This Settlement Agreement is like past Settlement Agreements because it is mostly slipping Consent Decree and Tri-Party Agreement Milestones. The Holistic Negotiations should have an all-inclusive look at options to do tank waste retrievals and waste processing better than we have been so far. A part of this should have been evaluating if the decisions made in the past were the right ones based on new information. I think there can be improvements in waste retrieval and waste processing if we continually keep trying to do better with the available resources to cleanup Hanford while focusing on the most important near-term risks.

Tank Retrievals

The revisions to the Single-Shell Tank retrieval Milestones are just an ongoing slippage of the existing Milestones. The original Tri-Party Agreement Milestones for finishing all Single-Shell Tank retrievals was by the end of 2019. Only 21 of the 149 Single-Shell Tanks have been retrieved to date. Part of this delay is probably due to the retrievals being much more difficult to do than was originally thought. However, there are two other factors that must also be considered. One is the original end-of-retrieval criterion of 360 cubic feet or less in Tri-Party Agreement Appendix H was supposed to be evaluated based on the results of the first few Single-Shell Tank retrievals. This has not happened. Tri-Party Agreement Appendix I also requires a Performance Assessment to be done for both the tank residuals and past leaks in each tank farm. The initial Performance Assessments for C-farm, A-farm, and AX-farm all indicate that more waste residuals could remain at Closure and the Closure Performance Standards would still be met with significant factors of safety. The end-of-retrieval criteria needs to be revised to be risk informed instead of just a volume value. By doing several fresh water rinses at the end-of-retrieval, most of the highly mobile contaminates are being removed. Also, the degradation of the concrete structure of the tanks and the grout filling is predicted to be a very slow process. Revising the end-of-retrieval criteria should be given a priority. A very large fraction of the retrieval time and resources is used to reach the existing end-of-retrieval criteria and this is probably not needed. Another reason Single-Shell Tank retrievals have slowed recently is there is almost no remaining storage capacity in the Double-Shell Tanks to support Single-Shell Tank retrievals. Once Low-Activity Waste processing begins, some Double-Shell Tank space will be freed up to support future Single-Shell Tank retrievals. However, Low-Activity Waste processing will only be removing liquids from the tanks. Sludge waste processing cannot start until the High-Level Waste processing begins and this is not scheduled for a long time and there are concerns this could be even further delayed. We should not be putting very much more sludge into the Double-Shell Tanks until there is active processing of the sludge waste. We should be delaying retrieval of A-104, A-105, and A-106 until sludge waste can be processed. These three tanks are all dry tank with no drainable liquids. A-104 and A-105 are known leakers. However, they present no near-term increased risk of further leaks. As we move to S-farm, SX-farm, and U-farm, we should be selecting near-term retrievals to be those with larger amounts of liquids and saltcake and minimal amounts of sludges. We should also consider possibly only retrieving the liquids and saltcake for now and retrieving the sludges at a future date. The retrieval of the liquids and saltcake will require much less complicated retrieval equipment that might be repurposed from tank to tank. Another reason to not put sludge into the Double-Shell Tanks in the near-term is this will require another difficult retrieval activity. The last three System Plans have modeled the sludge wastes being transferred to the Tank Waste Characterization and Staging Facility where the physical properties of the waste will be modified to meet the Waste Treatment Plant tank waste feed criteria. That includes reducing the median particle size and hardness of the waste. The Tank Waste Characterization and Staging Facility will need to have new tank designs that will allow the waste to be

remove much easier than from the flat bottomed Single-Shell and Double-Shell Tanks. Another concept to consider regarding Single-Shell Tank Retrievals is to remove more drainable liquids from them similar to what was done in the Interim Stabilization Program. Waste is going to remain in these tanks much longer than originally planned. We have also two actively leaking Single-Shell Tanks and more leaks are possible. The response to future tank leaks could be make better if we had equipment in place to remove the liquids, procedures in place, and staff trained to use the equipment used to remove liquids from any tank. Pumping of tank liquids was used in the Interim Stabilization Program and as the response to leaking Single-Shell Tanks before T-111 and B-109. Not being able to respond to the known leaking tanks in a timely manner is a clear indication that not all scenarios have been adequately considered in planning.

Tank Farms to Waste Treatment Plant Interface

The interface between tank farms and the Waste Treatment Plant is not being adequately addressed in this Settlement Agreement or other activities. The current plan is to send sludge waste from the tank farms to the Tank Waste Characterization and Staging Facility. Even though the name of this facility implies it will be characterizing the waste and then staging it to be sent to the Waste Treatment Plant, this facility is where it is currently planned to modify the physical properties of the waste to meet the waste feed criteria for the Waste Treatment Plant. 24950-WTP-ICD-MG-019, ICD 19 – Interface Control Document for Waste Feed lists multiple properties of the waste feed sent to the Waste Treatment Plant. Two examples are the median particle size and the median particle hardness of the waste. The median particle size requirement is like the size of talcum powder, which is very small. The size and hardness of the particles in the waste are part of the erosion process for moving the waste through pipelines and other components. However, these requirements were added to ICD-19 much later than most of the pipe lines and mixing vessels were designed. There is limited data on the actual distribution of particle sizes available. There is some data from 10 different tanks in the TWINS Database. Over 80 percent of the volume of particles in this data has sizes greater than the median size limit. This mean essentially all the sludge will need to be sent though a process to reduce it size. The description of the Tank Waste Characterization and Staging Facility in the last three System Plans did not describe what processes would be used. The description of this facility only described the number and size of storage tank and no other useful information. This is on example of why the System Plan as being implemented is more of a modeling activity with many unsupported assumptions rather than an actual planning document. I also have a concern with the limit on median particle hardness. Simply making the particles smaller by grinding it will not change the particles hardness. Smaller particles will present less erosion concerns. However, adding these limits along with other physical properties long after most of the Waste Treatment Plant was designed implies they were added to protect those building the plant if the plant is not able to operate as envisioned. An additional concern is the requirement that the waste feed be sampled and then stored for at least 140 days before being sent to the Waste Treatment Plant. Particles that small sitting in a liquid environment for that long may agglomerate and result in median particles sizes larger than the criteria. The interface between tank farm waste and the Waste Treatment Plant does not appear to be given enough attention.

Waste Treatment Plant

While Single-Shell Tank Retrievals have been occurring at a much slower rate than originally anticipated, the Waste Treatment Plant is much farther behind schedule and still has several unresolved technical

issues. Instead of starting with a small-scale prototype to evaluate the basic concept, the Waste Treatment Plant design started with a full-scale facility. When the original contractor determined the plant was going to cost much more to build and operate, a different contractor was picked. However, instead of considering a different overall approach, the original design was retained and many of the associated technical challenges remain. I have serious concerns that the technical issues cannot be easily resolved. It is time to seriously consider if a different approach to processing of the tank waste would be better. I am mostly concerned about the vitrification process. While this has been done successfully at small scale, I am not sure is the best option especially for the waste with solids. I have heard that any alternative to vitrification must be "as good as glass." If we consider both the stability of the final waste form and the cost of the overall process, other options may not be as good as glass. They may be <u>better</u> than glass. We also need to look at the actual composition of the tank waste. DOE is storing all the tank waste as if it is High-Level Waste. High-Level Waste is the highly radioactive materials produced as a byproduct of the reactions that occur inside nuclear reactors. High-level wastes take one of two forms: Spent (used) reactor fuel when it is accepted for disposal and waste materials remaining after spent fuel is reprocessed. However, what is highly radioactive is not defined. I downloaded the radionuclide inventory for the Single-Shell and Double-Shell Tanks from the PNNL PHOENIX website. When compared to the Classification of Low-Activity Waste, less than 0.3% of the waste phase volumes in the Single-Shell and Double-Shell Tank are currently greater than Class C Waste. In about 70 years, all the tank waste will decay to levels less than the upper Class C limit if it were to remain in the tanks. In 100 years, less than 4% would be greater than Class B Waste. When tank waste is put into a stable waste form such as glass or grout, the concentrations is also significantly reduced. If the tank waste had not been from the processing of spent fuel, it could be disposed of using the Low-Activity Waste requirements. From a common-sense perspective, it does not make sense to consider most of the tank waste as High-Level Waste and require it to be vitrified and stored in a deep geological repository just because of its source. Even if we were to vitrify most of the tank waste, it is not likely to go to a deep geological repository for a long time, if ever, given Congress's unwillingness to fund such a repository. We should be taking a risk informed approach to determining what is the best disposal pathway. The recent concept of doing some small-scale grouting of waste with the intent of having this processing potentially done far from Hanford does not make common-sense. We are already disposing of significant amounts of Low-Activity Waste on the Hanford Site. The most significant contamination issue on the Central Plateau is the groundwater contaminated by past planned and unplanned releases. Much of this was to the cribs and trenches. While progress is being made with groundwater cleanup, much remains to be done and we should be spending adequate funding on that part of cleanup. It is time to use a risk informed approach to determining how to dispose of the Hanford tank waste. While finishing the Waste Treatment Plant and using it as currently planned may be the best option, we do need to consider other alternatives that could be just as protective of human health and the environment but cost less and could be implemented sooner. Since we are already planning to grout fill the Single-Shell and Double-Shell Tanks as part of the Closure process to provide long-term structural integrity, it might even be practical to mix some of the tank waste with that grout. To provide the public with some sense of how radioactive the vitrified waste would be, it would be good for DOE to provide the information probably available on the concentrations of radionuclides in the Low-Activity and High-Level canisters as predicted by the System Plan. We also need to make sure that the non-radioactive contaminates are properly disposed.

It should be noted that to the best of my knowledge, since there are not yet any approved Closure Plans for the Single-Shell Tanks, we do not have a formal agreement of the grouting requirements. In addition,

the Tri-Party Agreement Appendix I defines the groundwater contaminated from the Single-Shell Tanks as part of the Single-Shell Tank System. However, the draft Closure Plans do not specify what the groundwater contamination levels will need to be to formally Close a tank farm.

Central Plateau Infrastructure

One of the problems that needs to be addressed is there is no way to adequately transfer waste from the remote Single-Shell Tanks to Double-Shell Tanks. None of the transfer lines that were used for transfers in the past are now fit for service. There are two existing cross-site transfer lines between the 200 West SY Double-Shell Tanks and the 200 East Double-Shell Tanks but neither is currently approved for use. It is possible the cross-site supernatant only line may be modified to make it useable. There are more significant issues with the cross-site slurry line that need to be resolve. There should be a program to determine the status of these two lines, determine what needs to be done to make them useable, and get a good cost estimate for these improvements. This should happen soon. Right now, if there were to be a tank leak in one of the SY Double-Shell Tanks, there may not be enough storage capacity in the other two nearby tanks. A lack of no useable transfer line to T-farm and B-farm has caused there to be no timely response to two tanks declared to be actively leaking. There should be a plan in place for installing new transfer capabilities between the remote tank farms and the Double-Shell Tank System as well as between the SY tank and 200 East. In addition to new waste transfer pipe lines, the use of tanker trucks and railroad cars should also be evaluated.

Conclusions

This current Settlement Agreement is like the past ones in that it is mostly about slipping Consent Decree and Tri-Party Agreement Milestones. Based on the better information we have now, we can make better informed decisions. It appears we are currently reluctant to revise the end-of-retrieval criteria in the Tri-Party Agreement because it might appear we are not being as “conservative” if we leave more waste in the tanks. We also need to revaluate the definition of High-Level Waste and develop risk informed disposal approaches that are adequately protective of human health and the environment while using our resources more effectively.

I would like us to be able to completely cleanup the whole Hanford site. However, given the past releases to the vadose zone, it is not practicable to clean up it up to the point that we will no longer need to keep monitoring to assure we have not missed some contamination sources. Some contamination will remain but we need to be sure that the regulatory requirements for closure are met. We also need to remind ourselves that at some point, Congress could decide to stop funding Hanford cleanup. We need to do the best job we can with the funding we have as soon as we can. We need to be continually rethinking the best ways to make progress. We need to start using the best science we can and stop using too much political science.