



FINAL MEETING SUMMARY

**HANFORD ADVISORY BOARD
TANK WASTE COMMITTEE**

March 13, 2019

Richland, WA

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This is only a summary of issues and actions discussed at this meeting. It may not represent the fullness of represented ideas or opinions, and it should not be used as a substitute for actual public involvement or public comment on any particular topic unless specifically identified as such.

Opening

Bob Suyama, Benton County and Tank Waste Committee (TWC) chair, welcomed committee members and introductions were made. The January 2019 meeting minutes¹ were approved by consensus.

Announcements

Bob Suyama reminded members that the election for TWC chair and vice-chair would take place at the end of the day. He encouraged attendees to express interest if interested in serving in a leadership role.

Susan Leckband, chair of the Hanford Advisory Board (HAB/Board) communicated that 2019 is the 25th anniversary of the Board. Members were encouraged to bring forward ideas, pictures and join the celebration planning committee.

Lindsay Strasser, Hanford Advisory Board facilitator reminded members, agency liaisons and contractors to sign in prior to leaving the meeting.

Glass Formulation

Bob Suyama, TWC chair, introduced the topic of Glass Formulation. Bob provided an introduction of Albert Kruger, U.S. Department of Energy, Office of River Protection (DOE-ORP). Key points from Albert's presentation² included:

- The Hanford project began in 1943. The site was identified as having large volumes of water, a remote location and was easily defensible.
- Production began with the construction of single-shell tanks (SSTs) followed by double-shell tanks (DSTs). Interim stabilization continued through the 1990s.
- There are roughly 56 million gallons of radioactive and chemical waste in the tanks waiting to be treated and put into a final waste form. This final waste form will ensure the health and safety of the community.
- All 56 million gallons of waste are currently being managed as high-level waste (HLW).
- There is a proposed change to Department of Energy (DOE) Order 435.1. As the change has not occurred, Albert works to the existing definition.
- Part of the program looks at what occurs in the glass making process. Unlike production of commercial glass, a water slurry of materials is introduced. The water slurry is a mixture of the tank waste and the glass-forming chemicals.
- There are gross differences between a high-level waste feed and a low-activity waste (LAW) feed. In a LAW feed, the thermal conductivity is about half of the HLW feed.

¹ [January 2019 Tank Waste Committee Meeting Minutes](#)

² [Enhanced Waste Glass Effort](#)

- There can be a radical differences between feeds in the amount of gas that is produced in the glass making process. An operator must be made aware of this. Glass melters are not very well instrumented compared to that of a nuclear reactor environment.
- In the development of the glass program, operational experience is provided. This experience allows operators the ability to know what to expect as they move from feed to feed.
- Glass models are being developed. The contractor was asked to develop three LAW glass recipes for envelopes A, B, and C. The contractor was also asked to develop a glass recipe for envelope E, direct feed low-activity waste. The contractor met the minimum requirements of the contract.
- “As good as glass” means the key properties of glass that give rise to its durability, stability, and long-term performance. Through the performance assessment protocol, subject matter experts (SME) are able to map out what they believe to be the appearance of these materials for diffusion into the environment. A test that is useful for one wasteform may not even be appropriate for another wasteform. The Product Consistency Test (PCT) is good for borosilicate glass and the equivalent for a Portland cement wasteform is the American Nuclear Society (ANS) 16.1.
- DOE is proposing the use of a standard test that measures the performance of the glass. Data packages will be provided for analysis of how the material will appear to the environment. SMEs are reviewing how the glass degrades in an environment identical to the Integrated Disposal Facility (IDF).
- Sodium ion is the most mobile species in the glass matrix tracked for release into the environment in all tests being conducted.
- In developing an accelerated test for the glass used at Hanford, SMEs are in the process of establishing the relationship between accelerated ageing tests and natural ageing. They are reproducing the glass used in Sweden to construct ramparts of a fort 1.500 years ago. They are also examining how the modern-produced formulations degrade in the accelerated testing, and comparing it to aged glass from the hillfort. In the future, this test will be introduced as a way to open up and understand how the glass performs in the environment.
- A test is being developed based on the Environmental Protection Agency (EPA) Standard Methods (SW-846: Methods 1313 & 1315). From an economic standpoint, one single pass flow through that costs between \$400,000 - \$500,000 to characterize each glass. In replacing that test with something more meaningful, DOE can take advantage of a test that can be done for \$10,000.
- The 1313 Interlab validation includes data for replicate samples from three independent laboratories (Pacific Northwest National Laboratory, Vanderbilt University & Sheffield University). There are slight difference in the minimum detection limits (MDL) between each laboratory due to the different test equipment being used, but there is excellent agreement for the data and the absolute deviation of the data.
- By 2008, it was recognized that one can do better in terms of glass processing or glass waste loading.

- In 2013, glass models were delivered to then Secretary Chu. The glass models showed in that era, SMEs were able to get much more chromium and aluminum into the HLW glass. Removing the caustic leaching step results in removing the 30,000 MT of sodium being added to the 60,000 MT of sodium in the LAW inventory. Removing the oxidative leaching step resolves the criticality safety concern for solubilizing fissile materials and having them report to LAW.
- SMEs have measured and quantified the uncertainty in the enhanced waste glass models. A report has been published that is available publicly. The combined uncertainty for the weight and mass measurements added to the analytical uncertainties is on the order of 5%.
- In the glass program, SMEs offer the science and the data from which engineers can perform the necessary work to treat and dispose of the waste in the plant that is being built. All of their work is being published in high-impact professional journals as a mechanism of presenting all that we do to rigorous independent review.
- Albert plans to retire by the end of 2021. He plans to deliver fully verified and validated models from a NQA-1 Evaluated Vendor for operations by the end of 2020.

Agency Perspective

Dan McDonald, Washington State Department of Ecology (Ecology) provided Ecology's perspective on Glass Formation. Dan communicated his concern for inconsistencies and uncertainties. If DOE has Albert's information as a benchmark, there will be a significantly larger amount of characterization and sampling that will need to be completed. Characterization and sampling will ensure that issues of concern in any one Tank Farm will fold into the envelopes and the environment that Albert is speaking to. If those types of things need to occur, the process flowsheet may look the same but the timeline to get through the process may look very different. The other issue in terms of blending is the location. The only place that exists currently for blending is in the DSTs. DSTs are aging and were not designed for complex and necessary blending for this initiative. If the decision is made to use DSTs for blending, emergency space is lost. You will already have one DST down, and need to sequester another DST for these activities. Dan did not suggest this is what will occur but are contributors to the conversation. Depending on how the flowsheet comes out, there may be changes required in the particular flowsheet that are going to contribute to the differences along the process both in Tank Farms and the Waste Treatment Plant (WTP).

Dan also addressed the topic of Best-basis inventory (BBI). Dan asked the group to think about how much is known about the propositions. It is well recognized that sampling and characterization takes a tremendous amount of time and is very expensive. If a better job needs to be done, it's going to take more time and be more expensive. The average full-scale sample out of a DST takes six to nine months to complete and costs several million dollars. Is there enough room in the budget? Can that level of efficiency be folded into the process?

Dan referenced the Army Corps of Engineers report and the skepticism on throughput methods. The contract says 70% whereas others would say 50% would be good. In terms of throughput and time, Dan cautioned the Board to hold comment on whether or not the throughput can remain the same, the emission is the same, or the number of canisters is the same. With the canisters, depending what is found in the

tanks, the constituents are different. The difference may require different throughput approaches. It may require moving things a little more slowly or a little faster.

Jay Decker, Washington State Department of Ecology (Ecology) provided additional perspective on Glass Formulation. Jay added that he feels it is great that DOE is looking at the durability and longevity of the glass. DOE is also reviewing the testing methods. Ecology has a keen interest in the testing methods development. Ecology is optimistic that the work that is being done is going to improve things. It is a matter of how much will improve. Jay noted that this is something that will evolve over time as operational experience continues.

Committee Member Questions (Q), Responses (R), and Comments (C):

Note: This section reflects individual questions, comments, and agency responses.

Q: “Does the Pilot Plant have the same type of production mechanism the final will have?”

R: “With the pilot facility we put together, we do mechanical mixing which may or may not be representative of the mixing that is done in the CRV. This is aside from feeding glass formers in and off to the melter. You cannot plug the feed lines until you know what movement you have to have. You have to know what size the feed particles are so you know how often they need to be agitated by whatever mechanism.”

C: “The test melter that was built on the east coast was 1/3 scale and far exceeded expectations which was very encouraging.”

C: “I absolutely agree that we should have blending tanks so there is some certainty in the feed that is going to WTP. The DWPF facility at the Savannah River site has blending tanks and they make huge batches. I think that is something that we could look at. I think it is a very legitimate thing to consider.”

Q: “You mentioned a change to 435.1 in your presentation. Can you elaborate on what that change is?”

R: “I don’t work to what may be until that ink is on that piece of paper directing me.”

Q: “What is the change?”

R: “What would change is LAW would see a slightly larger mission.”

Q: “How confident in the uncertainties that you presented are you?”

R: “I have a NQA-1 requirement of a 95% level of confidence in the work I do.”

Q: “What would it take from where we are today, to only needing one Low-Activity Waste facility?”

R: “That is an easy question. Start up the facility we have and figure out how we can get through it.”

Q: “Do you think it is achievable from process knowledge as we learned?”

R: “I think given we are within striking distance with all the hard constraints that were established in the 2000 timeframe, of treating the current LAW inventory in under 40-years in the WTP LAW Facility

being delivered. Another part of the enhanced waste glass program is delivering the evidence that some of those hard constraints were set when data was absent and so excessive conservatism for the sake of safety was appropriate”

Single Shell Tank (SST) Update

Bob Suyama, TWC chair, introduced the topic of the Single Shell Tank (SST) Update. Bob provided an introduction of Dusty Stewart, U.S. Department of Energy, Office of River Protection (DOE-ORP) and Karthik Subramanian, Washington River Protection Solutions (WRPS). Key points from today’s presentation³ included:

- With the SSTs, Hanford is a long-term mission. There are several SSTs onsite, and DOE-ORP would like to ensure the integrity of the tanks over the lifetime of the mission.
- Aging infrastructure is a challenge. There are 12 SST Farms onsite that were built between 1943 and 1964. There are 149 SSTs with various capacities.
- Hanford has had many different types of waste. There have been different processes going to different Tank Farms, which poses many challenges. The SST Integrity Program looks at their structures across all the different types of waste.
- There are several recommendations regarding the SSTs that come from the expert panel and the Independent Qualified Registered Professional Engineer (IQRPE). Each and every recommendation that comes from the IQRPE is considered very important.
- If there is a hole at the bottom of a SST, Drainable Interstitial Liquid (DIL) is identified as the liquid that would drain out.
- The tank waste summary report is updated monthly and noted as your “one stop shop” for information. This report will have all the current leak volume estimates recorded.
- Water Intrusion was noted as rainwater that would intrude SSTs.
- SST visual inspections are prioritized based on suspected water intrusion. Numbers recorded can be found in the tank waste summary monthly report.
- DOE-ORP has an active management program on SSTs that is continuously improving.

Rod Lobos, DOE-ORP provided additional slides⁴ and perspective on SSTs. Key points from Rod’s slides include:

³ [Hanford Single Shell Tank Integrity Updates](#)

⁴ [Office of River Protection - Additional Slides](#)

- DOE has an interstate agreement with the Nuclear Regulatory Commission (NRC). DOE is hoping that by the end of April, they will receive the NRC's request for additional information (RAI).
- Schedule will depend on when DOE-ORP receives the RAI from the NRC.
- Rod Lobos will be taking over Jan Bovier's duties at the end of the March 2019.
- DOE-ORP is working to a sampling analysis plan that is been approved by Ecology.

Agency Perspective

Jim Alzheimer, Washington State Department of Ecology (Ecology) provided Ecology's perspective on the SST program. Jim communicated that recently DOE completed the SST IQRPE report and said everything looks good. It is recommended that the report be completed again in 16 years. Ecology is in agreement with this recommendation. However, 16 years is a long time so Ecology recommends that DOE continue to look at new monitoring technology. Potentially in the next few years, DOE could complete a 3D laser scan to look at the inside the tanks. Margins for safety on these tanks is still good. Structural integrity is about the carbon steel reinforced concrete, not the liner of the tank. Ecology is looking at the surface level to see if there is leaking. Visual inspections help Ecology better understand the monitoring. Jim also shared that Ecology is revising the monitoring plan. The revision will allow data to become easily publically available. The plan is to have this information available on the Phoenix platform.

In terms of the internally monitoring of the tanks, there are capabilities to monitor if a suspected leak is identified. Jim feels that DOE is doing an incredible job. New leaks are going to be small compared to previous leaks. AY-105 is the most significant tank that needs to be dealt with. AY-105 requires good information to determine a path forward.

Committee Member Questions (Q), Responses (R), and Comments (C):

Note: This section reflects individual questions, comments, and agency responses.

Q: "In the December report, it appears there were two new tank intrusions. I think B-103 and BX-104. Is that true? If so, can you tell me the story?"

R: "We do roughly 12 SST visual examinations per year. Of those 12, if we find intrusions, we will announce it during that year. Those two tanks fit under that category. We announced it and we visually saw evidence of drifting from various places. We were able to confirm that there is water intrusion. When we do confirm it, we do our best to find an estimate. The estimate for the tanks that we found water intrusion in the last two years has been extremely low. It has been less than 100 gallons per year. We have been doing visual examinations since about 2013. We prioritize visual examinations based upon those we had evidence for possible intrusions. When we did some of those visual examinations, we estimated some of those tanks have a little bit larger level of intrusion. The ones lately have been less than 100 gallons per year."

Q: "How does it change your management of a tank, if at all after an intrusion is discovered?"

R: "Regulatory wise, not much. Right now, we have a regulatory basis for analyzing these tanks on an annual basis. We already do it on a quarterly basis."

R: "When we do have intrusions, we switch to monthly monitoring. We step up the frequency of inspections."

Q: "Have you learned anything from the structural analysis so far that would tell you how long we could wait to backfill the tanks? Or will that be an unknown until one collapses?"

R: "There have been studies. However, the structure of the tanks is still pretty good. To put it into perspective, they were standing on their own when they were empty. As Jim mentioned, the structure of particularly the SSTs is not related to the carbon steel liner. It's actually the concrete and the rebar that is on the outside. By having the tank empty, nothing has changed as far as the concrete or the rebar on the outside. The structural analysis will essentially stay the same for the time being."

Q: "I see you doing AY-104 and AY-105. Are you going to be doing the pushes on the other tanks too?"

R: "There is a focus area 2. That is more toward the south end. I don't know that we have that whole area defined yet."

Q: "Which tanks are you going to start emptying when you start this Tank Farm?"

R: "We don't know yet."

Q: "Do you have a date yet when that decision will be made?"

R: "I am not sure yet on my end. AX will be the first farm."

Q: "What do you expect to happen at the NRC public meeting in April? Are we going to be seeing new information?"

R: "For that public meeting, it will be just like the previous ones. DOE will be asking the NRC clarifying questions what the RAIs mean. Sometimes the RAIs are general. It will be drilling down to see exactly what meets what the NRC is looking for."

Q: "Will there be opportunity for public comment at the same time?"

R: "I believe there is at the end. The NRC and the Agency will have their discussion, which is open to the public to listen in. At the end, the public has an opportunity."

C: "I think the HAB needs to weigh in on at least the advice that we have."

Tank Side Cesium Removal (TSCR) Update

Bob Suyama, TWC chair, introduced the topic of Tank Side Cesium Removal (TSCR) Update. Bob provided an introduction of Sahid Smith, Federal Project Director for the U.S. Department of Energy, Office of River Protection (DOE-ORP). Key points from Sahid's presentation⁵ included:

- From 2014 – 2017, DOE-ORP pursued the Low-Activity Waste Pretreatment System (LAWPS). The goals of this project were to remove the cesium and the solids from the supernate waste to be able to send to WTP to be vitrified.
- From the standpoint of operations, not much has changed from LAWPS to TSCR. DOE-ORP will still be using the ion-exchange process to remove the cesium. They will also still be using filtration to remove the solids. The difference between the two processes includes the actual scale, some of the filtering elements, and the ion exchange media that will be used. These changes are a direct change based on an external, technical review that was completed in September 2017.
- The TSCR demonstration is run in two phases.
 - The first phase is to support the commissioning of WTP. WTP needs roughly 40,000 gallons of waste to go through the hot commissioning process. ORP estimates if they process 170,000 gallons of waste, they will be able to pull 100,000 of curies out of the waste stream. During this phase, ORP will evaluate how well they are able to remove the cesium from the waste
 - During phase two of the process, ORP plans to process up to 5 million gallons of waste while staying within their operating efficiency envelope. They will prove the kinetics of the CST media verifying the test completed at the Pacific Northwest National Laboratory (PNNL). They will also optimize potential performance.
- The conceptual layout of TSCR has three main components.
 1. The actual TSCR enclosure where the ion-exchange columns and filters will be housed.
 2. The ancillary enclosure, which will have the supplemental equipment to support the TSCR system.
 3. The control enclosure that will house the control system.
- DOE-ORP will be processing waste at five gallons per minute.
- In the first phase of processing, it is anticipated that 470,000 gallons of supernate will be processed.
- The TSCR system will be installed in the AP Farm. There will be a number of transfer lines to integrate the AP Farm.

⁵ [Tank Side Cesium Removal Demonstration Project](#)

- AP-107 is the feeder tank to the system. AP-106 is the feeder tank to WTP. As part of the project, DOE-ORP will build a number of transfer lines to transfer the liquid from AP-106 to WTP.
- The TSCR system is at 60% design complete. The integration of the Tank Farm upgrade is also at 60% design complete. The waste transfer lines are at 60% design complete.
- There have been a number of technology maturation tests run to ensure the system will work as designed. DOE-ORP completed a filter test in December 2018. In addition, they are near completion of the glass generation test that will assist in understanding how much hydrogen gas is being generated during storage of the ion-exchange columns. A media-drying test is near completion. This test will assist in understanding how long it will take for the media in the columns to dry after the liquid is extracted out. Finally, batch-content testing is expected to be completed in the early summer timeframe.

Agency Perspective

Jay Decker, Washington State Department of Ecology (Ecology) provided Ecology's perspective on TSCR. Jay communicated that there were a couple of things that are good and bad about TSCR from Ecology's perspective. TSCR is a lot simpler than technologies looked at in the past. Simpler is a good thing. DOE was also able to meeting schedule for feed to go to WTP. There are a few things that cause concern for Ecology. There are a number of DSTs that are part of the treatment system. Those tanks end up having a dedicated purpose for that feeding system. Ecology also has concerns about cesium resin. Ecology sees these vessels filled with cesium-loaded resin as a potential risk onsite. It will take another facility to extract the resin. The containers are not easy to extract the resin from. If things move forward as designed, Jay hopes that DOE will look at the long-term economics.

Steve Lowe, Washington State Department of Ecology (Ecology) provided additional perspective on TSCR. Steve expressed concern regarding the hose on hose transfer lines. Steve shared that a number of the hoses do not drain. In addition, TSCR must run continuously and some of the transfer lines are buried. Hose on hose transfer lines only have a three-year service life. Ecology is concerned hearing a five -year operation with no talk of replacing the hoses.

Dan McDonald, Washington State Department of Ecology (Ecology) provided additional perspective on TSCR. DOE is planning to run 170,000 gallons through. What is the backup? What is the contingency? At this point, TSCR is the only plan. If TSCR does not work, LAW stops. 170,000 gallons is a reasonable throughput and will not take long to run. If 170,000 gallons lasts for 60 days, at the first sign of trouble if DOE does not have a contingency plan, there will be a problem. Depending on the calculations, one or even seven TSCRs may not work. It will depend on process flow and how often things will need to be changed out. 140,000 curies is a best estimate. The canister with the cesium media is a concern. To Dan's knowledge, there has been no research that the cesium-loaded media are going to be compatible with the resin in the DSTs. Until it is known if there is a disposition path, the cesium media and the can in with it resides are orphan waste. On the assumption that the cesium media is removed, what do you do with the cans? It is still orphaned waste. There is not a lifecycle path for abandonment and disposition of these cans. That is huge concern for Ecology.

Committee Member Questions (Q), Responses (R), and Comments (C):

Note: This section reflects individual questions, comments, and agency responses.

Q: “Why are we doing this? I don’t feel comfortable with what we are doing based on what I am hearing. What does this provide to be vitrified by the LAW plant when the LAW plant starts? What are the constituents in that liquid that are going to LAW?”

R: “Constituents are the same constituents that would have gone through the pre-treatment facility with the exception of the solids and the cesium. Once we have gone through the pre-treatment system, the stream that comes out will be classified as low-activity waste.”

Q: “What is actually in it?”

R: “All of the radionuclides, I cannot answer at this time. I can get that answer to you.”

Q: “I understand that this year has a five-year operating life. When do we expect the pre-treatment plan to actually startup?”

R: “I can’t speak to the pretreatment facility. After we run the TSCR system for three years, we will perform a second analysis that will decide a longer-term answer to pretreatment of waste.”

Q: “Is LAWPS completely off the books?”

R: “No, it is not completely off the books. I would call TSCR a subproject of LAWPS.”

Q: “Have you done studies with that kind of a solid on this resin to ensure there won’t be a plug?”

R: “We have run a number of tests with PNNL using our media as well as waste and simulants. We have gone through the entire evolution. So far we have not seen any indication of plugging.”

Q: “Do you know the size of the particles going in?”

R: “There is a range. There has been a number of different test evolutions with the ion-exchange media and the filtration. We wanted to have a good level of confidence going forward regarding the performance of the technologies.”

Hanford Advisory Board Work Plan Review

Bob Suyama, TWC chair, introduced the topic of the Hanford Advisory Board Work Plan Review.

Members took the opportunity to have an open dialogue regarding topics they would like to see added to the FY2020 HAB work plan. Items recommended by TWC members to add to the FY2020 work plan include the following:

- WTP Educational Overview
- System Planning/System Plan One
 - Open Dialogue

- Education on how it works in the field
- System Plan 9 Input
 - What are the scenarios?
- National Academy of Sciences Review of Supplemental Waste
- System Integration/Risk
- Education and impacts on new contracting strategy
- Potential merger of ORP & RL

Open Forum/Committee Business

Bob Suyama introduced the topic of Open Forum/Committee Business. He explained to TWC members that the open forum provides an opportunity for members to discuss topics that may not be on the agenda or on the HAB's work plan. Committee business included the following:

3 Month Work Plan

The Tank Waste committee members discussed updates to the TWC's 3-month work plan. Updates include the following:

- Site Tour in May
- TSCR Follow-Up

TWC Chair & Vice-Chair Election

An election for chair and vice-chair of the TWC was held at the March TWC meeting. Bob Suyama and Steve Wiegman were nominated and confirmed their willingness to serve as TWC leadership. By consensus, Bob & Steve were elected to continue to serve in their leadership capacity.

Attachments

Attachment 1: Enhanced Waste Glass Effort

Attachment 2: Hanford Single Shell Tank Integrity Program updates

Attachment 3: Office of River Protection – Additional Slides

Attachment 4: Tank Side Cesium Removal Demonstration Project

Attendees

Board Members and Alternates:

Phillip Lemley, Alternate	Tony Umek, Member	Emmett Moore, Member
Steve Wiegman, Member	Bob Suyama, Member	Vince Panesko, Alternate
Susan Leckband, Member	Paige Knight, Member	Rebecca Holland, Member
Pam Larsen, Member	Dan Solitz, Alternate	Shelley Cimon, Member
Jeff Burright, Alternate	Kristen McNall, Member (Phone)	Tom Carpenter, Alternate (Phone)

Others:

Lindsay Strasser, ProSidian	Dan McDonald, Ecology	Jaime Murik, DOE
Sherri Schatz, ProSidian	Jim Alzheimer, Ecology	Ginger Wireman, Ecology
Kris Holmes, DOE-ORP	Jim Lynch, DOE	Chuck Torelli, Kennewick City Council
Hal McClure, WRPS	Steve Lowe, Ecology	Matt Louch, WRPS
Tom Rodgers, Department of Health	Jay Decker, Ecology	Rod Skeen, WRPS
Elvie Brown, WRPS	Rod Lobos, DOE-ORP	Karthik Subramanian, WRPS
David Reeplog, TRIDEC	Ruben Mendoza, WRPS	Mank Beck
Albert Kruger, DOE	Sahid Smith, DOE-ORP	Dusty Stewart, DOE-ORP
JoLynn Garcia, DOE-ORP	Abi Zilar, Northwind	Dana Gribble, MSA