Submitted via E-mail

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U.S. Department of Energy
Attn: Jennifer Colborn
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Richland, WA 99354
Email: TBIWIR@rl.gov

Subject: Comments on *Draft Waste Incidental to Reprocessing Evaluation for the Test Bed Initiative*

Dear Ms. Colborn,

Thank you for the opportunity to provide comments on the *Draft Waste Incidental to Reprocessing Evaluation for the Test Bed Initiative*.

Hanford Challenge is a non-profit, public interest, environmental, and worker advocacy organization located in Seattle, WA.[1] Hanford Challenge is an independent 501(c)(3) membership organization incorporated in the State of Washington with a mission to create a future for the Hanford Nuclear Site that secures human health and safety, advances accountability, and promotes a sustainable environmental legacy. Hanford Challenge has members who work at the Hanford Site. Other members of Hanford Challenge work and/or recreate near Hanford, where they may also be affected by hazardous materials emitted into the environment by Hanford. All members have a strong interest in ensuring the safe and effective cleanup of the nation's most toxic nuclear site for themselves and for current and future generations, and who are therefore affected by conditions that endanger human health and the environment.

Phase 2 of the Test Bed Initiative plans to use in-tank filters and ion-exchange to remove cesium-137 from about 2,000 gallons of tank waste from Tank SY-101. The pretreated tank liquids would be transported in special containers called "totes" to an offsite commercial treatment facility; either Perma-Fix Northwest in Richland; Perma-Fix DSSI in Kingston, TN; or directly transported to Waste Control Specialists in TX, or EnergySolutions in Clive, UT. The commercial facility would mix the pre-treated liquids with cement, resulting in approximately 65 drums of grouted waste to be disposed at either Waste Control Specialists (WCS) in Andrews County, TX or EnergySolutions in Clive, UT. Phase 3 would scale-up to 300,000-500,000 gallons of tank waste liquid treatment.

[1] Hanford Challenge mailing address: P.O. Box 28989 Seattle, WA 98118.

The following includes our overarching comments on the Phase 2 TBI WIR. Our technical comments are attached.

1. **Use of WIR is Contrary to Law**: The use of WIR is contrary to law. The Nuclear Waste Policy Act clearly defines high-level waste using a source-based definition. Under certain conditions reclassifying high-level waste is appropriate. Hanford Challenge has provided our conditions below. However, NRC's role under the WIR is purely as a consultant offering informed suggestions. NRC lacks the autonomy that an independent third-party review and authorization would hold, for example, the independent oversight that NRC has under the Nuclear Waste Policy Act. Public trust is also likely to increase with independent third-party review and authorization.
2. **Remove WIR Footnote 7 That Suggests No Waste is HLW**: Footnote 7 seems to suggest that no waste is high-level waste. We disagree with this interpretation and it should be removed.
3. **More Analysis Needed**: The analysis provided in the Phase 2 TBI WIR is not sufficient to support a larger scale project. By chopping this project into phases, DOE fails to analyze the larger environmental impacts from the start. Additionally, the information and data provided in the WIR is very limited and lacks the kind of technical rigor that would be needed to make a solid decision about grouting liquid tank waste. More analysis is needed on multiple fronts before greenlighting the test bed approach. The current approach minimizes the scaled-up impacts by only looking at the impacts from the test itself, not the larger implications of using grout for supplemental low activity waste treatment at Hanford, which involves up to 28 million gallons of liquid tank waste.
4. **Orphaned Waste/Bounce Back Waste**: The assumption that grouted liquid tank waste will all be disposed offsite seems to be the selling point that has generated so much enthusiasm for the Test Bed Initiative. While the proposed offsite facilities have expressed interest in accepting 2,000 gallons of grouted waste, there is no guarantee these facilities would accept the 500,000 gallons of grouted waste from Phase 3 or the ultimate 28 million gallons that DOE aspires to grout and ship offsite. Without a rigorous analysis of the total waste volume DOE intends to grout, the Test Bed Initiative could result in high volumes of orphaned grouted tank waste with no disposal pathway, that ends up "bouncing back" to Hanford for disposal.
5. **Point-By-Point Technical and Economic Practicability Analysis Needed:** The Phase 2 TBI WIR needs to expand its section 4.3 on technical and economic practicability related to removal of key radionuclides to provide a point by point analysis of how USDOE reached its conclusions. There is a laundry list captured on page 4-6 that warrants a section on each item listed.
6. **Third WIR Criteria On Shaky Ground**: It is unclear from the TBI WIR how USDOE plans to manage the treated waste as other than high-level waste while it remains in its liquid form. It is Hanford Challenge's understanding that until the treated liquid waste is in a solid physical form, it remains high-level waste and must be treated as such.
7. **Treat Hanford Waste Onsite**: Don't Use Perma-Fix NW for Hanford waste treatment, including the Test Bed Initiative.
8. **Key Radionuclides**: Treatment of Hanford tank waste needs to involve removal of key radionuclides, not just cesium, before waste can be grouted.

9. **Offsite Impacts**: Where will offsite environmental impacts be evaluated for this project? There is an incomplete analysis of this project without information, such as groundwater impacts, resulting from treating waste at Perma-Fix Northwest in Richland.
10. **Worker Protection from Toxic Chemical Vapors**: Tank vapor issues, including more accurate information on worker health and safety risks, and data on chemical constituents in the waste, need to be included in the WIR and documents related to the TBI.
11. **Improperly Characterized Conclusions About Grout**: Reference to previous reports of grout improperly characterizes conclusions about lifecycle cost comparisons between grout and vitrification and are misleading.
12. **Environmental Impact Statement**: If DOE is as invested in bringing grout to Hanford tank waste as it seems to be, a full Environmental Impact Statement should be conducted that considers all of the phases proposed for the Test Bed Initiative's plan to treat liquid tank wastes and immobilize the waste in grout. Disposal impacts should be considered for all scenarios, including orphaned grouted waste that stays on the Hanford site.

The Waste Incidental to Reprocessing Rule is Contrary to Law

The use of WIR is contrary to law. The Nuclear Waste Policy Act clearly defines high-level waste using a source-based definition.

Because high-level waste contains highly radioactive fission products and radionuclides that pose long-term dangers to human health and the environment, Congress enacted laws defining high level waste and defined DOE responsibilities to safely manage the waste at its sites and to dispose of that waste in geologic repositories. It has not given DOE authority to change the definition of high-level waste. DOE should therefore withdraw the Draft WIR and follow the statutory requirements in the Nuclear Waste Policy Act, which designates the Nuclear Regulatory Commission (NRC) as the appropriate agency to determine when high-level waste can be downgraded to low-level waste following the removal of radioactive constituents below "sufficient concentrations."

The Nuclear Waste Policy Act defines high-level waste as --

> (A) *the 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; and
>
> (B) other highly radioactive material that the Commission, consistent with existing law, determines by rule requires permanent isolation.[2]

Thus, the Nuclear Waste Policy Act defines high-level waste by its source – "the highly radioactive material resulting from the reprocessing of spent nuclear fuel"– rather than the specifics of its

[2] 42 U.S.C. § 10101(12). The Price-Anderson Amendments Act of 1988, Public Law 100-408, later incorporated the Nuclear Waste Policy Act's definition of "high-level radioactive waste" into the Atomic Energy Act of 1954 by reference. 42 U.S.C. § 2014(dd).

hazardous characteristics. Further, the Nuclear Regulatory Commission (NRC) has interpreted subparagraph (A) as "essentially identical" to the NRC's regulatory definition,[3] with one major difference. NRC's definition includes "solids into which such liquid wastes have been converted"[4] versus the Nuclear Waste Policy Act's definition states "solid material derived from such liquid waste *that contains fission products in sufficient concentrations*."[5] NRC read the distinction to "reflect the possibility that liquid reprocessing wastes may be partitioned or otherwise treated so that some of the solidified products will contain substantially reduced concentrations of radionuclides."[6]

It is plain that DOE's Draft WIR Evaluation violates the law and therefore must be withdrawn. We urge DOE to go back to the drawing board and commence a transparent public process, led by the States of Washington and Oregon, the Confederated Tribes and Bands of the Yakama Nation (Yakama Nation), the Confederated Tribes of the Umatilla Indian Reservation (CTUIR), and the Nez Perce Tribe, and concerned members of the public that can put the cleanup of Hanford on a course that is both scientifically defensible and publicly accepted.

Under certain conditions, reclassifying high-level waste is appropriate. Hanford Challenge believes that the reclassification of high-level waste is acceptable where:

- There is a presumption that high-level waste will be vitrified and buried in a deep, geological repository;
- There is an agreed-upon understanding that long-lived radionuclides presumptively require disposal in a geological repository;
- The use of reclassification is used in "special and unusual" circumstances — not wholesale to reclassify substantial portions of high-level waste and never for expediency or economic cost-savings reasons;
- The high-level waste has been treated and key radionuclides have been removed;
- An independent entity (such as a new agency or commission created for the purpose of nuclear waste disposition) makes the determination to reclassify the waste;
- There has been an open, transparent, and inclusive process involving interested stakeholders;
- The state of Washington and the affected tribal nations concur;
- There is a comprehensive report specifying what waste volumes/concentrations are being left at Hanford, for how long, and why;
- An assessment of the cumulative impact on the environment and future generations is prepared and made publicly available; and
- There is a judicial process available for aggrieved parties to challenge a determination in federal court.

NRC lacks the autonomy that an independent third-party review and authorization would hold, for example, the independent oversight that NRC has under the Nuclear Waste Policy Act. Public trust

[3] *See* 52 Fed. Reg. at 5994. NRC's high level waste disposal rules, adopted before Nuclear Waste Policy Act's 1982 enactment, include: (1) irradiated reactor fuel; (2) liquid reprocessing wastes as defined in the AEC's Appendix F; and (3) "solids into which such liquid wastes have been converted." 10 C.F.R. § 60.2.
[4] 10 C.F.R. § 60.2.
[5] 42 U.S.C. § 10101(12)(A) (emphasis added).
[6] 52 Fed. Reg. at 5994.

is also likely to increase with independent third-party review and authorization.

Remove High-Level Waste Footnote 7

Footnote 7 states:

> "Waste incidental to reprocessing is called "WIR" in this document. The term "reprocessing" is defined in Attachment 2 of DOE M 435.1-1 as: "Actions necessary to separate fissile elements (U-235, Pu-239, U-233, and Pu-241) and/or transuranium elements (e.g., Np, Pu, Am, Cm) from other materials (e.g., fission products, activated metals, cladding) contained in spent nuclear fuel for the purposes of recovering desired materials. Separation processes include aqueous separation processes, e.g., the REDOX and the PUREX processes, and nonaqueous processes, e.g., pyrometallurgical and pyrochemical processes. Wastes that are produced upstream of these separations processes, from processes such as chemical or mechanical decladding, cladding separations, conditioning, or accountability measuring, are not high-level waste. Such wastes are considered processing wastes and should be managed in accordance with the appropriate Chapters of DOE M 435.1- 1, as either transuranic, mixed low-level, or low-level waste. Likewise, wastes that are produced downstream of these separations processes, from such processes as decontamination, rinsing, washing, treating, vitrifying, or solidifying, are also not high-level waste and should be managed accordingly. Upstream and downstream wastes are not high-level waste because they do not result from reprocessing."

This footnote attempts to redefine the very nature of High-Level Waste, which is already defined by statute. The Nuclear Waste Policy Act defines high-level waste as --

> (A) *the 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; and
>
> (B) other highly radioactive material that the Commission, consistent with existing law, determines by rule requires permanent isolation.[7]

DOE attempts to subvert the statutory definition by claiming that wastes *downstream* of reprocessing somehow loses its statutory definition – even going so far as to claim that vitrification of HLW somehow transforms the waste into other than HLW. This is a legal and regulatory fiction that seriously changes both the letter and intent of the law. This footnote must be removed.

More Analysis Needed

Hanford Challenge is concerned about the implications these tests could have on the future of tank waste treatment and disposal at Hanford. The research and information we have access to suggests that a grouted waste form is ultimately less protective of human and environmental health than

[7] 42 U.S.C. § 10101(12). The Price-Anderson Amendments Act of 1988, Public Law 100-408, later incorporated the Nuclear Waste Policy Act's definition of "high-level radioactive waste" into the Atomic Energy Act of 1954 by reference. 42 U.S.C. § 2014(dd).

glass.[8] DOE itself has reached this conclusion in past reports, as documented in Hanford Challenge's recent report, *Why Grout Failed at Hanford*[9], which we incorporate into this comment.

While we understand that the Test Bed Initiative is focused on offsite treatment, the information from the tests could prove to be a foundation for future disposal of grouted waste at Hanford. The 2,000 gallon test needs more public involvement to ensure it is not fast-tracked in ways that negatively impact the future of tank waste treatment and disposal, and the mission to immobilize tank waste in glass. We are also concerned that the Phase 2 WIR may be used as a blueprint for Phase 3 of the Test Bed Initiative.

Treating 2,000 gallons of tank waste and sending it offsite to be grouted and disposed sets precedent for the planned scale-up in Phase 3 to 500,000 gallons, and may influence future decisions about supplemental low-activity tank waste treatment.

The analysis provided in the Phase 2 TBI WIR is not sufficient to support a larger scale project. By chopping this project into phases, DOE fails to analyze the larger environmental impacts from the start. Additionally, the information and data provided in the WIR, is very limited and lacks the kind of technical rigor that would be needed to make a solid decision about grouting liquid tank waste. More analysis is needed on multiple fronts before greenlighting the test bed approach. The current approach minimizes the scaled-up impacts by only looking at the impacts from the test itself, not the larger implications of using grout for supplemental low activity waste treatment at Hanford, which involves up to 28 million gallons of liquid tank waste.

For example, only looking at the waste profile of SY-101 paints a limited and specific view of what treating liquid tank waste at Hanford entails. We know that there is a great deal of variability and unknowns in the high-level tank wastes at Hanford. No broader conclusions should be drawn from the specific analysis of this one tank being used for Phase Two.

Characterization of Waste Needs More Rigor

There is insufficient information about how the waste will be analyzed as it is transferred from the tanks to the totes. As we understand, the grout formula depends on the waste characteristics. We need more than one sample to represent all of the waste in the six totes to get accurate data about what concentrations of radionuclides and chemicals are in the treated waste prior to grouting. This information is also necessary to see if the treatment technology is effective. More data, less assumptions.

Revise the WIR to include more verification sampling and explanation of how the characterization results will be analyzed to determine if the waste is acceptable for grouting.

Point-By-Point Technical and Economic Practicability Analysis Needed

The Phase 2 TBI WIR needs to expand its section 4.3 on technical and economic practicability

[8] Hanford Challenge, *Why Grout Failed at Hanford, Chronology of the Failed Grout Program*, June 2021, available at https://static1.squarespace.com/static/568adf4125981deb769d96b2/t/60f9b2bdb9480b7aeb6cbe15/1626976958173/2021+06.15+Why+Grout+Failed+at+Hanford.pdf
[9] Id.

related to removal of key radionuclides to provide a point by point analysis of how USDOE reached its conclusions. There is a laundry list captured on page 4-6 that warrants a section on each item listed:

> "The "maximum extent that is technically and economically practical" standard contemplates, among other things, consideration of expert judgment and opinion; environmental, health, timing, or other exigencies; the risks and benefits to public health, safety, and the environment arising from further radionuclide removal as compared with countervailing considerations that may ensue from not removing or delaying removal; life cycle costs; net social value; the cost (monetary as well as environmental and human health and safety costs) per curie removed; radiological removal efficiency; the point at which removal costs increase significantly in relationship to removal efficiency; the service life of equipment; the reasonable availability of proven technologies; the limitations of such technologies; the usefulness of such technologies; project schedule or funding constraints; and the sensibleness of using such technologies." (p. 4-6 DOE-ORP-2021-01, Rev 0, TBI WIR)

Without this point-by-point analysis, there is insufficient information and analysis to support the conclusion of impracticability for further key radionuclide removal as part of the TBI. Hanford Challenge is concerned about USDOE ending up with grouted waste at Hanford and wants to ensure that attempts are made to remove key radionuclides such as Tc-99 and I-129. Key radionuclides belong in vitrified high-level waste disposed of in a deep geological repository.

Orphaned Waste and Bounce Back Waste

The assumption that grouted liquid tank waste will all be disposed offsite seems to be the selling point that has generated so much enthusiasm for the Test Bed Initiative. While the proposed offsite facilities have expressed interest in accepting 2,000 gallons of grouted waste, there is no guarantee these facilities would accept the 500,000 gallons of grouted waste from Phase 3 or the ultimate 28 million gallons that DOE aspires to grout and ship offsite.

There are no written agreements that DOE can offer – only verbal assurances, that the grouted waste will actually be accepted for disposal in another location. By failing to analyze the ultimate waste volume DOE has expressed interest in grouting[10], Test Bed could potentially result in high volumes of orphaned grouted tank waste with no disposal pathway, that ends up "bouncing back" to Hanford for disposal. We don't want this to happen.

Third WIR Criteria On Shaky Ground

It is unclear from the TBI WIR, how USDOE plans to manage the treated waste as other than high-level waste while it remains in its liquid form. It is Hanford Challenge's understanding that until the treated liquid waste is in a solid physical form, it remains high-level waste and must be treated

[10] Hanford Challenge, *Grouting 80% of Hanford's Tank Waste? Hanford Challenge's Response*, January 2021, available at https://static1.squarespace.com/static/568adf4125981deb769d96b2/t/6019a4cc4e44c51227249a8c/1612293324688/2021+Feb+HC+Response+Grout+Report+to+Congress.pdf

as such. Hanford Challenge believes it is irresponsible to transport liquid tank waste off of the Hanford site. Perma-Fix NW is an unsuitable location for the reasons detailed in our comments. The other offsite treatment options involve long transportation routes. An accident involving 2,000 gallons of high-level liquid tank waste that has undergone limited treatment and has yet to be solidified seems like an unnecessary risk. This waste should be treated onsite, and glass is a better option.

Treat Hanford Waste at the Hanford Site

Phase Two proposes the use of a local facility called Perma-Fix NW as one of the treatment locations for the tank waste. Perma-Fix NW has off-gas stacks and groundwater within the Richland city limits, where residential communities are potentially impacted from releases. Perma-Fix NW is not a facility that should be under consideration for the Test Bed Initiative.

Perma-Fix Northwest is at the center of the Department of Energy's "Test Bed Initiative," a proposal launched in 2016 to explore the feasibility of treating liquids from Hanford's underground high-level waste (HLW) tanks by removing cesium and mixing the liquid tank waste with grout for offsite disposal. After initial in-tank pretreatment (cesium-ion exchange and filtration) the liquids would be classified by DOE as Mixed Low Level Wastes (MLLW) which the U.S. Nuclear Regulatory Commission (NRC) says may be highly radioactive and contain long-lived radionuclides. According to the NRC, this waste (LAW feed), which constitutes about 80% of the total volume in Hanford's HLW tanks:

> "has high radiation levels requiring handling within shielded structures. Three envelopes of LAW have been defined: Envelope A is standard, Envelope B contains higher levels of cesium, and Envelope C contains higher levels of strontium and TRU ... . LAW would come from the liquid phases of the DSTs and from solids washing operations…. LAW is still HLW and DOE identifies the solid phases as HLW, defined as Envelope D .... Envelope D contains cesium, strontium, and TRUs as the radionuclides. Metal oxides, hydroxides, nitrates, phosphates, and aluminates constitute the bulk of the chemical species."[11]

The Test Bed Initiative operates on a three-phase plan to pretreat liquid tank wastes, known as supernate, from Hanford's double-shell waste tanks. The Test Bed Initiative will send the pre-treated liquid waste to an offsite treatment facility to be mixed with cement (grout) and dispose the grouted waste offsite at a commercial low-level radioactive waste disposal site. In 2017, Phase 1 of this initiative was demonstrated using Perma-Fix Northwest as its offsite treatment facility.[12] It involved a composite of approximately 3 gallons of wastes from six of Hanford's high-level waste tanks. The waste was pretreated, mixed with grout at the Perma-Fix Northwest facility and then shipped to the Waste Control Specialists (WCS) disposal site in Andrews, Texas. WCS has less restrictive waste acceptance criteria as compared to what is expected for onsite landfill disposal at

[11] U.S. Nuclear Regulatory Commission, *Overview and Summary of NRC Involvement with DOE in the Tank Waste Remediation System-Privatization* (TWRS-P) Program June 29, 2001 NUREG 1747, p. 1. Table 2, pp. 1–3, https://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1747/.

[12] U.S. Department of Energy, Office of River Protection, Hanford Tank Waste Strategy, Test Bed Initiative-Phase II, For the Hanford Advisory Board, Tank Waste Committee, January 9, 2019.

other sites. Neither Waste Control Specialists, nor DOE has sufficiently analyzed whether grouted waste from pretreated high-level waste tanks meets the Waste Acceptance Criteria for disposal at Waste Control Specialists.

The practice of treating Hanford's low-level and plutonium-containing wastes at Perma-Fix Northwest, a commercial facility in Richland, WA, should end.

Perma-Fix Northwest is a commercial Low-Level Waste (LLW) and Mixed Low-Level Radioactive Waste (MLLW) treatment and storage facility approved, permitted or licensed for operation by the Environmental Protection Agency (EPA) Region 10, the Washington State Department of Ecology, and the Washington State Department of Health under their respective authorities. Perma-Fix Northwest is located on 35 acres in an urban area in the City of Richland and near the Department of Energy's (DOE) Hanford Nuclear Site.

Continued offsite shipping, storage and treatment of plutonium-containing nuclear wastes from Hanford to surrounding residential communities creates avoidable health, safety and security risks. According to the EPA, in 2010 over 32,000 people lived within 5 miles of Perma-Fix Northwest. Richland residents are at risk from the radioactive and hazardous materials transported over public roads between Hanford and Perma-Fix Northwest.

According to the State of Washington and federal regulators, Perma-Fix Northwest in Richland exceeded onsite soil contamination limits, improperly stored radioactive and other hazardous wastes, handled wastes resulting in leakage of plutonium and significant workplace contamination, failed to notify regulators of known violations, and exposed several employees to radiation. Perma-Fix Northwest was also fined a total of $551,891 from 2008 to 2019 by the U.S. Environmental Protection Agency and the Washington Department of Ecology for hazardous waste violations.

Hanford Challenge's November 2020 investigation, *Risky Business at Perma-Fix Northwest*[13], uncovered a disturbing history of accidents, violations, findings, and non-compliances that raise serious questions about whether Perma-Fix should be allowed to continue treating dangerous Hanford waste. Cost-savings is only one aspect to consider when deciding where and how to clean up Hanford's dangerous waste, but cost savings should never be the sole consideration.

We believe that DOE should revitalize treatment capacity on the Hanford site to perform waste treatment functions currently performed by Perma-Fix Northwest

Hanford Challenge has concluded that it would be safer to expand the treatment capacity at the Hanford Site instead of sending waste for treatment at Perma-Fix Northwest. Treatment of waste on the Hanford Site provides the best environment for compliance with safety standards, clear and coordinated regulatory oversight, transparency, and accountability.

Hanford Challenge recommends that the Department of Energy revitalize its internal capacity at Hanford to perform the waste treatment functions that it is currently sending to Perma-Fix

[13] Hanford Challenge, *Risky Business at Perma-Fix Northwest*, Nov 2020, available at https://static1.squarespace.com/static/568adf4125981deb769d96b2/t/5fce533274a40730fbc928bf/1607357241336/2020+12.04+PermaFix+Report+updated.pdf. This report and the documents referenced to in the report are incorporated as part of this Hanford Challenge comment.

Northwest. Hanford is a more suitable location for treatment due to a higher level of transparency and accountability, remote location further away from populated areas, further from the groundwater, able to avoid the risky practice of transporting thousands of cubic meters of dangerous waste on public roadways, and a workforce that is highly trained, qualified, and certified.

Revise the draft WIR to consider onsite treatment.

We understand that the TBI Phase 2 only considers treatment of 2,000 gallons, however we are concerned that conclusions drawn from analysis of Phase 2 will be incomplete without considering an onsite treatment facility. There are major issues with using Perma-Fix Northwest that are exacerbated in the Phase 3's scale-up scenario, that won't show up as clearly in Phase 2.

Phase 3 would expand the production scale to grout 300,000 to 500,000 gallons of soluble radioactive tank wastes over an 18-month period. At DOE's Phase 3 production scale, the Perma-Fix Northwest facility would generate as many as 16,364 55-gallon drums at a rate of about one drum filled every 45 minutes. In 2018, Perma-Fix Northwest proposed a similar plan.

A review of TBI's Phase 3 done in 2018 by federal and contractor experts at Hanford, questioned "whether Perma-Fix has the physical capacity and personnel required to handle the volume of waste which will be generated."[14] It would "require a 55-gallon drum to be produced roughly every 45 minutes."[15] After the drums are filled nearly 1,000 would have to remain in lag storage each month at the site for about 30 days, so that the grout can be cured to ensure its compressive strength before transport.[16] The transportation logistics for a waste volume this large have not been worked out. It is quite possible that the large waste volumes of about 1,000 drums per month, could create a transportation bottleneck resulting in a large backlog of stored grouted waste drums sitting at the Perma-Fix Northwest site.

The Draft WIR does not perform any kind of cumulative impact analysis of the operations at Perma-Fix NW.

DOE has stated that the 2,000 gallon treatment project would be a "small" fraction of the total capacity at Perma-Fix NW and elsewhere. The WIR should evaluate the cumulative impact of the waste forecast for treatment at Perma-Fix NW, per DOE's "emwims.org" web page. The sum of all the waste to be sent to PFNW is not only large by any standard, but is expected to grow even larger in the near future.

The volume and degree of radiologically-contaminated and high hazard waste DOE plans to send

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[14] U.S. Department of Energy, Richland Operations Office, OA Database entry 37276, Chief Engineer/TPD/TOD/MIO/ECD review of DFLAW Readiness, Downstream Treatment & Disposal (LERF, ETF, Off-Site Treatment of MLLW, SALDS, TEDF, IDF) April 19, 2018 p. 8.

[15] OA Database entry 37276, Chief Engineer/TPD/TOD/MIO/ECD review of DFLAW Readiness, Downstream Treatment & Disposal (LERF, ETF, Off-Site Treatment of MLLW, SALDS, TEDF, IDF), available at https://www.dropbox.com/s/ramkr3y334k0ns2/FN%20200%202018%2004.19%20DOE%20Review%20of%20DFLAW%20Interfaces%20PFNW.pdf?dl=0

[16] W.L. Elbert and J.L Jerden Jr., *Test Plan for Formulation and Evaluation of Grouted Waste Forms with SHINE Process Wastes*, U.S. Department of Energy, Argonne National Laboratory, ANL/NE-15/29, September 2015, p. 37, available at https://publications.anl.gov/anlpubs/2017/02/133742.pdf.

to Perma-Fix Northwest over the next 45 years should be considered against the additional waste DOE may send to Perma-Fix NW for treatment. The WIR should assess the cumulative human and environmental risks to the surrounding residential communities and workers. According to DOE projections, Perma-Fix NW is planning to accept and treat more than 43,000 cubic meters of mixed and low level radioactive wastes from Hanford and other sites between now and 2066. This will include toxic lead, cadmium, and mercury; pyrophoric depleted uranium metal, organic liquids, Waste Treatment Plant (WTP) wastes, contaminated equipment, radioactive lead wastes, transuranic wastes, contaminated pumps, Direct-Feed Low-Activity Waste (DFLAW) residuals, contaminated devices, and transfer lines. This also includes more than 600 cubic meters of radioactive wastes in packages larger than 10 cubic meters and with contact activity above 200 mRem per hour which will require remote handling. Some wastes, such as 473 cubic meters of spent resin (possibly for Cs-137 removal) will have unknown radioactivity.

The magnitude of dangerous radioactive and non-radioactive hazardous waste envisioned to be processed by DOE at Perma-Fix Northwest over the next 45 years, if realized, could well exceed the current regulatory capabilities of Washington State and the EPA to ensure safety of workers and the public.

Perma-Fix NW is operating under a temporary permit and has been since 2009. This permit needs to be updated.

Perma-Fix NW does not have a reasonable expectation that a new permit will be issued to include Hanford tank waste for a Test Bed Initiative in the near future. The permit is dependent on the issuance of a State Environmental Protection Act (SEPA) analysis, a draft of which has not been issued as of this date. Perma-Fix NW itself characterizes as "uncertain" as to the date for treating the 2,000 gallons of TBI waste to the Securities and Exchange Commission in their June 30, 2021 Form 10-Q Quarterly Report for the period ending June 30, 2021.[17]

The history and information about hazardous waste components of SY-101 waste needs to be updated for potential impacts on grout integrity.

Tank SY-101 is estimated to contain 892,000 gallons of supernate liquids and 223,000 gallons of salt cake.[18] As of 2013 it was estimated to contain about 705,000 curies of radioactivity, of which about 75% is from Cs-137.[19] The salt cake in this tank contains retained hydrogen gas, which poses a hazard if released as a result of the addition of water to dissolve the salt.[20]

In 2007, a report by Pacific Northwest National Laboratory (PNNL) describes the history of this tank as follows:

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[17] https://ir.perma-fix.com/all-sec-filings#document-50126-0001493152-21-019308

[18] A.M Templeton, Waste Tank Summary Report for Month Ending November 30, 2018, p. 20, available at https://www.emcbc.doe.gov/SEB/TCC/Documents/Site%20Tours/Waste%20Tank%20Summary%20Report%2011-18.pdf

[19] Tank Waste Inventory Network System, Best Basis Estimate 2013, available at https://phoenix.pnnl.gov/phoenix/apps/tanks/index.html

[20] J. S. Rodriguez, J. W. Kelly, D. C. Larsen, *Integrated Waste Feed Delivery Plan Volume 3 – Project Plan* Washington River Protection Solutions, LLC, March 26, 2012. Table D-1, available at https://www.hanford.gov/files.cfm/RPP-40149-VOL3_-_Rev_02.pdf

> "From 1990 through 1993, SY-101's flammable gas troubles were acknowledged as the highest priority safety issue in the entire DOE complex. Uncontrolled crust growth demanded another high-priority remedial effort from 1998 through April 2000. The direct cost of the bubbles, toils, and troubles was high. Overall, the price of dealing with the real and imagined hazards in SY-101 may have reached $250 million. The indirect cost was also high."[21]

Key Radionuclides

Treatment of Hanford tank waste needs to involve the removal of key radionuclides, not just cesium, before waste can be grouted.

Removing radioactive cesium elements is not enough to guarantee the integrity of the grout. There are also several chemicals in the SY-101 tank liquids that can cause deterioration of the cement used in grout. According to the Portland Cement Association, "chlorides and nitrates of ammonium, magnesium, aluminum, and iron all cause concrete deterioration, with those of ammonium producing the most damage."[22] All of these elements are present in Hanford's tank waste and it raises an important question as to whether Perma-Fix Northwest or another offsite facility will have to control them to ensure the integrity of its grout.

Tank SY-101 has one of the largest Total Organic Carbon (TOC) loads of Hanford's HLW tanks. Nearly 150 volatile organic compounds have been measured in retained gas emanating from the slurry in this tank.[23] At 46,900 kg,[24] this quantity of organic compounds poses a significant challenge without potentially complex pretreatment prior to grouting in order to comply with RCRA land disposal restrictions.[25]

Offsite Evaluation of Risks

The fact that discussion of grout treatment at facilities like Perma-Fix Northwest does not include or evaluate the relative risks to groundwater, air, and local populations makes this draft WIR incomplete. The Perma-Fix NW Annual Environment Report for 2020 states that "the area water table varies from approximately 10 feet at the west well to 21 feet at the east well[26]." Contrast this

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[21] Charles W. Stewart, *Hanford's Battle with Nuclear Waste Tank SY-101: Bubbles, Toils, and Troubles,* PNNL-SA-43778, June 2006, available at https://www.osti.gov/biblio/892228-hanford-battle-nuclear-waste-tank-sy-bubbles-toils-troubles

[22] Robert Alvarez, *Reducing the Risks of High-Level Radioactive Wastes at Hanford*, Science and Global Security, 13:43–86, 2005, Table 1, available at http://scienceandglobalsecurity.org/archive/sgs13alvarez.pdf

[17.] L.M. Stock, *Occurrence and Chemistry of Organic Compounds in Hanford Site Waste Tanks*, RPP-21854, Rev. 0, 07/27/2004, Table 3-10, available at https://hanfordvapors.com/wp-content/uploads/2016/09/Occurence-and-Chemistry-of-Organic-Compounds-in-Hanford-Site-Waste-Tanks-RPP-21854-Rev.-0-07-29-2004.pdf.

[24] Tank Waste Inventory Network System Best Basis Estimate 2013, available at https://phoenix.pnnl.gov/phoenix/apps/tanks/index.html.

[25] U.S. Department of Energy, Savanah River National Laboratory, *Report of Analysis of Approaches to Supplemental Treatment of Low-Activity Waste at the Hanford Nuclear Reservation*, SRNL-RP-2018-00687 October 10, 2019, Table 2, p. 28, available at https://www.nationalacademies.org/documents/embed/link/LF2255DA3DD1C41C0A42D3BEF0989ACAECE3053A6A9B/file/D5103F716F7BE9B50A8749F6FAD7382E42825D4BFC3E.

[26] PermaFix Northwest Richland, Inc., Annual Environmental Monitoring Report for 2020, submitted to the Washington Department of Health, July 29, 2021.

with the hundreds of feet to the water table in the Hanford 200 Areas. A spill during the handling or transportation of wastes at PFNW would quickly contaminate water that flows towards intakes and wells used by the City of Richland for drinking and irrigation. Perma-Fix NW has a history of experiencing losses of contamination control at the facility[27]. The WIR and associated TBI analyses must thoroughly evaluate the relative risks to groundwater, air, and local populations if waste is to be treated and grouted offsite.

Worker Impacts from Toxic Chemical Vapor Exposure

Tank vapor issues, including more accurate information on worker health and safety risks, and data on chemical constituents in the waste, need to be included in the WIR.

Tank SY-101 was a "burping" gas-producing tank, containing a variety of organic and inorganic compounds. Tank vapor releases pose a threat to both workers and the public near the Perma-Fix NW facility. Incredibly, DOE characterizes vapor risks for workers in the EA as minimal or temporary, and fails to mention chemical hazards at all in the WIR. This statement belies the long history of vapor exposures at Hanford and is demonstrative of DOE's dismissive attitude towards the health and safety of workers.

This statement comes on the heels of a just-released report from the Washington State Department of Commerce that conducted a survey of some 1,600 Hanford workers who reported that 57% of those surveyed had been exposed to toxic vapors.

Nearly a third, 32%, reported they had long-term exposure to hazardous materials at the nuclear reservation, rather than exposure during a single incident. The survey was conducted by the Hanford Healthy Energy Workers Board. The board was created by the Legislature and directed to survey workers and then provide recommendations to better meet the health care needs of Hanford workers.

Over 21% of those surveyed said they had illnesses due to a short-term exposure to hazardous materials at Hanford. In addition, 28% said they had illnesses from long-term exposure to hazardous materials at Hanford.

Even if there is rationale not to consider worker exposure to toxic chemicals as not within the scope of the WIR, the chemical hazard needs to be addressed due to its impact on the grout performance. The WIR does not contain information on the chemical constituents present in the waste. While we understand that the WIR is looking at the radioactive hazard, in order to meet its third criteria of a solid waste form, the chemical constituents are a vital piece of information to ensure that it is even possible for the grout to solidify.

Improperly Characterized Conclusions About Grout

USDOE makes a misleading reference to previous reports on the use of grout for Hanford tank waste in the draft WIR. USDOE improperly characterizes the reports' findings related to lifecycle

[27] Hanford Challenge, *Risky Business at Perma-Fix Northwest*, Nov 2020, available at https://static1.squarespace.com/static/568adf4125981deb769d96b2/t/5fce533274a40730fbc928bf/1607357241336/2020+12.04+PermaFix+Report+updated.pdf.

cost comparisons between grout and vitrification. The Draft WIR states:

> "Numerous studies by the National Academies of Science (NAS), the Government Accountability Office (GAO), the Federally Funded Research and Development Center (FFRDC), and DOE have recognized that using grout as a solidification approach for supplemental LAW may significantly reduce total lifecycle costs when compared to vitrification and steam reforming, with certain assumptions, uncertainties, and funding."

The footnote to this states "These reports are mentioned here for additional context and information, and speak for themselves." (p.4-17 TBI WIR)

Our review of these reports generated a different conclusion, which we also believe speaks for itself. The National Academy of Sciences, in a 2019 review of a DOE (FFRDC) report that listed grout as a cheaper option, stated:

> "The committee finds that, in its current iteration, the FFRDC's analysis:
> a. When taken alone, does not yet provide a complete technical basis needed to support a final decision on a treatment approach;" p. 3 and

> "The cost estimates in the FFRDC report are based on technologies that, for the most part, have not yet been fully developed, tested, or deployed for Hanford's particular, and particularly complex, tank wastes, and instead use costs from similar technologies. As a result, there are large attendant uncertainties, suggesting that costs could be much higher than estimated, but are unlikely to be much lower." p. 3

> "Assessment of waste form performance would have to include consideration of the characteristics of the disposal sites and the transport pathways to receptors over relevant periods of time, as well as be based on the inherent characteristics of the waste form." p. 4

Mention of these reports needs to be removed or updated to correct misleading conclusions that are presented in the current TBI WIR.

Environmental Impact Statement

If DOE is as invested in bringing grout to Hanford tank waste as it seems to be, a full Environmental Impact Statement should be conducted that considers all of the phases proposed for the Test Bed Initiative's plan to treat liquid tank wastes and immobilize the waste in grout. Disposal impacts should be considered for all scenarios including orphaned/bounce-back grouted waste that stays on the Hanford site.

Please consider our comments as stated above, as well as our attached technical comments.

Submitted by,

Tom Carpenter, Executive Director | Hanford Challenge

Marco Kaltofen, PhD., PE (Civil, Mass.)

Deficiencies in the Proposed Waste Incidental to Reprocessing Phase II Test Bed Initiative

Background

These comments are in response to the U.S. Department of Energy's 90-day public comment period on its Draft Waste Incidental to Reprocessing (WIR) Evaluation for the Test Bed Initiative (TBI).

The Department of Energy (DOE) may determine that certain waste is incidental to the reprocessing of spent nuclear fuel (SNF), is not high-level waste (HLW), and may be managed as low-level waste (LLW) so long as the criteria in DOE M 435.1-1 (Radioactive Waste Management Manual) are met.

The Draft WIR TBI Evaluation analyzes whether 2000 gallons of pretreated liquid waste from Hanford waste storage tank SY-101 meets the criteria in DOE M 435.1-1, is incidental to the reprocessing of spent nuclear fuel, and may be managed as mixed low-level radioactive waste and disposed of in an offsite licensed disposal facility (reference: Concept for Proposed [TBI] Demonstration at Tank SY-101, 11/4/2021).

Introduction

DOE/Hanford is currently required to remove millions of gallons of liquid tank waste from Hanford HLW tanks and filter that waste through the use of ion exchange columns to remove cesium and other radionuclides. This process would occur on an outdoor pad in the tank farms at Hanford. DOE has estimated that 10 mega-curies of cesium-137 would end up in the columns, for which there is presently no declared disposition pathway.

As currently required, pretreated liquids would then be sent to the Waste Treatment Plant, where the Low Activity Waste (LAW) melter facility would vitrify the waste. The canisters containing the vitrified waste (VLAW) would be disposed of in an onsite facility, which has already been built, called the Integrated Disposal Facility (IDF). Approximately 23.5 million gallons (based on volume before pretreatment and solidification) of Hanford's liquid tank waste would end up being disposed at the IDF in this proposal.

There are three criteria to be met before any VLAW can be separated from the existing high level wastes in Hanford's tank farms, pretreated to remove key radionuclides, vitrified, then disposed of onsite in the IDF. These are:

(1) As fully as possible, key radionuclides must first be removed from tank wastes.

(2) All applicable (10 CFR 61C) safety requirements must be met.

(3) Wastes must be in a solid form with radionuclide concentration limits not exceeding Class-C low-level waste (10 CFR 61.55).

The Draft WIR TBI proposes replacing onsite vitrification with offsite grouting. Instead of operating on Hanford's greater than 550 square mile DOE-controlled site, the TBI calls for offsite waste grouting in a commercial/agricultural/residential area of Richland, WA. The TBI must meet the same three criteria described above for vitrified liquid wastes.

In addition to these requirements, DOE/Hanford must also meet the requirements of DOE M I.2.F(4), which details the additional requirements for treating DOE wastes at offsite non-DOE locations. DOE's manual states that, "DOE waste shall be treated, stored, and in the case of low-level waste, disposed of at the site where the waste was generated, if practical, or at another DOE facility."

The proposed TBI is a 2000-gallon pilot test of an alternative to the current requirements for the 23.5 million gallons of liquid waste at Hanford. The TBI also proposes grouting this DOE waste at an offsite non-DOE location, namely Perma-Fix NW in Richland, WA, (PFNW). Grouted waste would then be transported and disposed of in Texas, Utah or another location.

To summarize, rather than vitrify separated liquid wastes from the high-level waste tanks, DOE/Hanford would instead mix 2000 gallons of pretreated liquid wastes with grout at an offsite location in Richland, WA. The grouted waste will be disposed of at another offsite location. The proposed pilot test would use a pretreatment process that operates inside HLW tank SY-101.

Concerns with the WIR TBI

Organics and ammonia in liquid wastes

Liquid nuclear wastes in Hanford's storage tanks are a mix of radioisotopes and various chemicals used to process spent fuels. State of Washington Ecology officials have determined that classifying some of the tank waste as low-level radioactive waste does not necessarily remove the RCRA vitrification treatment standard from the waste. The US GAO acknowledges that there is currently no acceptable disposal facility for grouted wastes. Grouted wastes also have a shorter stable lifetime than vitrified wastes, sometimes significantly shorter because grout monoliths may not set properly upon formation.

The organics and ammonia in liquid wastes are potentially reactive, toxic and combustible. Hanford's HLW tanks contain 54 million gallons of mixed nuclear and hazardous chemical wastes including ammonia, mercury compounds and hazardous organic chemical constituents. In particular, the presence in the liquid wastes of potentially hazardous and flammable organic compounds, and reactive chemicals like ammonia, dramatically increases the accidental release potential during grouting. Performing this task offsite makes the repercussions of such an accident, unnecessarily severe. The mix of immiscible organic liquids, reactive ammonia, suspended solids, and volatile compounds may interfere with grout formation, leading to early grout monolith failure.

A 2014 report by Hanford Challenge noted that more than 1,800 chemicals have been documented in the vapors contained within Hanford's tank headspaces, which escape from the tanks through various pathways, even under routine circumstances. According to tank farm contractor documents, at least 120 Hanford workers in and around the tank farms were exposed to toxic vapors since January 2015. Seventy-three (73) workers experienced a vapor exposure at Hanford in April and May 2016 alone.

Workers exposed to toxic vapors have suffered serious long-term health effects including brain damage, lung diseases, nervous system disorders, and cancer. Short-term health effects have included nosebleeds, profuse sweating, persistent headaches, tearing eyes, burning skin and lungs, coughing, sore throats, eye problems, dizziness, nausea, memory loss, difficulty breathing, and increased heart rates.

Some workers are on long-term disability resulting from chemical vapor exposure at Hanford, with illnesses such as toxic encephalopathy, neurological damage, nerve damage, and lung disease. Others are still fighting for their claims to be recognized. A 1997 Pacific Northwest National Laboratory study found that cancer risks from exposure to tank farm vapors carried a fatal cancer risk as high as 1 in 10. These risk levels are unconscionable for workers, but equally so for residents and workers offsite who could be exposed to chemical vapors at the nonDOE offsite grouting contractor in Richland, WA.

Perma-Fix NW is unsuited for this project

Treating tank waste from Hanford by solidifying liquid wastes at Perma-Fix NW is an unacceptable proposal, and it is also one highly discouraged by DOE's own policies and procedures. More than 32,000 people live within 5 miles of Perma-Fix NW and a daycare center is located less than a mile away. Perma-Fix NW received a notice of significant noncompliance from the US Environmental Protection Agency as recently as 2019. In that same year the facility had two fires, one of which was deemed "a near-catastrophe" by a state inspector, as fire alarms were inoperative at the time.

Perma-Fix NW does not have a permit nor is there a publicly available permit application for the proposed WIR TBI operations that might take place there. This means that there is no way to evaluate the safety of this proposal, which has not undergone a public permitting process. Critical questions such as, "Does Perma-Fix have sufficient controls to participate in TBI?" and "Can Perma-Fix deal with ammonia and organics?" remain unanswered and unanswerable.

Hanford waste should be treated on the Hanford Site, not off-site at Perma-Fix NW. This would lower the risk to the community; eliminate transportation risks; and increase transparency, accountability, and safety.

Liquid waste composition remains unknown

It's understood that the actual composition of the WIR TBI waste is not currently known, and it's unclear what will actually be in the 2000 gallons of liquid wastes that will potentially be sent to Perma-Fix NW in Richland, WA. The wastes in the Hanford tanks are not uniform and not well characterized. Grouting radioactive liquids with varying compositions remains an untested skill, but it is known that grouting will require customized grout formulations for each tank, and possibly for each batch from each tank.

Liquid tank wastes will be withdrawn from a single tank in the proposed TBI, however consistency between the wastes in each individual tote is potentially problematic. The tank contents themselves are stratified, with different compositions at different elevations within the same tank. A grout recipe that successfully sets for the first tote of withdrawn waste may not set for the sixth tote. Civil engineers normally use equalization tanks prior to waste liquid treatment, but adding this extra operation would increase the risks of offsite grouting beyond the already unacceptable proposed level.

Prior studies (Ojovan, doi:10.1016/j.jhazmat.2011.01.00) have noted that, "although cementation technology is typically simple the actual development of an appropriate formulation might require extended research dependent on the chemical complexity of the waste streams." The study goes on to note that the long-term safety of the grouted waste form in near-surface burial is dependent on the engineered nature of the disposal facility. The actual underground conditions are also noted as, "of paramount importance". Finally, in addition to site design, the actual final chemistry of the grouted waste is very important to ensuring the overall safety of the disposal plan.

This means that each critical portion of the plan for safe long-term storage (chemical composition of waste, optimizing grout recipes and conditions for both radiochemicals and hazardous chemicals simultaneously, burial conditions, near-surface landfill design) remains unknown. Just to make the stakes even higher, prior research on cemented radioactive wastes has generally been performed only on low-level or intermediate-level radioactive wastes. There is little data available to support significant plans to cement wastes originally classified as high-level.

One consequence of grouting waste liquids of unknown composition is that the true percent removal of key radionuclides via pretreatment is unknowable. Table 4-6 in the 2021 *Draft WIR Evaluation for the TBI Demonstration* makes the claim that key radionuclide percent removal before grouting will be 99.999%. The same document nevertheless admits that this figure is based on estimates rather than actual analyses, and that the varying composition of these radionuclides in tank sludges has not been accounted for by the estimates. Even if radionuclide partitioning to sludges is ignored, percent removals are difficult to calculate when the initial compositions are estimated, best-basis inventories using only the most recent tests of a heterogenous waste that changes composition via decay and chemical/physical reaction on a daily basis.

Of course many of the liquid wastes at Hanford are the result of the necessary

disposal of the corrosive and highly reactive chemicals used to convert spent nuclear fuel into dissolved forms of plutonium suitable for weapons. These powerful chemicals could not be recycled, and thus these remain in the liquid portion of these wastes. What little cementing data is actually available for high-level wastes is unlikely to also include this same degree of hazardous and reactive chemical constituents. The grouting process itself is a highly alkaline and chemically active environment. There is a significant and perhaps unavoidable risk in performing this level of extreme chemistry at an offsite, nonDOE facility that is located within an active mixed-use neighborhood.

Prior data point is only three gallons

Pretreated liquid Hanford tank waste has never been successfully grouted. Conjecture about this possible multi-billion dollar project depends on a prior experiment done with adding cement to three gallons of simulated liquid wastes. The proposed 2000-gallon TBI will be the first data point on whether this approach can be successful, regardless of whether it can also be scaled. This lack of safety and treatability data is a major impediment to allowing any part of this TBI to be performed offsite.

The liquid portion of mixed high-level nuclear and hazardous chemicals wastes in each of the 160 waste tanks at Hanford is distinct; no two tanks have the same constituent profile, and thus each of the grout recipes must be tailor-made. These grout recipes are not known because the actual constituents of each tank are currently unknown. This uncertainty applies to both the radiochemical and the hazardous/reactive but nonradiological portions of the waste.

The three gallons of the prior pilot grouting test were not compositionally related to the composition of the SY-101 waste in the proposed TBI. In fact, the 3-gallons of material pilot tested were actually a waste simulant.

Liquid removal from waste tanks impacts heat balancing; added capacity may be negated by the need to add water for evaporative cooling.

Liquid removal from the waste tanks will be done with narrow pipes and devices that must withstand the high heat and caustic environment of the tank interiors (Hanford/DOE 2022, https://www.hanford.gov/page.cfm/tankfarms). Historically waste tanks have used evaporative cooling (adding water that is allowed to boil off) to keep tanks from overheating. Some individual tanks have required more than

60,000 gallons of cooling water annually (DOE WHC-EP-0182-92 Waste Tank Report, 1995). Any tank capacity gained by liquid removal and grouting may be lost to introduced evaporative cooling water in many of the tanks.

Will grout become a one-size-fits all solution?

Grouted wasteforms are unproven and untried with actual SY-101 liquid wastes, but nevertheless have less stability upon disposal than vitrified waste forms. Long-lived isotopes such as plutonium and technetium will remain in the grouted wastes, and will have a high potential for release to the environment.

Onsite vs. offsite treatment

DOE guidance states that, "DOE waste shall be treated, stored, and in the case of low-level waste, disposed of at the site where the waste was generated, if practical, or at another DOE facility." Offsite treatment, and particularly, offsite treatment at Perma-Fix NW should be a last resort, not a first.

As noted in the introduction, in addition to these requirements of 10 CFR 61.55, DOE/Hanford must also meet the requirements of DOE M I.2.F(4), which details the compulsory prerequisites for treating DOE wastes at offsite nonDOE locations. DOE's manual states that, "DOE waste shall be treated, stored, and in the case of low-level waste, disposed of at the site where the waste was generated, if practical, or at another DOE facility."

New double shell tanks are the fastest and most reliable way to create more HLW capacity

In addition to the monetary analysis, Hanford/DOE believes that there is little capacity remaining in the double-shelled Hanford waste tanks. As wastes from failed tanks are redistributed, and as wastes are processed, DOE may run out of available tank space. Some Government stakeholders suggest that grouting rather than vitrifying liquids would free up tank space sooner, though we think this is based on assumptions with a great deal of uncertainty.

Tank Space Issue Better Solved with New Tanks: USDOE's Savannah River National Laboratory estimates that vitrification of supplemental waste would take 10 to 15 years, while grouting would take 8 to 13 years. This is not a significant difference in terms of providing added double-shell tank capacity. Constructing new double-shell

tanks however, would be faster than both grouting and vitrification in terms of providing added capacity.

One final technical consideration

The NRC has simple definitions for HLW and LLW. These are, "High-level radioactive wastes are the highly radioactive materials produced as a byproduct of the reactions that occur inside nuclear reactors. High-level wastes take one of two forms, spent (*used*) reactor fuel when it is accepted for disposal, and waste materials remaining after spent fuel is reprocessed"

"Low-level waste includes items that have become contaminated with radioactive material or have become radioactive through exposure to neutron radiation. This waste typically consists of contaminated protective shoe covers and clothing, wiping rags, mops, filters . . .."

While grouting reclassified HLW sounds like a valid option to some, HLW simply is not LLW. Grouted waste in a landfill will not have time to approach background levels of radioactivity before escaping into the environment. As currently understood by scientific staff at Hanford, all of the waste tanks will eventually leak into the vadose zone beneath the tank farms, resulting in potentially catastrophic releases of radioisotopes into the environment. After a short time, grouted wastes have and likely will release radionuclides to the environment in the same way. Sixty-nine Hanford tanks have already leaked. To prevent further releases, the HLW must be removed, stabilized by making it into a glass-like material, and then stored in an inaccessible underground geologic repository. Once in the repository, the HLW will have the best chance to be isolated from human activities for hundreds of thousands of years.

Summary of concerns with the WIR TBI

ORGANICS AND AMMONIA - Hanford's HLW tanks contain 54 million gallons of mixed nuclear and hazardous chemical wastes including ammonia, mercury compounds and hazardous organic chemical constituents. In particular, the presence in the liquid wastes of potentially hazardous and flammable organic compounds, and reactive chemicals like ammonia, dramatically increases the accidental release potential during grouting. Performing this task offsite makes the repercussions of such an accident, unnecessarily severe.

PERMA-FIX NW IS AN UNSUITABLE GROUTING SITE - The pretreated liquids would then be mixed with grout at an offsite location in Richland, WA, prior to disposal at a commercial facility in Utah or Texas. Perma-Fix NW in Richland, WA is the proposed grouting site for these liquid wastes, however the facility has had significant operating deficiencies. The deficiencies, and Perma-Fix's populated location, make it impossible to demonstrate that grouting pretreated liquid wastes at Perma-Fix would meet the requirements of DOE M I.2.F(4).

LIQUID WASTE COMPOSITION REMAINS UNKNOWN – The wastes in the Hanford tanks are not uniform and not well characterized. Grouting liquids with varying compositions remains an untested skill, and will require customized grout formulations for each tank, and possibly for each batch from each tank.

PRIOR DATA POINT IS ONLY THREE GALLONS - Pretreated liquid Hanford tank waste has never been successfully grouted. The needed grout recipes are not known because the actual constituents of each tank are currently not fully known. This high uncertainty in composition increases the risk level of any offsite operations.

THE IMPACT OF LIQUID REMOVAL ON HLW HEAT CONTROLS – Liquid waste removal from HLW tanks does not necessarily translate into added storage capacity, since evaporative cooling water has historically been added regularly to Hanford's tanks.

WILL GROUT BECOME A ONE-SIZE-FITS ALL SOLUTION? – Grouted wasteforms are unproven and untried with actual SY-101 liquid wastes, but nevertheless have less stability upon disposal than vitrified waste forms. Long-lived isotopes such as plutonium and technetium will remain in the grouted wastes, and will have a high potential for release to the environment.

ONSITE VS. OFFSITE TREATMENT - DOE guidance states that, "DOE waste shall be treated, stored, and in the case of low-level waste, disposed of at the site where the waste was generated, if practical, or at another DOE facility." Offsite treatment at Perma-Fix NW should be a last resort, not a first.

NEW DOUBLE SHELL TANKS ARE THE ONLY FAST AND RELIABLE WAY TO CREATE MORE HLW CAPACITY - The vitrification project would take 10 to 15 years, while grouting would take 8 to 13 years. Constructing new double-shell tanks would be faster than both in terms of providing added tank capacity.

ONE FINAL TECHNICAL CONSIDERATION - The US GAO acknowledges that there is currently no acceptable disposal facility for grouted wastes, and that grouted wastes in shallow burial have a shorter stable lifetime than vitrified wastes in a geologic repository.