

**FINAL MEETING SUMMARY**

**HANFORD ADVISORY BOARD  
TANK WASTE COMMITTEE MEETING  
March 12, 2009  
Richland, WA**

**Topics in this Meeting Summary**

Welcome and Introductions ..... 1  
Update on Single Shell Tank (SST) Retrieval ..... 1  
Single Shell Tank (SST) Integrity Expert Panel Study..... 9  
Committee Business..... 21  
Handouts ..... 21  
Attendees..... 22

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

**Welcome and Introductions**

Larry Lockrem, Tank Waste Committee (TWC) Chair, welcomed the committee, introductions were made, and the committee adopted the January meeting summary.

**Update on Single Shell Tank (SST) Retrieval**

Steve Pfaff, Department of Energy – Office of River Protection (DOE-ORP), provided an update on plans for retrieving single-shell tanks (SSTs). Tank C-110 is currently undergoing retrieval, and Steve said they have reached a plateau, or retrieval tail, which means it is difficult to continue retrieval. C-110 originally held 178,000 gallons of sludge, and 86 percent of this has been retrieved. The material remaining in the tank bottom resembles heavy sand, as the sluicing material has repeatedly broken down the size of the cobbles. Retrieval has been temporarily halted to support construction outages in C and AN farms, which will last four to six weeks. Steve said the material remaining in C-110 has not yet been sampled, but it most likely will be sampled. DOE is currently trying to determine the end state for these tanks, and he said they have incentivized the contractor, Washington River Protection Solutions (WRPS), to sample C-108 and possibly C-109 and C-110.

Steve then reviewed the status of C-104, which is currently undergoing construction in preparation for retrieval, and contains 259,000 gallons of sludge. He said all of the C Farm tanks are primarily sludge-type tanks, which has been a challenge because they

contain more alpha-emitting contamination. Two old pumps must be removed from C-104 and double-shell tank (DST) AN-101 must be completed in order to put a new transfer pump into service for C-104. Steve said a portable ventilation system is used when doing construction and retrieving these tanks due to the vapors emission and the potential spread of alpha particles. The anticipated start date for retrieval of C-104 is July 2009, with completion in 2010.

Tank C-111 is the next tank in line for retrieval, and Steve said DOE will use modified sluicing because this tank is an assumed leaker due to unexplained level drops. He said a leak-assessment process is conducted on the tanks to verify past leakage assumptions. Retrieval can be more efficient if it has been determined that a tank has not leaked. Retrieval planning for C-111 began this month and sluicing should begin in 2010.

Steve said they are currently undergoing an effort to determine a life-cycle baseline from 2009 on, and the tools that have been available for this are modified sluicing and a vacuum system for smaller and larger tanks. The vacuum system for larger tanks is a mobile arm retrieval system (MARS). Steve said they currently do not have large enough risers to use this, but it is possible to install these. DOE is employing technologies previously used for the baseline, but Steve said they are hoping a MARS will present another viable option.

Steve reviewed the MARS and said integrated testing on the system using stimulants will be completed by the end of 2009. The MARS has a central mast with a telescoping arm and uses a selection of end effectors to sluice and vacuum tanks. Steve said core drilling of the tanks will be required to install a new 42-inch riser in the center of the tank, which DOE has authorized WRPS to do. The mast would lower into the tank and the arm itself would scope out once inside. Steve said this technology also has the potential to be used on above-ground items, such as a vacuum skid. DOE would need to procure an arm as well as the shielding box that goes above ground, and would like the MARS to be used for multiple tanks. Steve said DOE hopes to deploy either the unit currently being tested or procure another unit by 2010 or 2011. He said vacuum retrieval on the C-200 tanks was not an efficient process because the waste had to be vacuumed above ground. With the MARS design, Steve said a smaller tank toward the bottom could pull waste horizontally, while a regular slurry pump could pull it toward the top and a possible booster pump could send it to the DST system. Steve said the hope is to create a more efficient retrieval process, and they have identified 12 tanks in farms other than C farm where they may have to use a vacuum arm and crawler device.

If the available technologies cannot complete tank retrieval to Tri-Party Agreement (TPA) criteria, Steve said DOE has the chemical means available to first add

concentrated sodium hydroxide, which would soak for one to two weeks before sluicing would be resumed. For S-112, DOE used a concentrated solution that was successful in developing materials. He said the downside of this is the sodium added to the tanks would need to be treated at the waste treatment plant (WTP). Another option is to use weak acid, such as oxalic acid, in an enhanced chemical cleaning (ECC) process. Steve said this also creates problems unless there is a mechanism to destroy the acid on the way to WTP. He said WRPS is looking at a process to destroy the acid using ultraviolet light.

Steve reviewed the overall C farm status. DOE has successfully retrieved five tanks including C-103, which had substantial waste that was retrieved successfully using modified sluicing. C-106, C-108 and C-109 are above the retrieval criteria in the TPA, and there are plans to sample materials in C-108 to determine what is left and how to retrieve it. He said the A and AX are the next farms planned for retrieval in 2012.

Steve said revision 3 of the system plan had a retrieval sequence that focused on producing the best possible blend of waste for WTP. However, this sequence would require hopping all over the SST farms, which is not efficient or cost effective; and the incidental blending strategy was not useful in producing a homogenous waste form to send to WTP. He said when DOE started working on revision 4 of the system plan they focused on retrieving all tanks in C farm to close Waste Management Area (WMA) C. He said a similar, farm-by-farm approach will be applied to A and AX farms. While this may not produce the optimum blend of waste for WTP, Steve said he thinks it is more cost effective to conduct retrieval this way. Farms A and AX were chosen next because they are close to DSTs. He said the overall strategy has changed from focusing on individual tanks to individual farms. In terms of providing waste to WTP using this approach, an interim tank blending facility may be needed between DSTs and WTP.

### **Regulator Perspectives**

- Jeff Lyon, Washington State Department of Ecology (Ecology), asked if the pumps being removed for retrieval of C-104 include the AN tank pump. Steve said it does not include this pump, which has not been used for decades.
- Jeff said Ecology is concerned about C-108 and C-109 and would like a schedule for these retrievals. He said the pace of retrieval and relationship of space and resources are concerns of theirs, and he thinks it would be beneficial to talk about having space available for retrieval in the event stimulus funding becomes available.
- Jeff explained that farms A and AX were selected because of risks to groundwater. He said one issue he has with these farms is the content of the tanks is not primarily sludge, and there is a preference for sending sludge rather than salt cake to WTP because salt cake takes up more space. He expressed concern that the tank farm

retrieval sequence was planned without input from Ecology, and he encouraged DOE to discuss this with them. He said two years ago Ecology had a group formulate a plan for approaching closures, which came up with T farm as the next area for retrieval. He suggested upgrading the Hanford Tank Waste Operating System (HTWOS) that DOE currently uses so it can consider these factors, as this would help Ecology set priorities.

- Jeff asked whether DOE has looked at the impact of retrievals in A and AX on WTP blending. Steve said DOE would involve WTP in the system planning, but could not comment on what extent because he is not on the planning committee. He said the last revision of the retrieval sequence document had scenarios from DOE-ORP and Ecology, and it was the Ecology scenario that suggested farms A and AX.
- Jeff said many of the tanks in farms A and AX leak, and he expressed concern about their potential impacts to the DST system. Steve said the TPA requires that DOE conduct retrieval demonstrations on different kinds of tanks, and they have yet to do that on a leaker tank.
- Jeff said the TPA provides a process of talking about and deciding on technologies for tank retrieval. He said a retrieval report for C-108 and C-109 is needed, and yet DOE is working on improving retrieval technology. He said this is usually worked on in the TPA process. Steve said DOE used the tank waste retrieval work plan as a vehicle to discuss technologies and get them approved. Jeff said those require DOE to finish retrieval within a year, which is another issue DOE and the regulatory agencies need to discuss.
- Jeff said MARS seems to include a number of moving parts, and in the past moving parts have increased the number of failures. He said he is concerned about this but excited about the new technology. Steve said the fold track they put in C-109 made it difficult for it to fall back out of tank. He said MARS is being designed with the ability to replace parts, which is a key feature.

### *Committee Discussion*

- Rob Davis recommended that additional funding go toward sampling and characterizing materials, such as the remaining material in tank C-110. He said many unknowns have gone into building the WTP because the materials it will treat have not been analyzed.
- Shelley Cimon asked how the holes to install larger risers for MARS were going to be drilled, given the gases contained in these tanks. Steve said a portable ventilation system would need to be attached to a different riser on the tank, and by using an exhauster to suck air out of the tanks during this operation air would enter the hole

rather than escape through it. Respiratory-protection equipment is also used to back up this system.

- Shelley expressed concern that MARS presents the potential for a fire. Steve said he did not know the potential for this, but said gases inside the tank are not at flammable levels. Through sampling and characterization, the waste was determined to be in a form that could be dried out or heated up. Steve said this also applies to tanks in C farm, where slurry waste is not in a dry form. Herb Berman, WRPS, said the domes inside the tanks are clean concrete, and the only concern would be when these are broken through. Steve said drilling would only be through concrete and embedded rebar, as there is no steel liner to drill through. He said for the pilot hole DOE will first put in a device to hold the big piece to avoid having the piece fall in and interact with the waste.
- Rob asked if the committee could have a presentation on MARS once the design and process are streamlined, specifically related to the safety of the individuals and the process.
- Harold Heacock asked whether the tanks on which retrieval criteria has been completed are empty. Steve said they are emptied to TPA criteria, which is less than 30 cubic feet of waste for smaller tanks. For larger tanks, such as C-103, this limit is 60 cubic feet. He said no actions have been taken on these tanks since, and DOE needs to work on the closure process. Harold asked whether DOE has criteria for what constitutes a closed tank. Steve said they do not have closure criteria, and are waiting for the Tank Closure and Waste Management Environmental Impact Statement (TC&WM EIS), which is due on May 15.
- Shelley asked when a decision on the interim blending facility would need to be made. Steve said WTP operations will begin in 2019, and testing and commissioning will take place a few years prior. Currently, DOE is examining the needs for characterization and a blending facility, and have initiated testing with the Savannah River National Laboratory (SRNL) to find out what they can do. WTP has many safety controls in place, and Steve said it is not practical for them to design systems and controls when the means to better mix waste and sample it are needed.
- Rob said WTP is more than 60 percent complete in design and a great deal of equipment has been purchased. He said they are building the plant for a worst-case scenario at this time, and the biggest problem WTP has will be accommodating all of these changes. Steve said to his knowledge this would not change WTP's design, but testing and operation is very expensive. If some technical-safety-requirement controls can be eliminated they can save money on plant operations. Steve said the only way to do this is to know what they are sending to WTP.

- Mike Korenko said the Hanford Advisory Board (HAB or Board) issued advice for DOE to use systems engineering and gave criteria for this. He asked whether the sandy material remaining in the tanks is now a secondary or tertiary waste, and whether a systems approach has been discussed. He expressed concern that this would create an issue like secondary waste or DST volume.
- Dick Smith asked if DOE will be able to replace parts on MARS without pulling the system out of the tank. Steve said the arm itself rides up and down on its mast, and they want to have the ability to change the moving parts, all of which would be located above ground.
- Dick expressed concern about the stability of the mast on MARS, since it is not firmly seated on the bottom of the tank. Steve said DOE is considering this and putting more robust equipment into the tank is one reason they would like a larger hole. Dick suggested they put a foot on the mast that can go on the bottom of the tank to stabilize it.
- Mike asked if the TC&WM EIS includes different paths for final closure for tanks that are suspected leakers and those that are not. Steve said he was not involved in development or review of the EIS, so he does not know. Jeff said the document includes options for farms but does not include tank-specific details. He said one alternative has the option of removing tanks that are in soil. The design of removing a tank is difficult due to other processes, and Jeff said the document uses scaling, since getting inside tank farms with heavy equipment is impossible due to safety concerns. Wade commented that this option was included in a white paper, and Jeff said the information from the white paper was included in that part of the EIS.
- Mike said at the last HAB meeting, the Board recommended DOE conduct a strategic brainstorming session to evaluate the site's end state, rather than just the end of the current contract. He asked if this would take place, particularly before the EIS is released. Steve said a capstone process would not take place before the draft EIS (DEIS) comes out on May 15. Mike said it would take only two weeks to plan a two- or three-day brainstorming session. Jeff asked whether Mike had participants in mind for the brainstorming session. Mike said the Board was going to leave this up to DOE.
- Dirk Dunning said the interim blending facility would not impact WTP, but does change the scenario analysis in systems engineering that looks at tank retrieval. He said these different scenarios varied by more than a decade, and he thinks DOE's proposed blending facility will ameliorate some of these impacts. Steve said this is correct, and older scenarios that called for putting waste in DSTs and sending one DST at a time to the WTP would not be effective in producing a constant stream to WTP.

- Dick said he does not see how a blending facility would help if DOE is only retrieving one tank per year. Pam Larsen said blending tanks provide the opportunity to pump more tanks earlier without the consequences of having to build more tanks for storage. Rob said since only one-third of the waste will go through the ultra-filtration process, the remainder of the waste could be processed through the blending facility, which could be an enhancement to the process. Shelley said there is a need for more tanks at Hanford, and suggested looking at building more tanks attached to that system to increase capacity.
- Dirk said if aluminum solvents are a problem there may be other solutions, such as leaching solids to remove contamination. He asked if DOE has looked at operations at Oak Ridge National Laboratory (ORNL) as an example. Steve said he has looked at some of what ORNL has done in tanks. Dirk said ORNL effectively reached free-release standards by applying all of the technologies from Hanford, SRNL and other sites.
- Dirk brought up the issue of plumes located under tanks. He said since there is lateral transport beneath the tank farms, they will probably have to go farm by farm, but will also have to examine contamination under other units. Regarding the closure process, he said this depends on whether issues of transport have been addressed sufficiently in the EIS, which will delay the record of decision.
- Al Boldt said there are several issues with the large particle size that has been observed, particularly with the MARS system. He said when this material is transferred to DSTs the large particles will need to be retrieved a second time. He said the WTP has a maximum particle size it can accommodate, and suggested using a size-reduction model, which is best at the beginning of the process. He expressed concern that these concentrated solids will plug the pipe during the first transfer.
- Pam said she supports the idea of mixer tanks, which provide the opportunity for more capacity and create a buffer to the WTP.
- Rob said he fully supports the blending facility and thinks this should be advanced given that the contract limits what can be fed to WTP. He also said that even for tanks on which DOE has reached the TPA target for retrieval, there should be an effort to go beyond these targets and retrieve as much of the material as possible. Steve said the TPA goals are based on retrieval demonstrations conducted on a number of different kinds of tanks. He said they are doing their best on every tank, and have to determine what is reasonable to achieve, as they are spending millions of dollars per tank. He said this is partly why DOE started the performance assessment (PA). Rob asked if DOE plans to focus on tanks identified as high risk in the SST Integrity Panel Study. He said he thinks the retrieval sequences should be based on risk, rather than convenience, since some tanks are now 40 years beyond their design life. Jeff said the sequencing document picks tanks that are high risk first, and then evaluates them

based on a set of criteria. Experts have given advice on sequencing, and suggested they close C farm. He said he thinks closing tanks farms makes sense as long as other factors are taken into account, which was the purpose of the HTWOS model. He said they spend \$200 million a year evaluating tanks by weighing seven or eight criteria, and looking at high-risk tanks is how they ended up with farms A and AX.

- Bob Suyama asked what factors limit tank retrieval, assuming extra funding is available. Steve said he has not been involved in discussions about where the stimulus money is going, so he cannot comment on that. Funding has been a limiting factor in the near term, but DST space would also become one, and treatment facilities to pull waste out of DSTs to create more space would be needed. Steve said building more tanks is a possibility, but that does not seem to be well supported. He said they will be receiving more money in fiscal year (FY) 2009 in addition to the stimulus money, and DOE will need to work on ensuring a consistent retrieval effort by preparing tanks for retrieval as soon as retrieval in the previous tank is finished.
- Maynard Plahuta asked how far along the blending facility is in the planning process, and how long it would take to begin operations if this option proceeds. Steve said it is too early to answer this. Planning for the facility will go through DOE's critical decision (CD) process, and he is not sure this is being drafted yet. Maynard said he thinks this alternative has great merit, but it needs to be looked at soon if it has the potential to speed up the recovery process.
- Ken Gasper asked if the waste retrieval facilities included in the DEIS and system plan are the same as the waste blending facilities. Steve said those are a different kind of facility. Ken said these two facilities are conceptually similar, and Steve agreed.
- Ken said when the plan was to do retrieval on S farm tanks, DOE set up an online chemical analysis along with fiscal property monitoring, which was to be a demonstration of that capability. He said dry runs had been completed in the 300 Area, and with the expectation that it was going to be demonstrated for S-109 retrieval to demonstrate a capability for online characterization.
- Dick asked whether all of the sand would be fed through the ultra filter, since a large fraction of the material fed to WTP will not go through this process. Rob said this depends on what the waste is mixed with, and materials such as silica would require an acid dissolution.
- Dick asked how the feed system would work. Mike said there are diminishing returns with washing, which is an indication it may be low-level class C waste. He said this process would save money if it is converted to a different waste form. Steve said his understanding is that all of the waste coming out of the tanks, with the exception of TRU, would go into glass logs. He said this is a good point and needs to be discussed.



- Susan suggested that the elements of this plan that are at a policy level, such as the blending tanks, should be considered when TWC reviews the TC&WM EIS. She thinks the committee can contribute advice on these issues at the policy level.
- Larry asked about the path forward on this issue, and whether the TWC would like another presentation this fall. Rob said a presentation that gave the committee a better understanding of issues surrounding feeding non-prototypical waste to WTP would be helpful.

### **Single Shell Tank (SST) Integrity Expert Panel Study**

Herb debriefed the committee on the SST Integrity Panel (SSTIP) workshop. The variety of SSTs, creates complexity due to seismic and structural differences.

Herb reviewed current SST integrity studies. One study consists of dome-deflection surveys, which determine whether domes are flattening or moving. Herb said the SST Structural Analysis of Record from 2002 does not meet modern finite analysis standards, and was mostly done using old analyses. Photo and video archives, as well as leak archives, are being reviewed. Herb said surveillances are being conducted, including liquid observation wells (LOWs); drywell monitoring; ENRAFs, which are level measuring devices; material balances to make sure waste is going where it is expected to; transfer-route monitoring during retrieval; and leakage-minimization activities to make sure the level of waste being treated does not go higher than known leak sites and sluicing stays in sound parts of tanks.

Herb said DOE is using High Resolution Resistivity (HRR) Measurement System to detect leaks. The system consists of a grid of surface geophysical electrodes (SGEs) installed around the tank, which are used to track plume movements and run full time to detect changes during retrieval. The SGEs are located two feet deep, unlike the HRR system, which goes below the tanks. Herb said transfer-route monitoring is a formal assessment process that includes radiological, toxological and visual indications of potential leaks. Monitoring capabilities for SSTs include remote cameras, video and high resolution stills, and remote radiation monitors. Herb said remote radiation monitors identify what waste goes through the system, and there are ten of these deployed for C-110 retrieval. Continuous air samples at seven locations for C-110 are another aspect of the monitoring process. Herb said if there is a spill these air samples allow for a dose reconstruction to see what kind of exposure has taken place.

The first SSTIP workshop took place at the end of January, and Herb said the panel held productive, open discussions focused on structural integrity and leak integrity. Herb said the workshop was attended by representatives from HAB, Ecology, the Defense Board,

Department of Energy Headquarters (DOE-HQ) and WRPS, a closed panel session, and a management outbrief on preliminary areas that would be investigated.

Herb reviewed preliminary findings from the initial SSTIP on structural integrity. He said based on photos from the undersides of zones and core samples that have been taken, the panel concluded that catastrophic failure is not likely under normal conditions. This is not necessarily true for a major seismic event as the condition of the re-bar in the sidewalls and base mat is uncertain. Herb said modern finite element stress analysis using soil structure interactions is needed, as well as seismic analysis similar to DSTs. Herb said some panel members suggested performing routine assessments of rebar and concrete conditions to see whether any sections have been degraded. Another option is conducting opportunistic analyses of the re-bar and concrete removed during the installation of new risers. Herb said there are some existing studies on the effect of waste leaks on concrete and rebar, but more simulations may be required to see the long-term effects of this. Drywell casings that were installed during the same time as the tanks with the same steel may also serve as a corrosion analogy for the tanks. Herb said these would be surveyed with a non-destructive examination (NDE) first and destructive testing would be conducted if necessary. A previous vertical core analysis of 241-SX-115 may be revisited as a structural integrity test by performing additional vertical core tests with a priority on high-temperature tanks. Herb said early photos of SST domes were not adequate to see cracks, but technology has improved and it would be helpful to obtain higher-quality images to systematically examine the tank dome's inner surface.

Herb then reviewed the panel's preliminary findings on leak integrity. He said future efforts should focus on matching programmatic needs and demonstrating the leak integrity of sound tanks. He said there is a need to demonstrate the failure mechanism, or the timing and location of leaks, for tanks assumed to be leakers. He said one panel discussion centered on the possibility that retrieval could be accelerated if it can be proven that tank liners and structures are sound, as that could allow them to transfer materials from known leakers into sound tanks. He said the panel agreed to maintain the current routine leak integrity activities while assessing the propensity for new leaks on whether liners are in danger of cracking or if they are in a favorable environment. Herb said another possibility is examining liners in tanks that have been retrieved to evaluate leak potential and identify failure mechanisms. This can be tested using an electromagnetic acoustic transducer (EMAT), which can scan the steel liner for cracking, thinning and pitting; ultrasonic testing; or vibro-thermography. Additional leak integrity opportunities include assessing leak rates through sludge and salt cake with simulated waste, assessing the effects of wall thinning and temperature on residual stress at welds, and testing for ionic conductivity between the inside and outside of the tanks.

The SSTIP also discussed leak mitigation opportunities. Herb said for known leakers, cooling may gel the waste and slow leakage, although this process needs to be evaluated to ensure it is reversible. External mechanisms, such as injecting apatite minerals or wax into the ground, can be used to create an external barrier around some tanks. Coating the inner liner of tanks with a barrier like thermal spray is another option that could potentially be used for waste mixing and storage.

Herb said the SSTIP preliminary findings have been agreed to by panel members, and they plan to document these findings and explore opportunities to be identified before the second expert panel workshop, which will be held the last week of April. Herb said this will also be a three-day workshop that will look at the results of literature reviews, review new information requested at the first workshop, and finalize the panel's recommendations.

### **Regulator Perspectives**

- Jeff said he is glad the SSTIPs are being conducted, and he is anxious for their results. He expressed concern about the issue of supporting an extension of the tanks' operational life, and asked how stable the tanks are, and when they may leak. He said DOE's scope differs from Ecology's concerns. Herb said the seismic assessments showed that some tanks may not survive an earthquake and may need to move up in priority.
- Jeff asked whether evaluations showed that the re-bar in the SSTs had corroded. Herb said based on a visual evaluation the re-bar is not showing cracks or squalling, and the dome and core samples showed a lack of any movement.
- Regarding transferring waste from leak-prone SSTs to more stable SSTs, Jeff said these tanks are not compliant and storage in them would be a legal problem. Herb said they would have to demonstrate that these tanks have integrity and using them for storage would accelerate retrieval process. Jeff said this would be a difficult process. Herb said they recognize the tanks are not RCRA compliant.

### **Committee Discussion**

- Ken suggested that DOE may be able to go back to installing LOWs by washing them into place. Herb said this is a good thought, and previously the time constant for water to move out of the tanks has been a year. If waste is leaking out of a tank, the ionic conductivity between the waste and soil can be distinguished through regular pathways. He said this may be an extremely sensitive way to show leaks.
- Larry said workshops like the SSTIP are beneficial in determining a path forward. He expressed concern about the path forward after workshops, specifically how

enhancements will be prioritized and where the funding to support these will come from. Herb said with DST panels, two things were important: keeping a subset of the expert panel as a steering committee to oversee the DST integrity program, and having support from DOE-ORP. He said they intend to keep a subset of the SST panel as a steering committee, and the difficult part will be evaluating and prioritizing recommendations. Some recommendations are short term, such as finite element and seismic analyses, and Herb said they hope to get funding for an additional corrosion testing program. Larry asked if funding could come from the stimulus package. Herb said that is the hope, as it will accelerate future work and help with the aging infrastructure.

- Al asked if there has been an assessment of how much retrieval could be accelerated if SSTs are re-deployed for retrieval. Herb said he knows scenarios have been run to determine this. Al asked what the incentive is to support this method of accelerating retrieval. Herb said re-deploying SSTs is just one aspect of accelerating retrievals, and it also depends on funding and the number of workers available. Al said building DSTs to accelerate retrieval has been recommended, and this would be an alternative. Herb said his understanding is that, DST capacity does not become an issue until 2018, based on the current retrieval rate . Al expressed concern that if DST space affects retrieval the WTP will be delayed beyond 2019. Al asked how many potential SSTs could be re-deployed. Herb said tentatively it is anticipated that contents of leaking tanks could be transferred to 50 sound tanks. He suggested a future presentation on the modeling for this and how many different variables go into the model.
- Ken suggested the panel quantify the amount retrieval can be accelerated versus how much funding would be needed when it finalizes its recommendations during the second workshop. Herb said they will try to give an estimate of priorities and the amount of funding necessary.
- Rob suggested an opportunity may be to combine the implementation process of the MARS system for tank cleanup with the evaluation of tank structural integrity He said the plugs that will be pulled out of the tops of the tank domes could provide excellent samples for corrosion studies. Additionally, if corrosion work is done, he said he would prefer Hanford waste evaluated at Hanford labs, rather than shipping the samples to SRNL. Herb said this process would be similar to the DST process, during which they evaluated simulants as well as real waste at Hanford laboratories.
- Dick asked what the overall schedule for accomplishing this program would be. Herb said they hope the panel's recommendations can be accomplished within five years.
- Regarding a path forward for the committee, the committee determined that they would wait until after the SSTIP final report is released this fall to discuss the panel's conclusions.

## **242-A Evaporator**

Vince Panesko introduced the 242-A evaporator discussion, which focused on facilities that are subject to single-point failure, the risks when failure occurs, and DOE-ORP's tank-space-management strategy. Vince said there is a feed transport system that is 50 to 60 years old between the WTP start-up in 2019 and the tank farm farms. He said the question for the TWC is the process or vision for this issue, determined by looking at certain aspects of the system rather than the whole feed-management system. In late 2009, a document will be produced on the evaporator's components, which will provide the committee with more detail on the issue.

Glyn Trenchard, DOE-ORP, gave a presentation on the evaporator. The evaporator is getting ready to start its 2009 campaign, during which it will process more than 2 million gallons for a resulting 43-percent waste reduction. He said the campaign is the only one that will take place and is expected to last 40 days. Last year the evaporator did not run any campaigns but did a cold run, and Glyn said one constraint on the facility is keeping qualified operators assigned to the evaporator.

This year DOE will perform a life-extension assessment, which is an engineering evaluation used to update and prioritize future upgrades. Glyn said this will be based on evolving mission priorities, including retrieval schedules, space-management requirements and strategies, and WTP feed requirements, as well as operability parameters such as the consequences of equipment in the aging facility nearing its design life, maximizing waste reduction, and conducting multi-pass runs to increase volume reductions. The results of this assessment will determine what components to evaluate and address funding considerations. He said there is a potential for stimulus funding because the evaporator impacts waste-feed delivery.

In FY 2008, the evaporator was upgraded through 242-A Evaporator System and PC-5000 Transfer Pipeline Integrity Assessments, including repair of the Evaporator Room secondary containment protective coatings (SPC), a heating, ventilation, and air conditioning (HVAC) supply-side upgrade, and a monitoring and control system (MCS) upgrade. Glyn said integrity assessments validated the ongoing preventive and corrective maintenance program and reinforced the continued need for life-extension projects. Glyn said cost estimating is currently underway for upgrades in FY 2009 and later that include replacing the raw-water service system and the diesel generator in the underground storage tanks.

The 242-A evaporator is a single-point failure facility and a key part of keeping up with SST retrievals and maintaining DST space. Glyn said a mitigating strategy for potential failure is to keep facility-upgrade work on the evaporator as a high priority, and it is important to balance evaporating with completing the facility upgrades. He said the replacement capacity is an important consideration, and cold campaigns and retaining staff for the facility are important aspects of the risk-mitigation strategy. Glyn reviewed elements of the risk management plan, which identifies risks from many different sources, including the DOE contractor, regulators, the Nuclear Defense Board and individuals employed by the contractor. Once risks have been evaluated, mitigating for these issues is considered. Glyn used the example of DST space management mitigation strategies, which include continuing upgrades and considering ways to generate less liquid during retrieval so there is less to evaporate later.

Glyn then provided an overview of the wiped film evaporator (WFE), which evaporates moisture by using a combination of creating a vacuum system and heat. The pressure is low enough in the WFE that water will boil at approximately 120 to 140 degrees Fahrenheit, which increases the effective evaporation rate. Glyn said the waste does not spend a lot of time in the unit, and it reduces the need for shielding. He said there is currently a pilot plant that runs at one gallon per minute, and the next full-scale model would run at 10 gallons per minute.

Results of the most recent report on DST space management determined that there are approximately 3.4 million gallons of space, which Glyn said would support retrievals through 2010. Five of the tanks currently staged will recover more than two million gallons of DST space, and over the next two years, approximately two million gallons of additional space will be recovered. Glyn reviewed ongoing tank-space-optimization activities, which include limiting emergency space, using restricted tank space, increasing DST fill height, which has been done on eight tanks in AP Farm, and concentrating supernatant waste to the maximum allowable specific gravity.

### **Regulator Perspectives**

- Jeff agreed that the evaporator is a critical path in principle. He asked whether the 3.4 million gallons of empty space in the DSTs is available to be filled, and Glyn confirmed yes.
- Glyn's presentation included a statement that the DSTs space available could support retrieval of C-110, C-104, C-112, as well as C-108 and C-109's heels. Jeff asked him if this referred to as-retrieved volumes. Glyn said as the DST system is filled, this would be an as-retrieved volume because the evaporator could not be used. He said even in planning toward 2019, waste could be transferred to DSTs knowing it will

later be evaporated, but the initial space still needs to be evaluated. He said the localized WFE would be helpful, as the operational space in DSTs would not be needed. Jeff asked if the WFE would make retrieval faster at the end of the process, and Glyn said this is true. Jeff asked if the WFE is expensive. Glyn said he has not seen a cost estimate for it, but Columbia Engineering is running the tests.

- Jeff said waste transfers are risky and moving small volumes creates the potential for failures. He said if at any point there is an accident during transfer, the evaporator fails, or the WTP does not start on time, there will be no way of retrieving tanks.

### *Committee Discussion*

- Mike asked if there are any innovative suggestions for soil washing the minerals and sand that could generate a stream to be concentrated through the evaporator. He said since the evaporator is not being used, it could be used for capital investments for other issues on the site.
- Mike asked why the evaporator stops at a 40-percent concentration of the solution. Glyn said this is constrained by specific gravity. The evaporator is run to the point where it gets precipitates.
- Vince said the 242-A evaporator's vulnerability and risk is linked with space management in DSTs. He suggested that DOE examine what could happen with the evaporator when the WTP starts up since eight million gallons have to be evaporated in 2020 or 2021. Glyn said the current campaign is essentially three campaigns being run at once, one startup, a long run, and then a shut down. Glyn said they are looking at running three to five campaigns a year. Vince asked what would happen if the evaporator has a failure and is not available when eight million gallons need to be evaporated in 2020. He said evaporator failure could affect retrieval, and asked whether a delay would occur once the WTP is started. The worst-case scenario in the risk management plan would be a five-year shut down with a \$1 billion per year cost, and Vince asked how they are planning to mitigate that kind of risk. Glyn said they will continue to do investigations and upgrade the plant to continue operations. He said if these upgrades are not in place it is still single-point failure. Vince asked if the facility upgrades will be reliable by the time the WTP starts. Glyn said because the plant is used once a year for a couple of weeks, minor problems are found each time, but the more it is used the better it functions, and the employees want to use it more as well. Vince said it is a huge challenge to keep unused facilities functioning.
- Maynard asked if the evaporator would be used for anything other than tanks, and Glyn said it would not.

- Maynard asked how many of the upgrades are shovel-ready, and if they are far enough along to use stimulus funding if available. Glyn said the next major upgrade is to the ventilation system, which is in the design phase.
- Dick asked if 242-A evaporator could be used to reduce the volume of the secondary-waste streams coming off the melter, since high chloride content is a concern. He asked if this would be a significant additional load on the facility. Glyn said this would depend on the timing. Dick said there would be a continuous stream if early low-activity waste (LAW) treatment begins before 2019. Glyn said he thinks the system plan looks at how this works together, but there is also a flow sheet that will examine how this ties into the WTP and its secondary-waste streams.
- Dirk expressed concern about issues with fixotropic or other fluids, as well as materials such as carbon-14, tritium or other organics that make operations volatile when coming off in streams. Glyn said at this point the WFE is only using a simulant that demonstrates its ability to separate materials.
- Al asked how much additional tank space would be obtained by using the WFE, and how many additional SSTs could be retrieved before 2019. Glyn said this depends partly on how long it would take to evaluate and implement a full-scale model. Al said support for using the WFE is needed.
- Dick inquired about the capital cost of a full-scale WFE unit, and Glyn said he had heard an estimate of approximately \$10 million.
- Mike said crystals form if the waste is concentrated too much. Mike asked if DOE has analyzed these forms to avoid sodium, and whether it is possible to apply the fractional crystallization concept to the 242-A evaporator.
- Dave Rowland, Yakama Nation, said when a new control room and operating system were implemented for the 242-A evaporator in 1990, operators caused deliberate equipment failures to test whether the building could handle them. He highly recommended this for when evaporator upgrades are installed.

### **Pretreatment Engineering Platform**

Rob Gilbert, DOE-ORP, provided an update on the status of the Pretreatment Engineering Platform (PEP), which is a test apparatus put together to address scale-up concerns focused on leaching and filtration processes. PEP is a quarter-scale system that was built in 16 modules and started up in late 2008. Rob said right now this is the largest and longest filtration test done by the Department of Energy Office of Environmental Management (DOE-EM).



Rob reviewed the layout of the system, which consists of two filter-feed-preparation vessels and an ultra-filter feed vessel, which can both do leaching. Waste is received and simulants are stored in three vessels. The ultra-filter feed vessel washes and concentrates the waste further and is then fed to a high-level vitrification process.

A functional test of the operations of PEP unit was conducted in fall 2008, followed by Integrated Test A, which included high-temperature leaching in the ultra-filter feed preparation vessels. Integrated Test D will complete phase one of PEP testing, and will be followed by a data analysis.

Preliminary PEP filtration results show that the bench-scale model and quarter-scale model appear to be equivalent, and the system has demonstrated the ability to concentrate solids. Rob said the control system has been effective, and periodic back-pulsing was successful in removing any solid cake and improving flux performance. The filter flux for the quarter-scale PEP was equivalent to the bench-scale flux filter, and Rob said if there are not issues with scaling, the radioactive test data could be applied directly to the full-scale plant in predicting system performance. All five of the filters had comparable performance.

Rob then reviewed preliminary PEP leaching results, which showed that steam from heating was able to maintain the target solution and aluminum leaching achieved targets and is able to be repeated. Results from five different leach tests in the ultra-filter feed preparation vessels demonstrated that this process appears to be repeatable and consistent.

Rob said when reviewing the mechanical objectives for PEP testing, the results show effective control of the dual series pumps and the spiral-plate heat exchanger. WTP engineers are currently reviewing the testing data and will make decisions in the upcoming months to finalize PEP design and procure equipment.

Issues with PEP have been with non-prototypic equipment, including the pressure-relief system, which was vented incorrectly and has been fixed with rupture disks; the PJM level probes, which had an unshielded upper portion; the laser level, which had issues with lens obstruction, moisture, misalignment and heat; the data acquisition system (DAS), which is an electronic system that experienced outages; the recirculation loop, which had to be realigned; and the recirculation pumps, which included carbon steel rather than the required stainless steel and had to be re-fabricated.

John Truax, WTP, said PEP testing has resulted in technical lessons learned, and as fluid properties change the pump-control system will need to be finalized. John said back-

pulsing effectively increases long-term permeate rates, and long-term filter fouling effects and back-pulsing frequency will need to be addressed. Bubbler level indication was affected by slurry flow, and the dip tubes caused sporadic level indications. John said late in the first test they learned the simulant was retaining gas, which ultimately led to some cavitation issues with the pump. He said DOE is analyzing ways to modify PEP operations to mitigate this issue. Simulant air entrainment is currently under investigation, and John said adding more air per unit in PEP increases the mixing rate by four to five times, and they will do further work to understand this. John said this is not a fatal issue for the plant's design, but they will need to adjust operations and how much air is being input.

Remaining PEP integrated tests will use different pump configurations and air streams to see what has the most impact on the system. John said Test B was begun recently and will take 10 to 14 days to complete. This will be followed by a short outage, and Test D will be completed in April. All initial analyses will be completed by June 30. John said the final verified reports will be issued by the end of 2009, and an evaluation of phase two recommendations is currently in progress.

John said overall the PEP data is meeting expectations and matching laboratory predictions. The testing has not raised concerns about the effectiveness of the leaching process, and John said DOE is gathering lessons learned from the testing. Future plans for PEP include potential future testing of the ultra-filtration system processes. John said three groups of testing were developed with input from WTP, the tank farm operating contractor, PNNL and DOE-ORP: Group 1, which will test ways to reduce risk in WTP, Group 2, which will test ways to support processing future WTP feeds, and Group 3, which will test to support process optimization. John said these tests can be cross-cut by incorporating PEP phase 1 data, laboratory waste characterization programs, and caustic reduction testing. DOE is currently looking at concepts for a ten-year testing plan, which would provide for improving knowledge and performance of the WTP on future feeds and continuing core competency of waste treatment technology.

### **Regulator Perspectives**

- Ed Fredenburg, Ecology, asked where the samples were taken to determine the amount of aluminum leached out of the simulant. John said these samples were taken from the vessel during the leach when they had isolated the recirculation loop from the vessel, added the caustic materials and increased the temperature. Ed asked if there is any evidence re-precipitation of aluminum is occurring. John said the testing flow sheet was designed so this would not occur, but they have seen some re-precipitation of sodium oxalates, which is a risk they are working through.

- Ed asked what the distinction between single-batch and multi-batch is in PEP testing. John said in multi-batch testing the batch accumulates in UFP 2, the ultra-filter feed vessel. This batch consists of five to eight percent solids, and is moved into the ultra-filter feed vessel to concentrate it to 17 percent, so six batches are combined to make one batch in the ultra-filter feed vessel.
- Ed asked DOE to discuss the pros and cons of leaching. John said leaching in UFP 1 was originally done to avoid bottlenecking. This leaching is a disadvantage for a tank with a great deal of bromide, which requires adding more sodium hydroxide to reach the desired end point. John said UFP 2 is more sodium-hydroxide efficient, and UFP 1 provides more effective throughput.
- Ed asked if in-line heat exchangers are included to avoid reliance on cooling jackets and decrease the time needed for cooling. John said these allow the waste to move forward sooner by avoiding the time it takes for the jacket to cool. Ed asked if waste would cool more rapidly if leaching took place in UFP 2 and heat exchangers were added. John said UFP 2 already has a heating jacket.
- Ed said he applauds DOE for conducting PEP tests, and said the cost of this has been approximately 1 percent of the cost of the WTP, and the lessons learned so far are valuable. He said Ecology strongly encourages phase two testing because they think there is more to learn, and since funding has already been invested in the equipment the follow-up activities will cost less. He said these tests will also have an affect on sizing the supplemental treatment capacity, along with testing to improve waste loading. Ed said this could help make a decision earlier on building supplemental treatment capacity.

### *Committee Discussion*

- Keith asked if the PEP has a way of filtering in off-gas. Rob said radionuclides are not involved, and all of the testing is done using a simulant. Each vessel has a knock-out pot for sampling, and there will be an extensive off-gas system in the pretreatment process.
- Keith asked if DOE would use a more stable operating system for the DAS than what it used for non-prototypical equipment. John said the plant uses a sophisticated state-acquisition system in which the software is verified and validated (V&V) in order to track the data.
- Larry asked the total cost for the PEP project. John said the total cost for the program, including equipment, testing, design, and startup is approximately \$90 million.
- Larry asked if PNNL did the hot testing. He said with the lessons learned on pump failures with nitric acid, he thought the WTP follows NP21 procurement processes.

John said PEP is procured to commercial standards, or nuclear quality assurance (NQA) Level 1. He said PNNL did the radioactive waste testing in the 325 radio processing laboratory.

- Dirk asked if pressure failures have resulted in equipment failures. John said when DOE was testing slurry the first time they had pump excursion and exceeded the pressure-relief unit, so they replaced it and started evaluating and modifying the pressure-protection program. He said they have not had problems with this issue since. Dirk said issues like that are major once the system is operational, so lessons learned are very important. John said they have been keeping an extensive list of lessons learned.
- Dirk asked how similar or dissimilar operation of the PEP prototype is to operation of the full-scale plant. John said they have prototypical equipment, including vessels that are almost exact duplicates and full-length filters. He said the control systems and operator interfaces are very different from the WTP, so PEP would not be an appropriate platform to run the system. Dirk asked if the equipment is similar in terms of design, and John said the prototypic equipment is, but how the slurry is transferred from the prototypic vessel is different. Dirk expressed concern about this difference.
- Keith asked if the feed material is the same or similar to what will be used at the pretreatment plant. John said the simulant being used looks almost exactly like tank waste, and they did testing with real waste and a simulant to check kinetics and solubility.
- Keith asked if, since the operation interface is not prototypical, training would take place at the Hazardous Materials Management and Emergency Response Training Center (HAMMER). John said training for operators will take place at the simulator next to HAMMER.
- Pam asked if the part made of carbon steel, rather than stainless steel, was identified before that part was put into the WTP. John said they know the WTP should not have carbon steel, and after that incident Bechtel said they would improve their speculations so all surfaces are made appropriately for chemistry.
- Pam said she had heard concern that there would not be funding for phase two of PEP testing. John said DOE is working to define the scope and identify funding. He said one option is utilizing some of the DOE-EM technology funding. Pam said the lack of funding is an issue, as phase two of the testing seems extremely worthwhile. She asked if there is a possibility that testing will be done through commissioning. John said there is not a final decision, and part of what feeds that is the lessons learned in phase one, how the bench-scale work relates to quarter-scale work, and the objectives that would be gained from doing larger-scale testing. John said they need to preserve this capability while analyzing the results of phase one to make a strategic decision.

- Pam asked whether PEP addresses the issue of blending challenges. John said he is not sure how the PEP would look at blending, except for possibly looking at heel compositions as waste is transferred from one type to another. He said it is not clear whether this is needed at the quarter scale.
- Ken said the Board recommended that some additional funding be used to support phase two testing, particularly as it relates to the sodium-management issue. He asked what kinds of tests during phase two would be particularly relevant for this issue if funding is made available. John said much of the testing needed for sodium management needs to be tested at the bench-scale level first. There have been discussions about looking at permeates before waste is fed, and what precipitates during processing.
- Ken asked when it would be appropriate for the committee to look for a follow-up report. John said this should be available at the end of June, after the M-12 issue is closed.
- Rob asked what the cost per month is to operate PEP. John said it costs approximately \$1.7 million per month. This figure includes the cost of sampling 15 locations every 30 minutes, and he said the analytical cost for these samples is roughly \$3 million.
- Rob said supporting phase two is important, and he suggested including corrosion studies in phase two tests, as this will be an issue when the full-scale plant begins operations. He also expressed concern that the downtime between phase one and phase two could create problems, unless there is a continued financial commitment for resources and the PEP is preserved with the intention of restarting operations. He said the pilot plant is crucial to final operation, and the TWC should continue to offer advice on PEP.
- Larry suggested examining major areas within the system for corrosion once the project is completed. Committee Business

Future meeting requests and topics include:

- ORP presentation on the sodium-management plan,
- ORP presentation on the conceptual design of MARS,
- Update on the NRC application process for Yucca Mountain,
- Update on WTP and the WTP permitting process,
- Review of the TC&WM EIS,
- Update on revision 4 of the System Plan, and
- Continue discussions on secondary waste mass balance.

## Handouts

*NOTE: Copies of meeting handouts can be obtained through the Hanford Advisory Board Administrator at (509) 942-1906, or [tgilley@enviroissues.com](mailto:tgilley@enviroissues.com)*

- Hanford Single-Shell Tank Retrieval Schedule and Technologies, Steve Pfaff, March 12, 2009.
- Hanford Tank Cleanup Status, Steve Pfaff, March 12, 2009.
- Single-Shell Tank Integrity Status, Herbert S. Berman, March 12, 2009.
- Tank Waste Space Management, G.D. Trenchard, March 12, 2009.
- Pretreatment Engineering Platform (PEP) status, Robert Gilbert, March 12, 2009.

**Attendees**

**HAB Members and Alternates**

Al Boldt	Mike Korenko	Maynard Plahuta
Shelley Cimon	Pam Larsen (On phone)	Wade Riggsbee
Robert Davis	Susan Leckband	Dick Smith
Dirk Dunning	Larry Lockrem	Keith Smith
Ken Gasper	Vince Panesko	Bob Suyama
Harold Heacock		

**Others**

Lori Gamache, DOE-ORP	Madeleine Brown, Ecology	Rico Cruz, CTUIR-DOSE
Rob Gilbert, DOE-ORP	Annette Carlson, Ecology	Molly Jensen, EnviroIssues
Brian Stickney, DOE-ORP	Ed Fredenburg, Ecology	Cathy McCague, EnviroIssues
Steve Pfaff, DOE-ORP	Jeff Lyon, Ecology	Stan Sobezyk, Nez Perce Tribe ERWM
		Michael Terry, PSGS/WRPS
		John Martell, WDOH
		Herb Berman, WRPS
		Kayle Boomer, WRPS
		John Truax, WTP
		Dave Rowland, YN ERWM