

**F-Tank Farm Performance Assessment Updates through the Special Analysis Process  
at Savannah River Site - 12169**

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**ABSTRACT**

The F-Area Tank Farm (FTF) is owned by the U.S. Department of Energy and operated by Savannah River Remediation, LLC (SRR), Liquid Waste Operations contractor at DOE's Savannah River Site (SRS). The FTF is in the north-central portion of the SRS and occupies approximately 22 acres within F-Area. The FTF is an active radioactive waste storage facility consisting of 22 carbon steel waste tanks and ancillary equipment such as transfer lines, evaporators and pump tanks. An FTF Performance Assessment (PA) was prepared to support the eventual closure of the FTF underground radioactive waste tanks and ancillary equipment. The PA provides the technical basis and results to be used in subsequent documents to demonstrate compliance with the pertinent requirements identified below for final closure of FTF. The F-Tank Farm is subject to a state industrial waste water permit and Federal Facility Agreement. Closure documentation will include an F-Tank Farm Closure Plan and tank-specific closure modules utilizing information from the performance assessment. For this reason, the State of South Carolina and the Environmental Protection Agency must be involved in the performance assessment review process. The residual material remaining after tank cleaning is also subject to reclassification prior to closure via a waste determination pursuant to Section 3116 of the Ronald W. Reagan National Defense Authorization Act of Fiscal Year 2005.

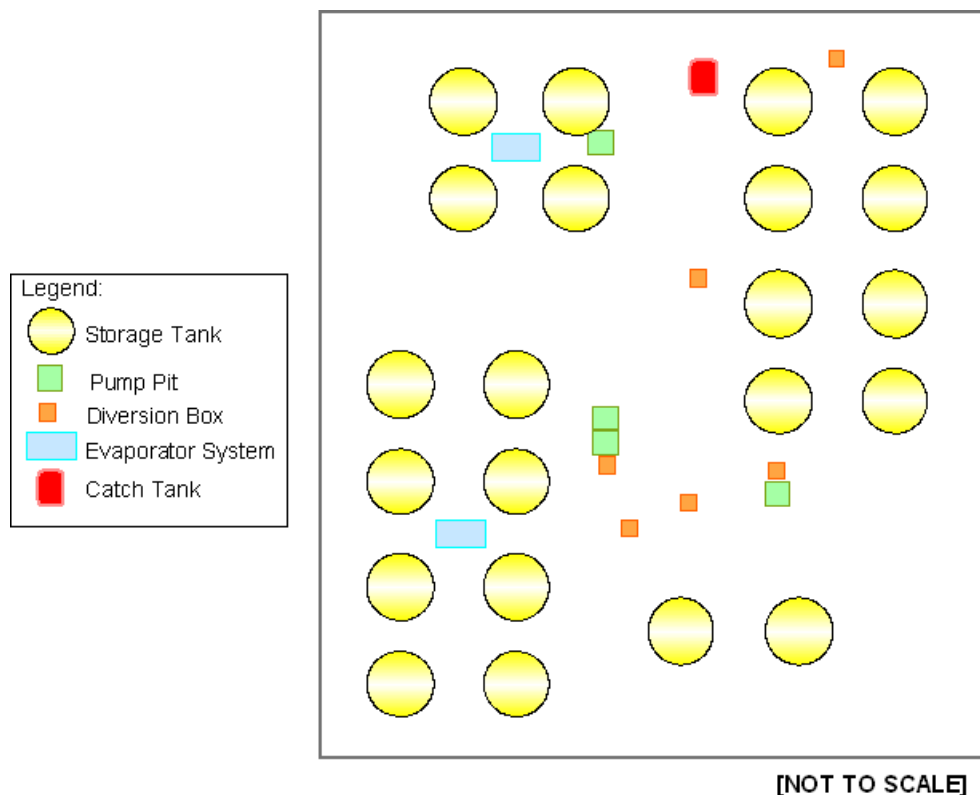
The projected waste tank inventories in the FTF PA provide reasonably bounding FTF inventory projections while taking into account uncertainties in the effectiveness of future tank cleaning technologies. As waste is removed from the FTF waste tanks, the residual contaminants will be sampled and the remaining residual inventory is characterized. In this manner, tank specific data for the tank inventories at closure will be available to supplement the waste tank inventory projections currently used in the FTF PA. For FTF, the new tank specific data will be evaluated through the Special Analysis process. The FTF Special Analyses process will be utilized to evaluate information regarding the final residual waste that will be grouted in place in the FTF Tanks and assess the potential impact the new inventory information has on the FTF PA assumptions and results. The Special Analysis can then be used to inform decisions regarding FTF tank closure documents. The purpose of this paper is to discuss the Special Analysis process and share insights gained while implementing this process. An example of an area of interest in the revision process is balancing continuous improvement versus configuration control of agreed upon methodologies. Other subjects to be covered include: 1) defining the scope of the revisions included in the Special Analysis, 2) determining which PA results should be addressed in the Special Analysis, and 3) deciding whether the Special Analysis should utilize more qualitative or quantitative assessments.

## INTRODUCTION

The Savannah River Site (SRS) is a U.S. Department of Energy (DOE) facility located in south-central South Carolina, approximately 161 kilometers (100 miles) from the Atlantic Coast. The major physical feature at SRS is the Savannah River, approximately 32 kilometers (20 miles) of which serves as the southwestern boundary of the site and the South Carolina-Georgia border. The SRS includes portions of Aiken, Barnwell, and Allendale Counties in South Carolina. The SRS occupies an almost circular area of approximately 803 square kilometers (310 square miles) and contains production, service, and research and development areas.

The F-Area is in the north-central portion of the SRS and occupies approximately 1.5 square kilometers (364 acres). The F-Area Tank Farm (FTF) is an active liquid waste storage facility operated by Savannah River Remediation, LLC (SRR), the Liquid Waste Operations contractor. The FTF is in the north-central portion of the SRS and occupies approximately 22 acres within F-Area. The FTF consists of 22 carbon steel waste tanks and ancillary equipment such as transfer lines, evaporators and pump tanks. The FTF carbon steel waste tanks store (or once stored) liquid radioactive waste generated primarily from chemical separations processes. There are four tank designs in FTF (Types I, III, IIIA and IV) which have unique design features that impact the Performance Assessment (PA) results. Tank 17 and Tank 20 have already been filled with grout and closed via a South Carolina and Environmental Protection Agency (EPA) reviewed and approved Closure Plan and Closure Modules. Figure 1 presents the general layout of FTF including the storage tanks and principal ancillary equipment.

The FTF PA was prepared to support the eventual closure of the FTF underground radioactive waste tanks and ancillary equipment. The PA provides the technical basis and results to be used in subsequent documents to demonstrate compliance with the pertinent requirements identified for final closure of FTF including those in DOE Order 435.1 [2], the *Ronald W. Reagan National Defense Authorization Act (NDAA) for Fiscal Year 2005* Section 3116 [3], and South Carolina Department of Health and Environmental Control (SCDHEC) industrial wastewater regulations. The projected waste tank inventories in the FTF PA provide reasonably bounding FTF inventory projections while taking into account uncertainties in the effectiveness of future tank cleaning technologies. As waste is removed from the FTF waste tanks, the residual contaminants will be sampled and the remaining residual inventory is characterized. In this manner, tank specific data for the tank inventories at closure will be available to supplement the waste tank inventory projections currently used in the FTF PA. For FTF, the new tank specific data will be evaluated through the Special Analysis process.



**Fig. 1. General Layout of F-Tank Farm.**

## THE SPECIAL ANALYSIS PROCESS

### Special Analysis Purpose

For the FTF, Special Analyses will be used as a means to assess the potential impact of new information on the FTF PA assumptions and results. The *Maintenance Guide for U.S. Department of Energy Low-Level Waste Disposal Facility Performance Assessments and Composite Analyses* [DOE\_11-10-1999] recognizes that conduct of a PA is not a static process, and states that, “Special analyses are expected to be needed as part of the routine maintenance of the performance assessment.” As described in the Maintenance Guide, “special analyses are analyses performed to evaluate the significance of new information or new analytical methods to the results of the performance assessment, or to supplement or amend the analyses performed in the original performance assessment. A special analysis is not the same as a revision to the performance assessment, but the results of the special analysis may be used to determine whether a performance assessment revision is needed.” As stated in the Maintenance Guide, a number of different factors may prompt a special analysis, including “wastes that exceed the concentrations analyzed for performance assessment-significant radionuclides.”

Per the Maintenance Guide, “the purpose of conducting special analyses can be thought of as similar to the process for resolving unreviewed safety questions described in the DOE Order 5480.21, *Unreviewed Safety Questions*. The intent of the process is to provide flexibility in day-to-day operations and to require those issues with a significant impact on the performance

*assessment's conclusions, and therefore the projected compliance with performance objectives, to be brought to the proper level for attention.” [DOE\_11-10-1999]*

Special Analyses are not intended to be used to supplant the Performance Assessment (PA) revision process. The SA should be considered an addendum to the PA, with the purpose of the SA being to provide additional information regarding specific conditions that differ from what was assumed in the PA. It is expected that most of the information contained within the FTF PA would be unaffected by the new information addressed in the SA, with the SA explicitly addressing only those few areas impacted by the new information. For FTF, a primary purpose of the Special Analyses will be to evaluate information regarding the final residual waste that will be grouted in place in the FTF waste tanks. The Special Analysis results can then be used to inform decisions regarding FTF closure documents.

### **Special Analysis Scope**

It is crucial in SA preparation that the scope of each distinct SA be well defined within the SA, since the specific scope may vary from SA to SA. Since the SAs may essentially serve as addendums to the PA, the SA scope should utilize the PA as the baseline from which the SA scope is defined. The SA needs to clearly define the areas in which the SA deviates from the assumptions of the SA. As discussed previously, a primary purpose of the FTF Special Analyses will be to evaluate information regarding the final residual waste that will be grouted in place in the FTF waste tanks. In this instance, new inventory information would be used to update the F-Tank Farm fate and transport modeling performed as part of the FTF PA and the potential impact of the new inventory information on FTF PA assumptions would be evaluated in the SA. Because the FTF PA analyzed projected inventories in FTF waste tanks for which waste removal may not be complete, future SAs will be prepared that focuses on the impact of the final residual waste data on the information presented in the FTF PA. It is not intended that information previously provided in the FTF PA that is unaffected by the new residual waste data be duplicated in future SAs.

In defining scope for revisions to be included in the Special Analysis, there are several matters that should be taken into consideration. One area of interest is the need to balance continuous improvement versus configuration control of agreed upon methodologies. It is tempting when preparing an SA to incorporate all of the lessons learned and potential PA enhancements known at the time into the SA. While it is imperative that known deficiencies that impact PA results need to be corrected, it should be recognized that there is usually not a single “correct” approach or methodology that must be utilized in PA development. The two primary concerns here are 1) is the modeling approach used within the SA scope defensible, and 2) is the SA scope limited such that the impact of the new information associated with the SA is discernable? For example, if an SA is being prepared to assess the impact of a change in waste tank residual inventories, including a new method of calculating changes in hydraulic conductivity over time might “improve” the model, but could mask the impact of the change in waste tank residual inventories or at the very least make it difficult to assign individual weights to the impact of the two changes. If the purpose of an SA is to learn about a specific change, it is important that the model allow for the change to be viewed in isolation to the maximum extent possible.

Another consideration when preparing an SA is determining which PA results should be addressed in the Special Analysis. A PA would be expected to contain not only analysis of the

expected configurations and scenarios, but also a range of sensitivity and uncertainty analyses. While it might not be necessary to replicate all of the sensitivity and uncertainty analyses in the SA, it would be appropriate to include within the SA additional analyses associated with the SA focus. For example, if the SA were addressing the impact of a change in a particular waste tank's residual inventory, it may be informative to include in the SA more sensitivity and uncertainty analyses tied directly to the affected tank, beyond even what might have been included in the PA.

A final consideration when preparing an SA is determining which type of assessments should be included in the Special Analysis. There is often a natural inclination to include quantitative assessments of the exact same type as were included in the PA, but in many instances simpler qualitative assessments could be used to impart the needed information. Given a good understanding of the relationship between the PA model inputs and the associated results, it is often evident what impact a change in the model would have without quantitative assessment. This is especially true in cases where sensitivity analyses were performed as part of the PA development in order to quantify the effect of parameter changes.

## **CONCLUSION**

For the SRS FTF, an FTF PA has been prepared to provide the technical basis and results to be used in subsequent documents to demonstrate compliance with the pertinent requirements for final closure of FTF. The FTF Special Analyses process will be utilized to evaluate the impact new information has on the FTF PA assumptions and results. The Special Analysis can then be used to inform decisions regarding FTF tank closure documents. In preparing SAs, it is crucial that the scope of the SA be well defined within the SA, since the specific scope will vary from SA to SA. Since the SAs are essentially addendums to the PA, the SA scope should utilize the PA as the baseline from which the SA scope is defined. The SA needs to focus on evaluating the change associated with the scope, and not let other changes interfere with the ability to perform that evaluation by masking the impact of the change. In preparing the SA, it is also important to let the scope determine whether the Special Analysis should utilize more qualitative or quantitative assessments and also which results from the PA should be addressed in the Special Analysis. These decisions can vary from SA and should not be predetermined.

## **REFERENCES**

1. "Performance Assessment for the F-Tank Farm at the Savannah River Site", SRS-REG-2007-00002, Revision 0, Washington Savannah River Company (2008).
2. "Radioactive Waste Management", DOE O 435.1, Chg. 1, U.S. Department of Energy, (2001).
3. "Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005", Public Law 108-375, "Defense Site Acceleration Completion", Section 3116, (2004).
4. "Maintenance Guide for U.S. Department of Energy Low-Level Waste Disposal Facility Performance Assessments and Composite Analyses", DOE\_11-10-1999, U.S. Department of Energy, (1999).