



## **SRS Citizens Advisory Board**

### **Salt Processing Focus Group**

#### **Meeting Summary**

September 12, 2000  
Aiken Federal Building  
Aiken, SC

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The Salt Processing Focus Group met on Tuesday, September 12, 2000, at 5:00 p.m. at the Aiken Federal Building in Aiken, SC. Attendance was as follows:

Bill McDonell	Jerome P. Morin, WSRC
Bill Lawless	Joe T. Carter, WSRC
Karen Patterson	Ken Rueter, WSRC
Lee Poe	John Reynolds, DOE
Mike French	Julie Petersen, DOE
Ernie Chaput	Kelly Dean, WSRC

Lee Poe welcomed everyone and started the meeting.

Mr. Poe quickly briefed the group on his presentation to the Waste Management Committee on Monday, September 11, at the Partridge Inn in Augusta, at which he brought the committee up-to-date on the Focus Group's work thus far. He then briefly outlined the waste removal progress to date, Tanks 14 & 15 leak sites, tank inspections, and tank corrosion.

#### **Acronyms**

CST-Crystalline Silicotitanate	ORNL-Oak Ridge National Lab
CSTR-Continuous Stir Tank Reactor	PD-Palladium
DWPF-Defense Waste Processing Facility	PU-Plutonium
HFIR-High Flux Isotope Reactor	QA-Quality Assurance
HLW-High Level Waste	SRS-Savannah River Site
IE911-Ion Exchanger	SRTC-Savannah River Technology Center
IIT-Illinois Institute of Technology	
MST-Monosodium Titanate	

#### **Alpha Removal**

Mr. Rueter began with the remaining high risks; which are MST plutonium removal performance, the MST/Sludge equipment scale, equipment size, and filter feed rate. He then outlined the activity goals and activity tasks.

#### **MST PU Removal Performance and MST/Sludge Equipment Scale**

## Goals

- Determine adsorption kinetics for MST at conditions relevant for ion exchange and solvent extraction processes.
- Examine alternate sorbents and technologies to remove strontium and actinides.

## Tasks

1. To measure extent and rate of Sr, Pu, U and Np removal from 5.6 M Na<sup>+</sup> salt solution
2. To evaluate performance of Honeywell sodium nonatitanate
3. To assess feasibility of alternative separation technologies
4. To determine soluble alpha activity in SRS waste samples

## Status

1. The MST sorption studies have been documented, the report has been issued, and the design bases have been verified.
2. The report has been issued on Honeywell sodium nonatitanate.
3. Alternate materials for testing have been identified and the report has been issued.
4. Analysis of soluble actinides in real waste has started and is proceeding as scheduled.

## Equipment Size and Filter Feed Rate

### Goals

- To identify a means to reduce filter equipment size and to identify the most promising alternate solid-liquid separation technologies for future testing.

### Tasks

1. To examine influence of axial velocity, trans-membrane pressure, and concentration of solids on filtration of MST and sludge mixture at "pilot scale"
2. To examine flocculents and filter aids
3. To identify alternate solid/liquid separation technologies

### Status

1. The filtration tests at "pilot scale" (USC) have been completed.
2. The list of candidate chemical additives has been reviewed.
3. The survey report of alternate solid-liquid separation technologies has been completed. In addition, the engineering study that recommends alternate equipment configuration in order to increase filter utility and reduce equipment size has been completed.

Mr. Rueter summarized the alpha removal technology with these facts. The MST, Pu, and Sr adsorption rates are equal to or better than pre-conceptual design basis. Sodium nonatitanate adsorption DF performance is poorer than MST. The literature study of other alternative actinide and strontium removal technologies is routing for approval. Future candidates for testing have been identified and scoped for FY01. Larger scale filtration tests have been completed, confirming filter performance for sludge/MST baselines. The literature study of alternate solid-liquid separation methods has been approved. Additional testing in FY01 is scoped and funded.

## CST Non-Elutable Ion Exchange

Next Mr. Rueter outlined the goals, tasks, and status for the remaining technology risks, which are resin stability, resin handling and sampling, and gas generation.

### Resin Stability

#### Goal 1

- Predictability of performance in SRS waste regarding presence and fate of leached materials, lot-to-lot variability and chemical and thermal stability between ORNL and SRTC.

#### Tasks/ORNL

1. To measure cesium loading, batch leaching and column leaching at various temperatures using various solutions during extended contact with simulant solutions
2. To examine CST stability after prolonged contact with caustic and waste
3. To understand post-precipitation in waste simulants

#### Status/ORNL

1. The long-term leaching studies are to be complete by 9/00 and 2/01.
2. The post-precipitation studies of waste simulants are progressing.
3. The leaching of various elements from IE-911 is under study.

#### Tasks/SRTC

1. To improve IE-911 manufacturing process to reduce leaching of components through contract with UOP
2. To investigate IE-911 performance in SRS wastes

#### Status/SRTC

1. A contract has been established with UOP, a technical exchange has been held, and a path forward has been developed.
2. Real waste samples are being collected for Kd measurements.

In addition, Cesium loading tests, batch-leaching test, flow-through column tests have been done.

#### Goal 2

- Develop an understanding of formation of precipitates in HLW as a function of temperature and waste composition.
- Establish conditions under which CST constituents precipitate.

#### Tasks/ORNL

1. To perform salt equilibrium thermodynamic modeling and precipitation studies to evaluate the overall stability of the waste streams

#### Status/ORNL

1. Calculations of thermodynamic equilibria are nearing completion.
2. Bench tests for simulants are complete.

3. Effects of CST components and waste impurities are being evaluated.
4. Precipitates from simulant preparations have been analyzed.
5. Thermodynamic equilibrium has been calculated.

## Gas Generation

### Goal 1

- To conduct radioactive bench-scale column tests to determine the impact of radiolytic generation of gas on cesium sorption column performance.

### Tasks/ORNL

1. To utilize the ORNL HFIR as a radiation source to performing flowing column test
2. To design system that ensures gas generation and collection within Authorization basis of HFIR facility

### Status/ORNL

1. Test equipment has been cold tested and issued for use.
2. Gas generation test in HFIR has been completed.
3. Baseline test has started.

### Tasks/SRTC

1. To perform computer simulations of gas formation

### Status/SRTC

1. Results of calculation have been incorporated into the design of the gas-generation test equipment.

### Goal 2

- Evaluate/demonstrate methods for removing gas between columns.
- Determine effect of entrained gas on downstream columns.
- Determine thermal conductivity of CST.

### Tasks

1. Evaluate gas-disengagement equipment options and determine overall removal system performance requirements for radiolytically generated gases from CST Ion Exchange column
2. Obtain thermodynamic properties to support column design

### Status

1. Gas-disengagement equipment fabricated and installed in tall column system at ORNL.
2. Thermal conductivity of CST-air and CST-average simulant has been measured.
3. Design and fabrication of the column modifications, second column gas volume-fraction measurement chamber and bubble size measurement apparatus are complete.
4. Tall column system design baseline established.

## Resin Handling and Sampling

### Tasks

1. Evaluate suspension in DWPF vessels
2. Examine Hydragard sampling of CST/sludge/frit slurries
3. Reduce resin size

### Status

1. Sampling tests with Hydragard Sampler conducted.
2. CST size-reduction demonstrated in two vendor tests.

## Small Tank TPB Precipitation

Mr. Rueter began with the remaining high risks, neither of which is closed yet, catalytic product decomposition and reactor/vessel foaming.

## Catalytic Product Decomposition

### Goals

- To enhance the understanding of the catalytic decomposition and determine how to predict the behavior.

### Tasks

1. To enlist support of expert consultants in the field of catalytic system identification
2. To characterize palladium catalyst
3. To conduct Pd synergism studies
4. To verify the role of intermediates
5. To define simulated waste that provides batch decomposition rates similar to those of real waste
6. To examine reactivity using real waste samples from tanks
7. To test 20-L CSTR unit operations

### Status

1. Interactions with the consultants have been achieved and their recommendations have been incorporated.
2. The Pd catalyst and synergistic reactions have been characterized.
3. Simulated wastes that provide batch decomposition rates similar to those of real wastes have been defined.
4. Roles of intermediates (3PB, 2PB, 1PB) have been determined.
5. Real waste testing has been started.
6. 20-L CSTR Unit Operations are complete.

## Foaming

### Goal

- For the antifoam to be effective in multiple chemical environments and stable in a radioactive environment.

#### Tasks/SRTC & IIT

1. Examine the causes of foaming
2. Identify the foam control agents
3. Examine performance of agents in bench-scale and large-scale tests
4. Recommend an effective antifoam agent

#### Status

1. IIT has studied the cause of foaming and a stabilizer was found.
2. Three defoamers were identified and tested.

#### Tasks/ORNL

1. Determine antifoam effectiveness

#### Status/ORNL

1. The program testing in the 20-L CSTR system at Oak Ridge recommended IIT B52.

In summary, Mr. Rueter reiterated that good progress has been made in the understanding of TPB decomposition and a preferred antifoam agent has been identified, tested, recommended and demonstrated.

#### Caustic Side Solvent Extraction

Mr. Rueter outlined the remaining technology risks that are radiolytic stability, chemical stability, resistance to impurity effects, real waste performance, and flow sheet solvent system proof-of-concept.

#### Radiolytic and Chemical Stability and Resistance to Impurity Effects

##### Goal

- To demonstrate Decontamination Factor (DF) of 40,000 in batch extraction.

##### Tasks

1. Batch extraction and strip in hot and strip cell and radiochemical hoods
2. Solvent-performance diagnostics for the stripped solvent

##### Status

1. The simulant is prepared, and the quality assurance tests are complete.
2. The preparations for the hot-cell elements of the experiment are complete.
3. The multi solvent cycle batch extraction and strip test is complete.

#### Radiolytic Stability, Chemical Stability and Resistance to Impurity Effects, and Real Waste Performance

##### Goal

- To evaluate the overall revised solvent system chemical and radiolytic stability along with identifying degradation components.

#### Tasks/ORNL

1. To irradiate cesium with a waste simulant
2. To determine the impact of solvent decomposition on contactor hydraulic performance
3. To identify potential solvent clean -up methods
4. To identify solvent decomposition/waste interaction
5. To understand partitioning behavior with solvent system

#### Status/ORNL

1. Simulant is prepared.
  2. Hot-cell contactor test apparatus is completed.
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1. Dose calculations for the experimental work are complete.
  2. Samples irradiated with  $^{60}\text{Co}$  at SRTC have been analyzed.
  3. Thermal decomposition experiments are underway.

#### Tasks/SRTC

1. To irradiate solvent with a waste simulant
2. To examine radiolytic stability of solvent in contact with real waste
3. To measure performance in batch contacting for actual SRS waste samples

#### Status/SRTC

1. Co irradiations are complete.
2. Real waste samples have been taken, and characterization is complete.
3. Real waste batch exposure preparations are underway.

#### Real Waste Performance

##### Goal

- To determine the chemical and physical properties that impact the useful life of the solvent.

##### Task

1. To determine the solubility and partitioning behavior for the following: solvent components, major and minor components in the waste, methods for cleanup of degraded solvent, and impact of minor components in the waste feed

##### Status

1. Component loading and 3<sup>rd</sup> phase formation studies are complete.
2. Component partitioning data has been obtained.
3. Modifier solubility studies have been conducted.
4. No solubility problems with the baseline modifier Cs-7SB have been found.
5. Alternative modifier forms an insoluble dihydrate.
6. BOBCalixC6 is soluble to at least 200 mM.

## Flow Sheet Solvent System Proof of Concept

### Goal

- To define a process for commercialization of the solvent system.

### Tasks

1. To prepare solvent for FY00 experiments
2. To define solvent composition requirements
3. To manage the modifiers
4. To identify potential commercial suppliers of solvent components

### Status

1. A solvent QA procedure has been prepared.
2. Solvent preparation tasks for FY00 experimental programs have been completed.
3. Draft patent disclosure covering Cs-7SB has been prepared.
4. Calix synthesis procedure has been improved and evaluated.

## Real Waste Performance and Flowsheet Solvent System Proof of Concept

### Goal

- To conduct a test of the proposed flowsheet using 2-cm contactors to demonstrate the required DF of 40,000 and CF of 15.

### Tasks

1. To modify 2-cm contactors to achieve stage efficiency
2. To add stages to the contactor bank
3. To conduct flowsheet tests with and without solvent recycle

### Status

1. Contactor modification has been completed.
2. Flow sheet test preparations are on schedule.
3. Real waste feasibility plans have been issued.
4. Test location has been established.

The next meeting was scheduled for Thursday, October 5, 2000, 5:00 p.m., Aiken Federal Building.

The October meeting will include, but is not limited to, the following:

- Changes to Small Tank for Precipitate Hydrolysis
- Trade studies
- NAS report

Mr. Poe asked for questions or comment. There being none, he adjourned the meeting at 8:45 p.m.

***Meeting handouts may be obtained by calling 1-800-249-8155.***

