

Hanford High-Level Wastes and Spent Nuclear Fuel

Allyn Boldt

Hanford Challenge

April 16, 2013

High-Level Waste (HLW) Production

Nine production reactors produced approximately 100,000 MTHM irradiated fuel over 45 years

Approximately 98,000 MTHM was reprocessed in four reprocessing facilities resulting in HLW

2,100 MTHM was not reprocessed and is in interim storage (Spent Nuclear Fuel, SNF)

Hanford Spent Nuclear Fuel

2,100 MTHM N Reactor Zircalloy clad fuel and 3.4 MTHM Aluminum clad fuel

Last N reactor fuel discharge 1990 (shutdown 1987)

Transfer of fuel from basin storage canisters to stainless steel Multi-Canister Overpacks (MCO) with 450 psi design pressure

MCOs “dried” to less than 0.2 liter free water, each, backfilled with helium, and sealed

MCO contents are pyrophoric: uranium and zirconium metals plus uranium hydride

394 MCOs (13.7 ft long x 25 in dia.) in interim storage in Canister Storage Building (CSB).

New HLW and SNF repository goal for operation in 2048

MCO over-packed fuel will require new repository acceptance criteria or treatment prior to disposal in new repository.

Hanford Spent Nuclear Fuel (cont.)

0.2 cu yards fuel fines and 38 cu yards contaminated basin sludges

Fuel fines are interim stored in CSB with MCO Spent Nuclear Fuel

Contaminated basin sludges currently in water basin storage at K West reactor site

Phase 1 treatment for interim storage at T Plant, removal complete 12/31/2015

Basin sludges to be disposed at Waste Isolation Pilot Plant (WIPP) as Remote Handled TRU

Phase 2 treatment at T Plant for packaging and disposal at WIPP with technology selection 3/31/2015

WIPP decommissioning scheduled 2030

Reprocessed Nuclear Fuel

Hanford has reprocessed approximately 98,000 MT of irradiated nuclear fuel

The resulting HLW was routed to underground tanks for interim storage

The stored tank farm wastes were subsequently further processed

Uranium recovery operation

Strontium-90 and Cesium-137 removal to lower heat content, 1967-1983

Concentration of supernatant and crystallization of salt-cake to reduce volume

Tank transfers to manage tank space

Failure of 67 Single-Shell Tanks (known and suspect leakers) resulted in about 1 % of tank HLW inventory discharged to the vadose zone.

Previously separated Sr-90 and Cs-137 are HLW

Currently, approximately 54 million gallons of sludge, salt-cake, and supernatant inventory in 149 Single-Shell and 28 Double-Shell Tanks (SST and DST)

Processing and Treatment of SST and DST HLW

The Tank Closure and Waste Management EIS (TC&WMEIS) was issued December 2012 without preferred alternatives for some tank waste treatment critical actions and Records of Decision deferred

SST and DST wastes are retrieved. The “empty” tanks, tank farm infrastructure contaminants, and vadose zone contamination are “treated” for disposal. Failed HLW melters require disposal.

The retrieved wastes are separated into three waste classifications for treatment and disposal

Disposal of Failed HLW Melter, “Empty” Tanks, Tank Farm Infrastructure, and Vadose Zone Contamination

The WTP is projected to produce 12 failed HLW melter (one HLW melter/2.5 years)

The tank farm closure inventory (current baseline), “empty” tanks, infrastructure, and vadose zone contamination, is approximately 2 % of the tanks HLW inventory

Failed HLW melter disposal at Hanford and Tank Farm Closure (treatment and disposal in place) requires Nuclear Regulatory Commission (NRC) determinations that the HLW inventory is reclassified as “Waste Incidental to Reprocessing” (WIR). The NRC WIR requirements are:

- (1) Have been processed (or will be further processed) to remove key radionuclides to the maximum extent that is technically and economically practical;**
- (2) Will be incorporated in a solid physical form at a concentration that does not exceed the applicable concentration limits for Class C low-level waste as set out in 10 CFR Part 61; and**
- (3) Are to be managed, pursuant to the Atomic Energy Act, so that safety requirements comparable to the performance objectives set out in 10 CFR Part 61 are satisfied.**

Note: See attachment 1, page 3, for a discussion of “The Legal Bar Against Reclassifying HLW” at Hanford

Retrieved Tank HLW Separation and Treatment

The current baseline is to separate the retrieved tank HLW into three classifications for treatment and disposal:

Contact and Remote Handled TRU for disposal at WIPP

March 11, 2013 ROD for up to 20 SSTs inventory disposal at WIPP

NRC reclassification of tank HLW as TRU required, activity initiated (See attachment 1)

Vitrified HLW for disposal at the national HLW repository

Vitrified Low-Activity Waste (LAW) for disposal as WIR at Hanford

The current Waste Treatment Plant Project (WTP) separates and treats approximately 30% of the total LAW fraction

The December 2012 TC&WMEIS did not select a preferred alternative for the remaining 70% of the separated LAW fraction. Supplemental treatment technology selection scheduled for Sept 2014.

The current vitrified LAW has a NRC provisional classification as “Waste Incidental to Reprocessing”. Change of the LAW form requires revisiting the NRC for waste reclassification.

Note: See attachment 2 for additional discussion of potential programmatic impacts with changing LAW form

Previously Separated Sr-90 and Cs-137 HLW

Previously separated Sr-90 and Cs-137 HLW exists at Hanford as capsules at the Waste Encapsulation Storage Facility (WESF) and as vitrified glass logs prepared for Germany

Sr-90 and Cs-137 HLW Capsules

1,936 capsules containing 106 MCi of Sr-90 and Cs-137 stored in WSEF Basin

WESF Basin has suffered radiolytic damage to concrete walls behind stainless steel liner, capsules relocated within basin to minimize future damage

Sr-90 and Cs-137 capsules may be transferred to dry storage containers, decision path June 2017

Future HLW repository may require evaluation of containerized soluble HLW form for disposal

German HLW Glass Logs

Hanford prepared 34 glass logs containing 8 MCi Sr-90 and Cs 137 for German program in 1987

The HLW logs transferred to eight steel dry storage casks in 1997

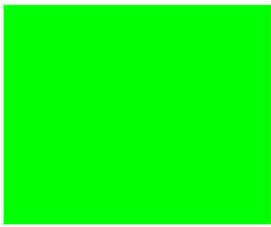
Storage casks employ modified seals (metallic O rings) with a rated life of 40 years. May require review and replacement or recertification of seals in 2037 prior to 2048 startup of new national HLW and SNF Repository.

Repository may review existing steel storage cask as acceptable overpack for HLW disposal

Attachment 1

NRDC, et al, letter to Secretary Chu, March 26, 2013, *RE: Proposal to Ship Hanford High-Level Radioactive Waste to New Mexico*

<http://www.hanfordchallenge.org/wp-content/uploads/2013/03/2013-03.26-NRDC-et-al-Letter-to-Chu-re-HLW-to-WIPP-FINAL.pdf>



March 26, 2013

Secretary Steven Chu
Office of the Secretary
Department of Energy
1000 Independence Ave SW
Washington DC 20585
The.Secretary@hq.doe.gov

RE: Proposal to Ship Hanford High-Level Radioactive Waste to New Mexico

Dear Secretary Chu,

We write to you regarding the Department of Energy's (DOE) News Release and subsequent publication in the Federal Register on March 11, 2013 of DOE's "preferred alternative" to retrieve, treat, package, characterize and certify certain Hanford tank wastes for disposal at the Waste Isolation Pilot Plant (WIPP) in Carlsbad, New Mexico.¹ As detailed below, DOE's proposed course of action would fail to resolve or meaningfully address potential threats to the Columbia River from leaking high-level radioactive waste (HLW) tanks at Hanford. The waste proposed for treatment and transfer to WIPP is too small a fraction of the total inventory of Hanford tank waste to make the investment worthwhile and the proposal does not prioritize the leaking single-shell tanks. Further, DOE's "preferred alternative" would likely have a disastrous impact on both efforts to arrive at a national nuclear waste strategy and associated progress at the WIPP facility from legal, technical and institutional perspectives.

With such caution in mind, we urge you to ensure DOE complies with the law and retracts the preferred alternative of attempting to ship high-level radioactive waste to New Mexico. It is costly, unwise and illegal to ship Hanford tank waste to WIPP. DOE should move as quickly as practicable to build new tanks to empty the actively leaking high-level radioactive waste tanks and have tank capacity for eventual feed to the Waste Treatment Plant. We would be happy to meet with your successor in the coming weeks to discuss these and other matters. We further detail these matters below.

Background

As national and regional groups that have worked on the nuclear weapons complex cleanup for decades, we share DOE's concerns about protecting human health, the environment, and of course, the Columbia River and its central role as the lifeblood of the Pacific Northwest. We also share concerns about achieving an effective high-level waste program inclusive of state, tribal and public

¹ EIS-0391: Notice of Preferred Alternative, 78 Fed. Reg. 15358, (March 11, 2013). Notice available at: <http://energy.gov/nepa/downloads/eis-0391-notice-preferred-alternative>.

interests that ultimately arrives at long-term geologic disposal solution for defense-generated HLW and commercial spent nuclear fuel.

As you know, Hanford's tanks are leaking HLW with an underground flow pathway toward the Columbia River. An estimated one million gallons of contamination have already leaked from the tanks, and an undetermined quantity has entered the groundwater adjacent to the river. The Washington State Department of Ecology has declared, "out of these 149 SSTs, 67 have been declared as known or assumed leakers that have released more than one million gallons of waste to the soil and groundwater. The released tank waste is now moving toward, but has not reached, the Columbia River."² Six single-shell tanks and one double-shell tank are now confirmed to be actively leaking, and 14 others may be leaking, according to DOE.³ Such leaks will only serve to drive existing contamination closer to the Columbia River. This is an urgent problem, and we applaud the State of Washington and the Department of Energy for their renewed commitment to address this crisis.

While we share concerns for a meaningful and effective high-level waste disposal program, the position of the NRDC, Hanford Challenge and Southwest Research and Development Center is that DOE's "preferred alternative" to retrieve, treat, package, characterize and certify certain Hanford tank wastes for disposal at WIPP in New Mexico is both unlawful and fraught with several technical problems that make it evident any such plan does not meaningfully solve the urgent situation in Washington.

The Hanford EIS and the subject of shipping HLW to New Mexico

Prior to the close of the public comment period on the Draft Tank Closure & Waste Management EIS (TC & WM EIS), DOE issued a statement in the Federal Register (74 FR 67189) that indicated it was no longer considering sending Hanford tank waste to WIPP, declaring the intention that these wastes would be retrieved and treated at the Waste Treatment Plant (WTP) being constructed at Hanford.⁴ For this reason, the State of Washington Department of Ecology (Ecology) and many members of the public did not comment on sending tank waste to WIPP during the public comment period, and no public meeting was held in New Mexico. However DOE changed its position in the Final TC & WM EIS and included the preferred alternative of sending portions of tank waste to WIPP.

In its Forward to the Final TC & WM EIS, Ecology elaborated on some of its concerns over DOE's current approach to the potential mixed TRU tank waste:

Ecology has legal and technical concerns with any tank waste being classified as mixed TRU waste at this time. DOE must provide peer-reviewed data and a strong, defensible, technically and legally detailed justification for the designation of any tank waste as mixed TRU waste, rather than as HLW. DOE must also complete the WIPP certification process and assure Ecology that there is a viable disposal pathway

² http://www.ecy.wa.gov/programs/nwp/tank_waste_storage.htm

³ "The U.S. Department of Energy and its contractor are evaluating 14 other single-shell tanks that appeared to have lost liquid, according to state regulators and others who attended a DOE briefing in Oregon Monday."
http://www.oregonlive.com/environment/index.ssf/2013/03/more_tanks_could_be_leaking_at.html#incart_river_default

⁴ "DOE is now expressing its preference that no Hanford tank wastes would be shipped to WIPP." 74 Federal Register 67189, (December 18, 2009).

(i.e., permit approval from the State of New Mexico and the U.S. Environmental Protection Agency) before Ecology will modify the Hanford Sitewide Permit to allow tank waste to be treated as mixed TRU waste. Further, Ecology is concerned with the cost benefit viability of an approach that sends a relatively minor amount of tank waste to WIPP, given the cost it would take to secure the disposal path, and to construct and operate the drying facility for the TRU tank waste.⁵

A treatment facility to retrieve, process and package Hanford tank waste for shipment to WIPP would be expensive, and time-consuming. Without substantially more information, we are unclear how any such plan could comply with current law. We are unaware of blueprints or plans for such a drying facility, and certainly there is no existing facility at Hanford that could accomplish that mission.

DOE named 20 tanks with high level waste that DOE would seek to reclassify as TRU in the Final TC & WM EIS,⁶ but an earlier review by the Washington State Department of Ecology put the number of tanks that might qualify under the legal definition of TRU at only eight tanks.⁷ DOE's current presentations further the intention to classify 11 tanks as Contact Handled TRU (CH-TRU) and send this waste, totaling around 280,000 gallons to WIPP.⁸ However, no policy, cost or legal analysis on the topic has been completed and therefore there is no credible basis at this time for DOE's preferred alternative of sending Hanford tank waste to WIPP.

The Legal Bar Against Reclassifying HLW

There is a contentious legal history on the subject of treatment and disposal of HLW, particularly with respect to "reclassifying" HLW and disposing of it in a manner not consistent with the Nuclear Waste Policy Act, 42 U.S.C. § 10101, *et seq.* DOE's efforts to reserve to itself unfettered authority to reclassify HLW over the last 15 years have precipitated litigation by NRDC and other environmental groups, and the direct objection of several states. *See, NRDC v. Abraham*, 271 F.Supp. 2d 1260 (D. Idaho 2003), *rvsd*' on ripeness grounds, *NRDC v. Abraham*, 388 F.3d 701 (9th Cir. 2004) (collectively the "HLW Decisions"). *See also*, Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005, Pub. L. No. 108-375, § 3116, 118 Stat. 1811, 2162-64 (2004). We will not review that entire history here, but make a few relevant points.

First, all the waste in the tanks is currently HLW.⁹ However, we note that DOE is not barred from removing high-level radioactive waste (HLW) from the tanks and treating that waste for disposal. Nor do the HLW decisions bar DOE from separating some portion of that waste into a stream that meets low-level radioactive waste (LLW) standards and disposing of that portion of the waste outside

⁵ Washington State Department of Ecology Forward, Final TC & WM EIS, DOE/EIS-0391, December 2012.

⁶ Final TC & WM EIS, DOE/EIS-0391, December 2012, p. 2-26 sec. 2.2.2.2.5.

⁷ Conversation between Tom Carpenter, Hanford Challenge, and Department of Ecology staffer, March 16, 2013.

⁸ USDOE ORP Presentation by Kevin Smith to the Oregon Hanford Cleanup Board, March 4, 2013.

⁹ "It is undisputed that the waste stored at Hanford, INEEL, and Savannah River is highly radioactive and the result of reprocessing. No solids have yet been extracted from the liquid waste at those sites and treated to reduce fission products. Thus, the waste at issue in this case falls within NWPA's definition of HLW." *NRDC v. Abraham*, 271 F.Supp.2d 1260, 1265 (D.Idaho 2003) (emphasis added).

of a geologic repository in a properly licensed disposal site. Such a process, however, is not what DOE has proposed.

Second, Section 3116 of the 2005 National Defense Authorization Act, the Bush Administration's response to the original Idaho Federal District Court HLW Decision, was a significant change to the entire structure and purpose of the NWPA, not a "clarification."¹⁰ That law, which allows DOE to reclassify HLW as "Waste Incidental to Reprocessing" subject to certain criteria, has application in South Carolina and Idaho. Section 3116 does not have application in Washington or Oregon. *See*, Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005, Pub. L. No. 108-375, § 3116, 118 Stat. 1811, 2162-64 (2004). Further, the "waste incidental to reprocessing" concept codified in Section 3116 does not set cleanup standards of "99 percent," "most of the radioactivity," or an "inch and half of waste at the bottom of the tank." The Natural Resources Defense Council and Hanford Challenge voiced repeatedly in comments Hanford Draft TC & WM EIS that this concept should be dropped from consideration in final and preferred alternatives for the Hanford Draft TC & WM EIS.

In short, under the current NWPA, the Environmental Protection Agency (EPA) and the Nuclear Regulatory Commission (NRC) regulate the geologic disposal of HLW – and decide what is (and what is not) HLW. At the Hanford Reservation, DOE may not unilaterally decide that HLW has been transformed into "waste incidental to reprocessing" or "TRU waste" for disposal at WIPP. If the concepts embodied in Section 3116 are in any way adopted or used via the Hanford Final TC & WM EIS and subsequent preferred alternatives, DOE will be in direct contravention of the NWPA.

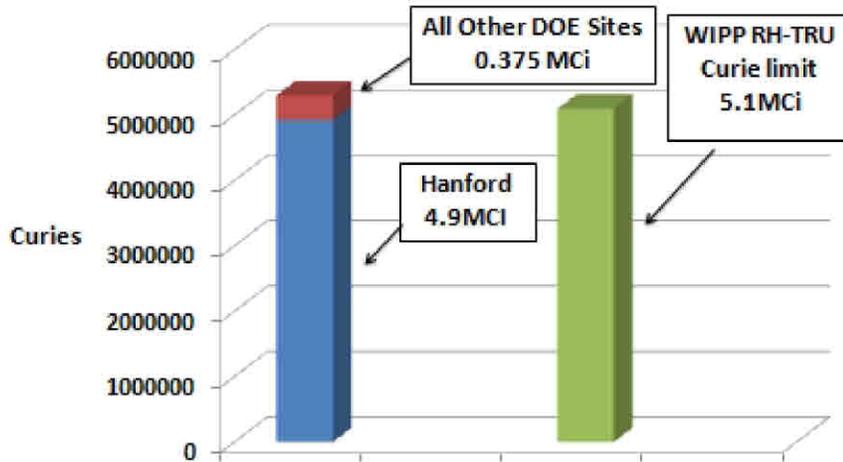
Further Data and Analysis of Hanford HLW Tanks Needed

Along with ensuring you are clear on the status of HLW law, we would like you to consider the characteristics of the wastes in the 20 Hanford tanks named as candidates for disposal at WIPP. An analysis of Hanford's TWINS database reveals that the radioactivity content of these 20 Hanford tanks named in the EIS come close to almost entirely filling the radioactivity limits for the WIPP facility. Specifically, for remote-handled Transuranic Waste (RH-TRU), the curie content in the Hanford tanks is 4.9 million curies. WIPP's RH-TRU limit for such waste is 5.1 million curies.¹¹

¹⁰ NRDC and dozens of environmental and public interest groups stood with Washington, Oregon, New York, and New Mexico and objected to the concepts embodied in Section 3116. Only the states of South Carolina and Idaho – who sided with the other states throughout the litigation until March 2004 in objecting to DOE's assertion of "waste incidental to reprocessing" authority – submitted to DOE's cleanup budget-threatening tactics and supported the legislative change. Via Section 3116, DOE obtained an exemption from the NWPA and the ability to reclassify HLW as "incidental waste" without any congressional or state oversight. No such similar path forward exists at the Hanford site.

¹¹ http://www.wipp.energy.gov/library/seis/DOE_EIS-0026-SA-08.pdf

WIPP Bound Remote Handled Transuranic Waste
(including the content of 9 HLW Tanks at Hanford)



Sources: TWINS Data Base (09-2003), DOE/EIS-0391, Table E-11, DOE/TRU-12-342, Table 3.11

Apparently, DOE has no plans to remove radionuclides from these wastes, and instead relies on a plan to simply remove and dry the tank waste according to Appendix E of the Final TC &WM EIS. However, in order to stay under the curie limit for WIPP, either the current law will have to change to substantially increase the curie limits for the RH-TRU, or DOE will have to decontaminate the sludge (10-20% of the volume containing ~95% of the Sr) and the Cs in the salts (80-80% of the volume containing ~90% of the Cs.). This will likely involve the use of sludge washing. Once these contaminants are removed, we have no information where DOE intends to dispose of these toxic radionuclides.

The Situation at the Hanford Tank Farms

We concur with DOE and the State of Washington that there is practically little if any capacity to receive more high level wastes in the current underground waste tanks at the Hanford Tank Farms. And specifically there is diminishing capacity left in the existing double-shell tanks (DST), according to Hanford's System Plan, relied upon in the 2013 Hanford Lifecycle Scope, Schedule and Costs Report. The System Plan identifies that, after the C Farm tank waste campaign is completed and waste is retrieved from the AX Farm Single-Shell-Tanks (SSTs) and from some of the A Farm SSTs by 2020, there will be only 0.9 million gallons of Double-Shell-Tank (DST) capacity left.¹²

However, these estimates consider neither the need to empty and take AY-102 out of commission nor the amount of waste in actively leaking tanks. The recently identified DST leaker, AY-102, has 800,000 gallons of waste that will need to be removed from that tank alone. The lack of integrity of

¹² River Protection Project System Plan, ORP-11242 Revision 6, p.5-10. October 2011. Available at www.hanford.gov/files.cfm/ORP-11242_REV_6_-_1110050954.pdf.

tank AY-102 calls into question the assumption that the current DSTs will last long enough to see the waste treatment mission through.

There is at least a significant question about how many, if any, of the Hanford tanks identified as TRU-waste candidates, would actually qualify as such. Even giving DOE the benefit of the doubt that some portion of this waste could be removed, treated, and disposed of as TRU, which as we describe above is not a lawful act, assuming all 20 of the tanks qualify as TRU, it still amounts to only 3.1 million gallons, or around 5.6 percent of the total waste volume in the tanks. It is not worth the time and money to build a TRU treatment facility at Hanford for such a small amount of waste. Second, even if the waste was suitable for WIPP, the timing does not negate the need for immediate action to build new tanks, empty leaking tanks and get the Waste Treatment Plant on track. We cannot let the false solution of unlawfully shipping some insignificant fraction of HLW to WIPP distract us from real and immediate needs.

What We Recommend at Hanford

The only sure way to relieve the crisis at Hanford is to build new waste tanks, as soon as possible. Indeed, this conclusion has been reached by the Governors of both Washington¹³ and Oregon,¹⁴ and by the Hanford Advisory Board,¹⁵ a 32-member council of diverse Hanford stakeholder seats that operates by consensus. This has been a contentious political point for years, as investing in new tanks was feared to take attention (and funding) away from the much needed Waste Treatment Plant and would become a default “solution.” However, with the integrity of current tanks in such question and the delays at the WTP, new DSTs need to be on the table. The technology is mature, there are no questions about the legality or technical feasibility of such a plan, and given the trade-offs in costs between building a (risky) TRU-treatment facility and tanks, the choice is clear. Additionally, new double-shell tanks are needed to help staging for Waste Treatment Plant operation.

Washington law requires that any tank containing hazardous materials that is reported as starting to leak must be pumped below the point of the leak within 24 hours, or as soon as practicable.¹⁶ It is of paramount importance that no new leakage be tolerated, and those tanks that are reported to be actively leaking must be remediated as soon as possible. This requires that waste in those tanks be moved to double-shell tanks that have not leaked (i.e., not AY-102) and have enough room to accommodate the waste.

Furthermore, the System Plan assumes that RH-TRU waste will be treated at the WTP together with HLW.¹⁷ Regardless of what DOE may intend to someday ship to WIPP, new tanks are needed immediately at Hanford to prevent more waste from entering the ground and water systems and to

¹³ Governor Jay Inslee wants more tanks at Hanford, Feb. 1, 2013, *Tri-City Herald*, <http://www.tricityherald.com/2013/02/01/2258268/governor-jay-inslee-wants-more.html>

¹⁴ John Kitzhaber calls for more tanks to hold Hanford's high-level radioactive waste, Jan. 30, 2013, *Oregonian*, http://www.oregonlive.com/environment/index.ssf/2013/01/kitzhaber_calls_for_-more_tanks.html

¹⁵ Hanford Advisory Board Advice, Nov. 2, 2012, http://www.hanford.gov/files.cfm/HABAdv_263.pdf

¹⁶ Washington Admin. Code 173-303-640.

¹⁷ 2013 Hanford Lifecycle Scope, Schedule and Costs Report, DOE/RL-2012-13, Rev. O. December 2012. Available at http://www.hanford.gov/files.cfm/DOE-RL-2012-13_FINAL_REV.0_.pdf.

ensure that the transfer of waste to the Waste Treatment Plant is efficient and safe once operational. Furthermore, DOE must act to put the Waste Treatment Plant on track with an independent assessment and realistic plan for how to address the cost-overruns, delays, and most importantly the design and quality assurance problems plaguing the WTP.

Institutional Implications of Such a “Preferred Alternative”

The DOE’s relationship with several states, including licensing issues, and the coherency of the entire nuclear weapons complex cleanup will be called into question if DOE proceeds with this preferred alternative. Specifically, the WIPP Land Withdrawal Act (LWA, PL 102-579, Section 12, 106 Stat. 4791 (1992)) bans transportation to or disposal of HLW or commercially generated spent nuclear fuel at WIPP. *See* Section 12 of the LWA. The ban reflected the position of New Mexico officials and the congressional delegation, as well as public opinion. The legislative history illustrates Congressional recognition that Hanford tank wastes are HLW and included in the ban.

Further, DOE’s WIPP environmental impact statements have at no point included any Hanford HLW (or any other HLW from any other site, for that matter) in possible WIPP inventory. Therefore, transportation or emplacement of any Hanford tank waste at WIPP requires congressional action to amend the LWA, as well as substantial and new NEPA analyses.

Finally, such a preferred alternative contradicts the national nuclear waste strategy proposed by President Obama’s Blue Ribbon Commission on America’s Nuclear Future and DOE’s January 2013 proposal to emphasize the importance of consent in future nuclear waste storage and disposal programs.¹⁸ Indeed, an effort to enact the ideas of the BRC into legislation was proposed at the end of the previous Congress by former Energy & Natural Resources Chairman Jeff Bingaman (NM). New iterations modeled on Senator Bingaman’s template are currently being developed in this Congress. In the context of WIPP, the consent given was clearly under the stipulation that no HLW or spent nuclear fuel would be transported or disposed there. Not abiding by the longstanding limitations included in the state’s consent would not only undermine DOE’s credibility and Congressional action for New Mexico, but also set an extraordinary precedent, rendering it unthinkable that any other state would rely on DOE’s assurance that the agency would abide by conditions or limitations that are integral to state consent.

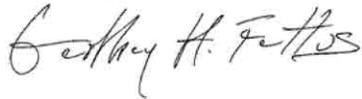
And as a practical matter, WIPP is not designed for and does not have the capabilities to handle HLW. Indeed, WIPP is not succeeding in its remote-handled (RH) waste disposal mission, as it has available space for only about half of the RH waste that is allowed by the LWA and the Consultation and Cooperation Agreement. DOE’s focus regarding WIPP should be on assuring that the facility is fulfilling its mission, not on adding additional activities for which the site is not suited.

This is a matter of significant concern and, we note, some measure of complexity. Representatives from each signatory group will be in Washington, D.C. from April 15-19, 2013 and request to meet

¹⁸ Department of Energy, Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste, January 2013. Available at: <http://energy.gov/sites/prod/files/Strategy%20for%20the%20Management%20and%20Disposal%20of%20Used%20Nuclear%20Fuel%20and%20High%20Level%20Radioactive%20Waste.pdf>

with your successor and staff to discuss these matters. Thank for your consideration and we look forward to hearing from you.

Sincerely,



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cc: David Huizenga (DOE), Governor Jay Inslee, Governor John Kitzhaber, Maia Bellon (WA State Department of Ecology), Governor Susana Martinez, Senator Maria Cantwell, Senator Patty Murray, Senator Jeff Merkley, Senator Ron Wyden, Senator Martin Heinrich, Senator Tom Udall, Representative Doc Hastings, and Representative Adam Smith

Attachment 2

**Allyn Boldt, Open letter to Secretary Chu and David Huizenga, May 14, 2012,
*Thoughts on the Hanford Waste Treatment Plant Project***

<http://www.hanfordchallenge.org/wp-content/uploads/2010/05/Open-Letter-Thoughts-on-Hanford-Waste-Treatment-Plant-1.pdf>

May 14, 2012

Open letter to: The Honorable Steven Chu
Secretary of Energy
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-1000

David Huizenga
Senior Advisor for Environmental Management
U.S. Department of Energy
1000 Independence Avenue,
Washington, DC 20585-1000

From: Allyn Boldt
1019 S. Irby St.
Kennewick, WA 99338

Subject: **Thoughts on the Hanford Waste Treatment Plant Project**

Introduction

I have been in the nuclear industry since 1963 and am a retired Hanford engineer. I have been observing the Hanford WTP (Waste Treatment Plant) progress for 18 years since announcement of the WTP privatization contract approach by the Clinton Administration. It was claimed to be an improvement in contracting, which would allow operation of waste treatment in 2003 rather than 2008. This project has demonstrated a lack of mission or vision leading to poor execution with a severely deficient technical basis and still not scheduled to treat waste for nearly another decade.

Current Issue – Low Activity Waste Supplemental Treatment

The DOE (Department of Energy) and Ecology (Washington State Department of Ecology) are at loggerheads on the Tank Closure and Waste Management Environmental Impact Statement (TC&WM EIS) and the future Phase 2 expansion of the WTP supplemental treatment of LAW (Low Activity Waste) as described in the press. <http://www.tri-cityherald.com/2012/04/19/1909105/doe-not-ready-to-commit-to-expanding.html>. Following are my thoughts on the project and the current decision process for supplemental treatment of LAW.

Borosilicate Glass Waste Form

Borosilicate (BSi) glass was selected as the immobilization matrix very early during system process design, primarily because there existed a significant performance experience and a knowledge data base available from immobilizing wastes from reprocessing of commercial spent nuclear fuel, both in the U.S. and in foreign countries. It was later recognized that the mixtures of wastes in the Hanford tanks were widely variable and much more complex than the wastes from commercial spent fuel reprocessing. In addition, the low solubility of key chemical elements (sulfate, aluminum, and chromium) made BSi glass an inefficient matrix material for

Hanford tank wastes. These factors combine to perhaps double the volume of glass needed to immobilize the Hanford wastes, when compared against some other possible glass matrix materials.

The Waste Treatment Plant name is a misnomer, the plant should be named Sulfate Treatment Plant. WTP glass melters are operated with a sulfur limit (SO_3) that results in limiting the amount of waste in the glass product. In fact, privatization explored building a sulfate removal facility because of its large impact on the amount of glass produced. The cost for this facility removed it from consideration as an option.

The current WTP design is based on an estimated total of 3,800 metric tons (MT) of sulfate (SO_4) in the summed 177 tank inventory. This "Best Basis Inventory" estimate was developed from sampled wastes in only about half of the 177 single-shell (SST) waste tanks. The rest of the materials in the tanks have been estimated by examining the old processing records at the Hanford fuel reprocessing plants to see which waste streams from which processing plants went into which tanks at their initial disposal, with further adjustments for tank-to-tank transfers during tank farm operations. A parallel "Global Best Basis Inventory" was also developed that used production records and historical chemical processing flowsheets to develop a total chemical inventory routed to the tank farms without identification of individual tanks. This independent tank farms chemical inventory indicated a total 5,000 MT of sulfate in the 177 tank inventory.

In addition, the amount of sulfate remaining in washed tank waste sludges is based on limited samples and experimental observations. This limited data on washing performance with inventory uncertainty results in an inadequate design margin for the amount of residual sulfate as SO_3 in the HLW glass. Thus this uncertainty with sulfur can increase the process duration and decrease the process efficiency.

Supplemental Treatment Using Borosilicate Glass

Recently, River Protection Project System Plan, ORP-11242 Rev 6 (System Plan 6) was issued that calculates the amounts of HLW and LAW glass produced to the completion of the tank waste treatment mission. The System Plan identifies facilities required to complete the mission within the Tri-Party Agreement tank waste treatment end date milestone of 2047. The System Plan identified LAW-2 having six melters for the baseline system. This baseline scenario requires a total of two HLW melters and eight LAW melters to complete the waste treatment mission. The System Plan did no quantitative margin analysis to provide for process and inventory uncertainties. Thus even with ten melters operating by 2022 there is a high risk that processing will extend into the latter half of this century.

To provide for a potential 30% increased SO_4 inventory and uncertainty in leach factors with current process (water, caustic, and permanganate sludge washing), the final borosilicate WTP configuration could be: two pretreatment facilities; one 2-melter HLW vitrification facility with potential 10 year mission extension ; four LAW vitrification facilities, LAW-1 two melters, LAW-2,-3,-4 three melters each. This configuration would lead to a total of thirteen melters.

The four new major facilities in phase two will require about \$20 billion additional capital cost over the phase one costs. Annual operating costs of about \$4 billion/year versus current projected \$2 billion/year for project operation. Combined, these costs would add about \$100 billion to the cleanup cost. This cost increase will not happen, Congress will not fund this escalation in costs and may continue reduction of existing WTP funding until an acceptable funding profile is defined.

DOE Position on Hanford TC&WM EIS

DOE is correct in refusing to commit to borosilicate glass in the TC&WM EIS as the waste form for supplemental treatment. DOE states that they will evaluate less expensive alternatives. The DOE states these alternatives will be protective of the environment and will make a decision on the supplemental LAW treatment by 2014. DOE is apparently considering the use of Bulk Vitrification, grouting like Saltstone/Cast Stone used at Savannah River Site (SRS), or Steam Reforming used at Idaho National Laboratory (INL) as a less expensive alternative for supplemental treatment.

Ecology Position on Hanford TC&WM EIS

Ecology is correct pointing out that bulk vitrification, steam reforming, and grouting were evaluated in the current TC&WM EIS and other studies. These alternate waste forms did not provide adequate protection of the environment. In Washington State, the regulatory point of compliance is the groundwater under the waste disposal site with ground water concentration limits for chemicals and radionuclides set by EPA (Environmental Protection Agency) regulations. The radionuclide limits in groundwater result in 4 mrem/year dose.

Alternate Waste Forms for Supplemental Treatment

Bulk Vitrification was explored at Hanford over a period of years. An advanced conceptual design was prepared, numerous alternatives were evaluated, and a full scale cold test performed. This work showed that Bulk Vitrification would have a cost comparable with the LAW-2 facility and that environmental releases from the waste form were unacceptable in Washington State.

The INL site uses Steam Reforming to treat waste from the nuclear fuel reprocessing source. The INL waste is proposed to be disposed of at the Waste Isolation Pilot Plant (WIPP) in New Mexico. The point of compliance is at WIPP in New Mexico. Disposal of the INL waste at WIPP requires a state of New Mexico WIPP permit modification. The INL wastes are currently specifically prohibited at WIPP as tank wastes previously managed as HLW.

The SRS uses a grouting system with regulations different than the Hanford site. The SRS is regulated under an industrial wastewater permit. The point of compliance is surface streams. The regulatory limits are EPA drinking water standards for chemicals and 4 mrem/year dose for radionuclides. The limit for groundwater under the grout disposal site is the Nuclear Regulatory Commission (NRC) limit of 500 mrem/year dose for the agricultural intruder scenario (10 CFR 61.42)

The Nuclear Regulatory Commission (NRC) recently released a report that states the NRC is not convinced that the radiation exposure dosage to the general population from the SRS Saltstone Disposal Facility (SDF) would be below the required dose 10,000 years from now. "... Based on its evaluation of DOE's results and independent sensitivity analyses conducted with DOE's models, the NRC staff no longer has reasonable assurance that DOE's disposal activities at the SDF meet the performance objective for protection of the general population from releases of radioactivity," according to the nearly 300-page report. The NRC report discusses dose rates to off-site member of the general public of 90-100 mrem/yr (10 CFR 61.41 limit 25 mrem/year). The NRC report also estimated a peak chronic agricultural intruder dose to be approximately 420 mrem/yr from groundwater use (105 times the Hanford regulatory limit).

Public Position

We, the public, are between a rock, DOE (unacceptable costs for BSi glass vitrification for expanding the LAW vitrification plant) and a hard place, Ecology (none of the non-glass forms evaluated to date meet the environmental regulations). If this difference between DOE and Ecology is not resolved by 2014, Congress will have learned of the issue and may place the WTP project in lay-away, caretaker funding status with no construction budget, until the issue is resolved.

Future DOE Actions

DOE has two potential approaches to resolve this issue:

- They could change the regulatory/permitting process at Hanford. This approach would lead to breach of contract with Ecology with one- sided renegotiation, use the administration to rescind the agreement state status of Ecology to enforce RCRA regulations, or propose congressional action to declare Hanford a national sacrifice area and exempt from the national environmental laws. These options would be unacceptable to the citizens of Washington and Oregon and would wind up in federal courts with appeals resulting in decades of delay.
- Develop a glass waste form that accommodates high concentrations of sulfate, aluminum, and chromium and meets the leaching requirements to deliver acceptable environmental protection for the phase 2 operation. Development and commitment to the improved glass formulation should be by 2014 to minimize impact on the tank waste treatment mission.

Fortunately, there is a glass that accommodates sulfate, aluminum, and chromium. The glass is iron phosphate (FeP) glass that is very similar to the phosphate glass utilized by the Russian defense nuclear waste vitrification program on wastes similar to Hanford tank wastes. The Russian facility at Mayak produced over 17,000 canisters containing over 8,000 metric tons of glass. DOE has been aware of this glass form for over 10 years. There were favorable reviews about 10 years ago by Pacific Northwest National Laboratory (PNNL) for the potential use of FeP glass for Hanford wastes. Unfortunately, DOE has failed to properly evaluate FeP glass use in Hanford facilities.

Alternate Glass Form for Supplemental Treatment

In March, 2004, DOE prepared a flawed, biased evaluation of using FeP glass in LAW-1. A summary presentation of that document was clearly focused on concluding that FeP glass was not a viable candidate for use in WTP, in support of the contention that any further consideration of FeP glass would be inappropriate. Many of the statements in the presentation were unsupported by information in the document, and many other statements were clearly incorrect.

Subsequent to the above, the National Academy of Sciences committee reviewed EM-31's Technology Roadmap documents. The committee's final report encouraged additional exploration and evaluation of FeP glass for use at WTP.

Following that study, DOE EM-31 established a small (~\$1 million) project to evaluate the performance of FeP glass in a small joule-heated melter (at PNNL) and in a small cold crucible induction melter at Idaho National Laboratory, INL.

The experimental activities for this project were completed in late 2010. The project results demonstrated SO₃ loadings four times BSi glass capabilities with high sodium oxide loadings in the FeP LAW glass product. The glass product met or exceeded all other melter and glass criteria. In addition, FeP glass allows operation of melters at a lower temperature than BSi glass, which is a significant process advantage. This small experimental program was terminated early due to “budget considerations”.

Iron phosphate glass would also assist in the mitigation of the WTP ‘s technical, safety, and design problems in the Pretreatment Facility associated with solids mixing capability, criticality safety, corrosion, erosion, hydrogen safety, and other operability concerns. These concerns can’t be resolved economically or within a schedule that does not impact startup and completion of the tank waste treatment mission if the baseline BSi continues.

Thus, there was a proposal to DOE Office of River Protection (ORP) that the WTP operate without the Pretreatment Facility and convert both HLW and LAW vitrification facilities to FeP glasses.

Aspects of this proposal were explored in Scenario 5 of System Plan 6 postulating the use of small rotary microfilters and small ion exchange columns located at selected tanks to provide early waste feed to the LAW melters prior to when the Pretreatment Facility (PT) becomes available for service. Building on Scenario 5, it was suggested that a new scenario be developed and evaluated which would incorporate and expand the in-farm early LAW filter and ion exchange capabilities to provide full-capacity feed for both the HLW and LAW melters.

This proposal bypasses the PT with its extensive washing and solids liquid separation operations and uses FeP glass in both the LAW and HLW melters. Without the PT, the current concerns about safety, durability, and mixing in the PT would be eliminated. The FeP HLW and LAW glasses would incorporate much higher levels of sulfate, aluminum, and chromium into the glass matrix than can the baseline borosilicate glass. Thus this scenario would result in a much-reduced volume of LAW glass (~70-80% reduction), and a small potential reduction in the volume of HLW glass. The PT would be completed to provide alternate limited functionality; feed consolidation of tank farm decanted supernatants with centralized polishing filtration and cesium ion exchange to prepare LAW feed.

The projected reduced glass volumes and the lower melter temperatures demonstrated with the use of FeP glasses could make possible the completion of the WTP mission within the required time frame with the existing 2-melter LAW facility. This scenario would avoid the funding and schedule penalties associated with the design, construction, and operation of supplemental LAW treatment facilities, a second Pretreatment Facility, and modifications to the existing Pretreatment Facility. The magnitude of these system cost reductions would reduce or eliminate of the expected large future funding requests to Congress to complete the ORP mission with the present baseline or alternate LAW waste forms. As such, a thorough evaluation of FeP glass in this scenario could resolve both the supplemental LAW treatment and Pretreatment Facility design/safety concerns.

The previous DOE ORP evaluation of FeP glass was limited to a single facility, LAW-1. The proposed scenario was a system modification of all portions of the WTP project; waste retrieval operations, Pretreatment Facility, HLW

vitrification, and LAW-1 vitrification. DOE ORP's informal response to this proposal was essentially "been there, done that, won't revisit that subject." This attitude has contributed to our current situation.

Factors involved for why we are in the current situation:

- Not Invented Here (NIH, http://en.wikipedia.org/wiki/Not_invented_here)
- Internal DOE/contractor culture suppressing technical changes similar to the internal culture suppressing expression of safety concerns
- No financial incentive for contractors to promote or support low or no cost future projects versus high cost alternatives
- Compartmentalization of activities and responsibilities with the exclusion of systems engineering oversight and integration
- Inherent conflict of interest in making the architect engineer the design authority of the WTP, thus reviewing and passing judgment on their own work
- Failure of providing independent review and approval authority of WTP design by the ultimate operating contractor
- Conflict of interest in co-staffing a start-up team with architect engineer personnel and operations personnel under DOE authority primarily responsible for WTP construction
- Lobby efforts by profit-orientated vendors of alternative, unproven technologies
- Loss of institutional knowledge at management levels by frequent turnover resulting in repeating previous studies and politically-correct biased decisions
- Decisions made for near term benefit resulting in deferring problems years into the future and avoiding responsibility as the decision maker will have left the project and not be held accountable
- Failure to perform quantitative sensitivity analyses and design margin definition for phase II processes and facilities
- Technical decisions made at DOE headquarters driven by budgetary and political considerations without adequate technical support.

Conclusion

After nearly two decades of WTP Project mismanagement, the public and Congress should demand changes in DOE management culture and practices. The current culture allows for delay and perpetuation of failure to go unchecked without accountability. A system similar to that used to build Hanford in the 1940s and 50s is needed to effect successful resolution of the supplemental LAW treatment issue by 2014. This approach isn't the cliché "We need a new Manhattan Project" or "another re-arrangement of the deck chairs"; but, is a dedicated company/institution that manages and is responsible for all aspects of the project.