Transportation Analysis

Under an offsite disposal alternative, we recognize the potential risk reduction associated with transporting waste a shorter distance to its disposal destination, even if that path travels through Oregon. As stated during the April 2022 meeting, Oregon is willing to work with USDOE and others to ensure safe transportation of waste through the state and accident response planning.

The analysis as presented does not offer a clear and organized comparison between transporting LAW in a solid or liquid form. We request additional information on the relative tradeoffs, including total number of railcar shipments, non-radiological transportation fatality risk, logistical/cost considerations, and accident consequence comparison.

The FFRDC analysis should include an accident scenario in which a liquid shipment loses containment and consider the potential costs and risks associated with the necessary cleanup. Such a situation would potentially create new unintended exposure pathways if not addressed. The analysis should consider whether the cost of mitigating this risk, in the unlikely event that it is realized, would significantly affect the comparative evaluation of liquid vs. solid offsite LAW transport or onsite vs. offsite disposal of LAW.

Organic Pretreatment and Cross-Site Transfer Assumptions for Grout 4B and Grout 6

As we discussed in October 2021, we do not believe it is correct to assert that the cross-site transfer line for liquids is not needed under the onsite grout alternatives, so long as vitrification is upheld as an alternative treatment method for wastes that fail to meet LDR standards for organics after the proposed low-temperature oxidation pretreatment step. The latest FFRDC report appears to continue with this assumption (Vol. I, p. 29-30), while also portraying, “Moderate confidence LDR organics can be removed/destroyed to beneath regulatory limits” (p. C-37).

We request that the revised FFRDC report provide additional discussion of the logistical and cost aspects of diverting LDR-incompatible wastes for vitrification if pretreatment fails.