TFA TANKS FOCUS AREA

FY 1996 Site Needs Assessment

March 1996

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Executive Summary

The Tanks Focus Area's (TFA's) mission is to manage an integrated technology development program that results in the application of technology to safely and efficiently accomplish tank waste remediation across the U.S. Department of Energy (DOE) complex. The TFA uses a systematic process for developing its annual program that draws from the tanks technology development needs expressed by four DOE tank waste sites -- Hanford, Idaho, Oak Ridge, and Savannah River Sites. The process is iterative and involves four steps:
1) identify and validate tank technology needs at these four sites, 2) define a technical program that responds to these needs, 3) select specific tasks and schedules that accomplish program objectives, and 4) develop integrated teams to carry out selected tasks.

This document describes the first of these four steps: identification of sites' tank technology needs. This step concentrates solely on needs identification, collection, and validation. Funding requirements and specific scope of responsive technical activities are not considered until later steps in program definition. This year, the collection and validation of site needs were accomplished through written input from the Site Technology Coordination Groups (STCGs). The TFA recognizes the importance of a continuing solid partnership with the sites through the STCG and DOE as well as contractor users and, therefore, ensured site participation and close coordination throughout the process.

Using needs collected in the previous year as a starting point, the TFA asked each site to validate, modify, or delete previous needs, and add any new needs. The TFA paid particular attention to those needs with a site-assigned "high" priority, and examined each need for its suitability for inclusion into the national program. A total of 273 needs were collected and catalogued, and the TFA developed an additional 14 to cover potential gaps in technology. Following the needs validation process with DOE site user representatives and the TFA User Steering Group (USG), which is comprised of management and operations (M&O) contractors from the four sites and three national laboratory representatives, 130 needs were named as high impact. The TFA used four criteria to determine the high-impact set:

- **site priority** - Needs identified by the sites as high, medium, or low priority retained those same ratings. Some medium and low site priority needs were included in TFA's high-impact needs, due to their high rating in one or more of the remaining three criteria. The TFA assumed sites considered environmental, safety, and health (ES&H) and urgency of need in their rankings, including responses to regulatory commitments.

- **cost reduction** - Needs with an estimated savings expected value over $250M were rated high, between $250M and $50M were rated medium, and less than $50M were rated low.

- **confidence** - The TFA estimated whether research and development responsive to each need increased the confidence that the site would manage or remediate its tank waste effectively. A high rating was given to needs for which the site could not proceed without a solution, a medium was given if there was a possibility of delay if the need was not met, and low was given if the solution helped the site but was not required for them to move forward.

- **broad-based** - Solutions to each need could be deployed at any multiple of sites. A high rating was given if all tank sites had the same problem, medium if only two or three sites had the problem, and low if a single site had the problem.

The limitations associated with the current needs data include the following:

- Needs input from the STCG's varied in the detail and methods by which the specific user and stakeholder needs were collected and updated

- Specific site needs, priorities, and schedules will change with time.

The limitations associated with the needs ranking process include the following:

- While the criteria were carefully constructed and reviewed, TFA judgments on each need against these criteria were largely subjective, albeit based on expert opinion

- Each site used their own and slightly different criteria for identifying whether their site-specific needs were of high, medium, or low priority.

The needs assessment process is the initial step in defining the TFA technical program. The high-impact needs have been reviewed and validated by DOE site user representatives and the TFA USG. Furthermore, the TFA Technical Team has grouped the individual high-impact needs into problem elements that reflect the objectives to be met in remediating tanks. These problem elements which are identified in Table ES.1 become the basis for technical program definition. The needs included in each of these problem elements are also shown in Table ES.1 (in Table ES.1, Site Need consists of a TFA record number and need title).

The next steps toward program definition include the following:

Step 1 - Complete Needs Assessment

Step 2 - Map Site Schedules to High-Impact Needs

Step 3 - Identify Products and Need Activities for FY 1997 and 1998 Required to Meet Schedules

Step 4 - Map Planned Technical Work within EM-30, 40, and 50 to FY 1997 and 1998 Activities to Identify Gaps

Step 5 - Describe Scope and Products Required in FY 1998

Step 6 - Document in the TFA Multi-Year Program Plan (MYPP)

The MYPP referred to in Step 6 is the companion document to this needs assessment. It contains details on the scope of the technical program that responds to the high-impact needs identified in this document.

The TFA established a framework to begin the program planning process. This framework groups similar or related needs from different sites and allows for technical integration across functions to solve specific problems, as opposed to consolidating needs by technical focus. This activity begins the transition from needs collection and analysis to TFA program development. Program development is addressed in the upcoming revision to the MYPP. To describe the TFA's program planning framework, the problem element structure is introduced here. The problem elements

- provide an updated method to logically group high-impact needs
- assist in sequencing and scheduling needs resolution
- identify the problem elements and the needs within them as baseline, enhancements, or alternatives.

Site Need	Problem Element
169 - Develop "Fly By" NDE Inspection System/Idaho	Extend Tank Life - Monitor Tank Integrity
363 - Issues with Safe Operation, Decon, and Removal of Tank End Effectors/Idaho	
382 - Develop Real-Time Corrosion Monitoring Techniques/SRS	
601 - Extension of Carbon Steel Tank Life and Minimizing the Imact to Processing/TIM	Avoid Tank Corrosion
514 - Develop Mechanisms and/or Devices to Passively Ventilate Hydrogen and Other Potentially Combustible Vapors from HLW Tanks/SRS	Ventilate Tanks
357 - Field Methods for 3D Mapping of Waste Chemical and Radiological Properties/Oak Ridge	Characterize Waste In Situ
399 - Develop In Situ Sensor to Identify Flammable Gas Species/Idaho	
486 - In Situ Characterization Capability (Minilab)/Idaho	
531 - Development of Direct/Indirect In Situ Waste Energetics Measurement Capability/Hanford	
532 - Instrumentation to Remotely Monitor Low (<5 wt.%) Waste Moisture Concentrations/Hanford	
541 - In Situ Core Drilling-Speciation/Hanford	
530 - Off Riser Sampling/Hanford	Sample Waste
595 - Waste Characterization for Tc/TIM	Analyze Waste
596 - Waste Characterization Strategy (Physical/Chemical) to Support Processing Needs/TIM	
102 - Concentrate Waste - Reducing Water Volume of DWPF/SRS	Reduce Recycle Streams
303 - DWPF Recycle Stream Flow and Composition/SRS	
309 - Methods for Recycle Minimization/SRS	
64 - Heel Waste Retrieval - Vehicle/Oak Ridge	Deploy Equipment
187 - Heel Waste Retrieval/Characterization - LDUA Deployment Systems/Oak Ridge	
346 - Bulk Sludge Mobilization and Slurry Transport - Alternative Mechanical Mobilization Systems/Oak Ridge	
347 - Heel Waste Retrieval - WD&C/Oak Ridge	
363 - Issues with Safe Operation, Decon, and Removal of Tank End Effectors/Idaho	
364 - Issues with Safe Removal, Decon, and Insertion of Retrieval Devices/Oak Ridge	
365 - Issues with Safe Removal, Decon, and Insertion of Retrieval Devices/SRS	
371 - Develop Inspection Technologies for Type I & II Tank Annulus/SRS	

Table ES.1. High-Impact Needs and Problem Elements

Site Need	Problem Element
423 - Develop Removal Techniques for Mired Equipment/SRS	Deploy Equipment
445 - Heel Waste Retrieval/Characterization - LDUA Deployment Systems/Idaho	
530 - Off Riser Sampling/Hanford	
602 - Develop Strategy, Requirements, and Needs for Deployment in Tanks/TIM	
343 - Bulk Sludge Mobilization and Slurry Transport - Mix & Mobilize Sludge/Oak Ridge	Mobilize Bulk Waste
346 - Bulk Sludge Mobilization and Slurry Transport - Alternative Mechanical Mobilization Systems/Oak Ridge	
347 - Heel Waste Retrieval - WD&C/Oak Ridge	
374 - Develop Simulants/Idaho	
375 - Develop Simulants/Oak Ridge	
421 - Outline Mix Requirements and Pump Configuration for Salt Dissolution/Sludge Removal/SRS	
422 - Improve Salt Mining Equipment and Techniques/SRS	
430 - Develop Method to Address Insoluble Solids in Salt Tanks/SRS	
431 - Develop Method to Remove Mixed Salt and Sludge/SRS	
432 - Develop Method to Remove Dry/Hardened Sludge/SRS	
436 - Develop Method to Remove Tank Heels/SRS	
439 - Develop Improved Slurry Pumps to Minimize Addition of Inhibited Water/SRS	
448 - Retrieve Calcine From Bins/Idaho	
487 - Develop Simulants/SRS	
534 - Waste Retrieval Methods Needed for DST Waste Not Amenable to Advanced Design Mixer Pump Retrieval/Hanford	
535 - SST Retrieval Equipment/System Development/Hanford	
569 - Settle Decant Demonstration for Solid-Liquid Separations/Hanford	
575 - Simulant (Retrieval Process Test Material) Development/Hanford	
343 - Bulk Sludge Mobilization and Slurry Transport - Mix & Mobilize Sludge/Oak Ridge	Mix Waste
346 - Bulk Sludge Mobilization and Slurry Transport - Alternative Mechanical Mobilization Systems/Oak Ridge	
347 - Heel Waste Retrieval - WD&C/Oak Ridge	
374 - Develop Simulants/Idaho	
375 - Develop Simulants/Oak Ridge	

Table ES.1. (contd)

Site Need	Problem Element
421 - Outline Mix Requirements and Pump Configuration for Salt Dissolution/Sludge Removal/SRS	Mix Waste
422 - Improve Salt Mining Equipment and Techniques/SRS	
431 - Develop Method to Remove Mixed Salt and Sludge/SRS	
432 - Develop Method to Remove Dry/Hardened Sludge/SRS	
439 - Develop Improved Slurry Pumps to Minimize Addition of Inhibited Water/SRS	
448 - Retrieve Calcine From Bins/Idaho	
487 - Develop Simulants/SRS	
534 - Waste Retrieval Methods Needed for DST Waste Not Amenable to Advanced Design Mixer Pump Retrieval/Hanford	
535 - SST Retrieval Equipment/System Development/Hanford	
575 - Simulant (Retrieval Process Test Material) Development/Hanford	
185 - Bulk Sludge Mobilization and Slurry Transport - Slurry Transport Studies/Oak Ridge	Transfer Waste
343 - Bulk Sludge Mobilization and Slurry Transport - Mix & Mobilize Sludge/Oak Ridge	
346 - Bulk Sludge Mobilization and Slurry Transport - Alternative Mechanical Mobilization Systems/Oak Ridge	
347 - Heel Waste Retrieval - WD&C/Oak Ridge	
374 - Develop Simulants/Idaho	
375 - Develop Simulants/Oak Ridge	
405 - Develop Improved Pump Testing and Maintenance Program/SRS	
422 - Improve Salt Mining Equipment and Techniques/SRS	
431 - Develop Method to Remove Mixed Salt and Sludge/SRS	
432 - Develop Method to Remove Dry/Hardened Sludge/SRS	
439 - Develop Improved Slurry Pumps to Minimize Addition of Inhibited Water/SRS	
448 - Retrieve Calcine From Bins/Idaho	
487 - Develop Simulants/SRS	
575 - Simulant (Retrieval Process Test Material) Development/Hanford	
384 - Develop Leak Repair Techniques/SRS	Detect and Mitigate Leaks
544 - Tank Leak Mitigation Systems/Hanford	
345 - Bulk Sludge Mobilization and Slurry Transport - In-Line Solids Monitoring/Oak Ridge	Monitor & Control Retrieval Process

Table ES.1. (contd)

Site Need	Problem Element
482 - On-Line Monitoring Waste Retrieval Process/Oak Ridge	Monitor & Control Retrieval Process
555 - Real Time Waste Property Measurement System for Waste Transfer/Hanford	
594 - Develop Strategy and Method for Managing Interface Between Functions/TIM	Interface with Pretreatment
597 - Waste Handling at the Interface with Retrieval and Immobilization/TIM	
162 - Retrieval: Robotics, Mixer Pumps, Waste Dislodging and Conveyance/Idaho	Mobilize Heel
437 - Tank Clean and Closure/SRS	
475 - Tank System Closure Demonstration/Oak Ridge	
528 - Tank Closure Demonstration for an Arid Site/Hanford	
501 - Alternative Calcination Process Flowsheet/Idaho	Calcine Waste
502 - On-Line Process Monitor for Elemental Analysis of Calcine Product/Idaho	
591 - Prevent/Remediate Foaming in Process Vessels/TIM	Interface with Retrieval & Transfer
597 - Waste Handling at the Interface with Retrieval and Immobilization/TIM	
598 - Waste Chemistry/TIM	
9 - Removal of Undissolved Solids from Tank Waste & Dissolved Calcine/Idaho	Clarify Liquid Stream
97 - Late Wash Precipitate - Clarification of Liquid Streams/SRS	
176 - Liquids/Solids Separations Studies/Oak Ridge	
403- Optimize Transfer Jet Performance/SRS	
563 - Demonstrate Filtration for Pretreatment Solid-Liquid Separations/Hanford	
569 - Settle Decant Demonstration for Solid-Liquid Separations/Hanford	
247 - Removal of TRU, Sr, Tc, Cs from Tank Waste & Dissolved Calcine/Idaho	Remove Radionuclide
489 - LLLW Supernatant/Oak Ridge	
495 - Sr, Tc, and Ru Removal/Oak Ridge	
498 - Source Treatment/Oak Ridge	
519 - Evaluate Ion Exchange or Precipitation Methods to Selectively Remove Cesium from High Potassium Salts/SRS	
533 - Technetium Removal/Hanford	
539 - Demonstration of TRU/Sr-90 Removal/Hanford	
562 - Demonstrate Cs Removal for Hanford Supernatants/Hanford	

Table ES.1. (contd)

Site Need	Problem Element
597 - Waste Handling at the Interface with Retrieval and Immobilization/TIM	Interface with LLW Immobilization
598 - Waste Chemistry/TIM	
600 - Reduce Volume of LLW by Sodium Nitrate Recovery/TIM	
178 - Sludge Separations/Oak Ridge	Process Sludge
518 - Develop Counter-Current Decantation Process for Sludge Washing/SRS	
538 - Pretreatment Demonstration for Phase I Sludges/Hanford	
553 - Pretreatment Demonstration for Phase II HLW Sludges/Hanford	
574 - Continuous Sludge Leaching and Processing Reactors/Hanford	
517 - Develop Electrochemical Treatment of Salt Solutions for Caustic Recovery and Recycle/SRS	Interface with HLW Immobilization
570 - LLW - Separable Phase Organics/Hanford	
585 - Cost Effective Caustic Recycle/Hanford	
591 - Prevent/Remediate Foaming in Process Vessels/TIM	
597 - Waste Handling at the Interface with Retrieval and Immobilization/TIM	
598 - Waste Chemistry/TIM	
599 - Concentration of Sludge Prior to Immobilization/TIM	
94 - Characterization Methods for Tc-99 and I-129/Oak Ridge	Process LLW - Monitor & Control Process
529 - Waste Acceptance Testing/Hanford	
549 - LLW - On-Line Analysis/Hanford	
593 - Identification of Technology Gaps to Support Privatization/TIM	Prepare LLW Feed
594 - Develop Strategy and Method for Managing Interface Between Functions/TIM	
252 - Develop Grout Process for Sodium Bearing Waste/Idaho	Immobilize LLW Stream
492 - Waste Form Acceptance/Oak Ridge	
493 - Sludge Waste Form Study/Oak Ridge	
494 - Sludge Waste Form Demonstration/Oak Ridge	
524 - Evaluate LLW Vitrification as an Alternative to Saltstone/SRS	
543 - LLW - Offgas Treatment/Hanford	Treat Offgas
594 - Develop Strategy and Method for Managing Interface Between Functions/TIM	
285 - DWPF Analytical Methods for Attainment/SRS	Process HLW - Monitor & Control Process
287 - Improve DWPF Level Probes/SRS	
529 - Waste Acceptance Testing/Hanford	

Table ES.1. (contd)

Site Need	Problem Element
189 - Secondary Waste Immobilization Studies/Oak Ridge	Prepare Secondary Waste from Pretreatment
558 - Process for Immobilization of Tc-Rich Waste Stream/Hanford	
567 - Crystalline Silico-Titanate (CST) in HLW Glass/Hanford	
66 - Prepare Melter Feed - Enhance Pumping/Mixing/SRS	Prepare HLW Feed
266 - DWPF Flowsheet Model/SRS	
269 - Effects of Irradiation on Precipitate/SRS	
310 - Determine Maximum H_2 Evolution/SRS	
316 - Reduce Noble Metal Deposition/SRS	
520 - Optimize Waste Loading for DWPF Glass/SRS	
521 - Identify Alternates to Formic Acid for Melter Feed Redox Adjustment to Reduce H_2 and NH_3 Formation/SRS	
523 - Demonstrate Process for Amalgamation of Mercury which Results in a Nonhazardous Waste/SRS	
554 - Waste Loading Optimization for HLW/Hanford	
593 - Identification of Technology Gaps to Support Privatization/TIM	
594 - Develop Strategy and Method for Managing Interface Between Functions/TIM	
1 - Develop HLW Formulations for the High Activity Fraction of SBW and Calcine/Idaho	Immobilize HLW Stream
4 - Process Control Limits and Model Development for Waste Immobilization/Idaho	
5 - Integrated Demonstration of Immobilization Equipment/Idaho	
315 - Extend Operating Life of DWPF Melter/SRS	
316 - Reduce Noble Metal Deposition/SRS	
501 - Alternative Calcination Process Flowsheet/Idaho	
542 - Radioactive HLW Vitrification Tests - Phase I/Hanford	
561 - Radioactive Small-Scale Vitrification Demonstration (HLW-13)/Hanford	
592 - Smaller, Cheaper Melters/TIM	
282 - Cold Cap/Offgas Thermodynamics Model/SRS	Treat Offgas
594 - Develop Strategy and Method for Managing Interface Between Functions/TIM	
169 - Develop "Fly By" NDE Inspection System/Idaho	Monitor Tank

Table ES.1. (contd)

Site Need	Problem Element
445 - Heel Waste Retrieval/Characterization - LDUA Deployment Systems/Idaho	Characterize Heels
165 - Determination of a Generalized Risk-Based Closure Criteria/Idaho	Define Closure Criteria
435 - Determine Zeolite Removal Requirements/SRS	
437 - Tank Clean and Closure/SRS	
454 - Stabilization and Closure Analysis Tools/SRS	
455 - Establish Clean-Up Standard/Criteria/Oak Ridge	
459 - Data for Closure/SRS	
475 - Tank System Closure Demonstration/Oak Ridge	
528 - Tank Closure Demonstration for an Arid Site/Hanford	
382 - Develop Real-Time Corrosion Monitoring Techniques/SRS	Interface with Pretreatment
419 - Determine Salt Dissolution Kinetics/SRS	
594 - Develop Strategy and Method for Managing Interface Between Functions/TIM	
598 - Waste Chemistry/TIM	
500 - In Situ Sludge Treatment Capability Studies/Oak Ridge	Treat Heel in Place
546 - Testing of Capillary Breaks/Hanford	Stabilize Tank for Closure
547 - Getter Materials/Hanford	
578 - Long-Term Testing of Surface Barrier/Hanford	
529 - Waste Acceptance Testing/Hanford	Monitor Waste for Acceptance
540 - Contaminant Release from Waste Form/Hanford	Determine Performance of Waste Form
545 - In Situ Testing of LLW Glass Release/Hanford	
590 - Establish Waste Acceptance for Idaho Grout/TIM	
87 - Manage Disposal of Tank Farm Failed Equipment/SRS	Provide Disposal System
462 - Close LLW Storage Vaults/SRS	
482 - On-Line Monitoring Waste Retrieval Process/Oak Ridge	
546 - Testing of Capillary Breaks/Hanford	
547 - Getter Materials/Hanford	
578 - Long-Term Testing of Surface Barrier/Hanford	
589 - Need for Consistent Waste Acceptance Criteria for Private Vendors/TIM	

Table ES.1. (contd)

Acronyms

3D	three-dimensional
ATI	Alternative Technology Initiative
Cs	cesium
CST	crystalline silico-titanate
DOE	U.S. Department of Energy
DST	double-shell tank
DWPF	Defense Waste Processing Facility
EM	DOE's Office of Environmental Restoration and Waste Management
HLW	high-level waste
IRB	Internal Review Budget
LDUA	Light-Duty Utility Arm
LLLW	liquid low-level waste
LLW	low-level waste
MYPP	Multi-Year Program Plan
NBS	Needs Breakdown Structure
NDE	nondestructive examination
RDS	Risk Data Sheet
Ru	ruthenium
SBW	sodium-bearing waste
Sr	strontium

SRS	Savannah River Site
SST	single-shell tank
STCG	Site Technology Coordination Group
Tc	technectium
TFA	Tanks Focus Area
TIM	Technology Integration Manager
TRU	transuranic
USG	(TFA's) User Steering Group
WD&C	waste dislogding and conveyance

Contents

Figures

Tables

Section 1 - Introduction

This document describes the needs assessment product and process. It contains a summary of information contained within the Tanks Focus Area (TFA) needs database, portraying information provided by four major U.S. Department of Energy (DOE) sites with tank waste problems. The Site Needs Assessment also summarizes the needs prioritization process and how this process leads to program definition.

This is the second edition of the TFA Site Needs Assessment. The FY 1995 version (TFA 1995) described the TFA's initial work in collecting and analyzing tank remediation technology development needs from across the DOE complex. The analysis of those needs served as the basis for formulation of the FY 1996 - FY 1997 TFA program. This FY 1996 version serves as the basis for formulation of the FY 1997-FY 1998 TFA program.

The TFA goal remains unchanged - to provide integrated solutions that will accelerate safe and cost-effective cleanup and closure of DOE's tank system. The TFA focused mainly on the four major DOE sites with tank waste problems: Hanford Site, Idaho Site, Oak Ridge Site, and Savannah River Site. These four sites possess more than 300 tanks that store over 380,000 m^3 of high-level waste (HLW) and transuranic (TRU) wastes. The varying tank structure, construction, and capacity, as well as the different waste types themselves, have provided extraordinary challenges to the formation of an integrated tanks technology development program. The varying programmatic, institutional, and regulatory issues across the four sites adds to the complex-wide challenge of the technical risks of remediation.

The overall TFA program objective is to deliver a tanks technology program that reduces the current cost, and the operational and safety risks of tank remediation. Since the publication of the last Site Needs Assessment, the TFA's understanding of complex-wide issues has matured greatly. There is a deeper understanding of the operational nuances of each site with the further development of working relationships with key organizations and individuals. In FY 1995, the TFA cited four tanks technology program attributes essential for success. Significant progress has been made to make the program

- **applicable** - addresses user's needs and can be implemented within budget, schedule, and regulatory constraints. The care taken in last year's comprehensive needs collection and analysis effort paid off with a deeper understanding of the interrelationships of the needs. This led to a systematic approach for the use of available funding. Building on last year's lessons learned, this year's process permitted a more thorough understanding of the needs and when technical solutions must be available.

- **integrated** - leverages relevant activities across the DOE Environmental Restoration and Waste Management (EM) system and, later, across the DOE complex and beyond. The TFA is part of a technology development network that has formed within the focus areas and at each site. There is a growing awareness of related work between sites and focus areas. The TFA continues to develop this awareness of leveraging opportunities.

- **acceptable** - has broad involvement of key stakeholders and incorporates expertise from outside the laboratory system, e.g., from industry and universities as appropriate. The TFA has made special efforts to involve stakeholders. These stakeholders include the Site Technology Coordination Groups (STCGs) and the TFA User Steering Group (USG).

- **accountable** - performs within budget, on schedule, and produces a clear benefit. Since the last Site Needs Assessment, the TFA was required to tightly select tasks for continued funding. Budget reductions required full consideration of the expected benefits from each task funded to meet user needs.

The TFA accomplishes its objective by executing an iterative approach to program development that involves site users and stakeholders through the STCGs at each site. The needs assessment process is the basis for the program definition. The process involves four major steps (Figure 1.1):

- needs assessment

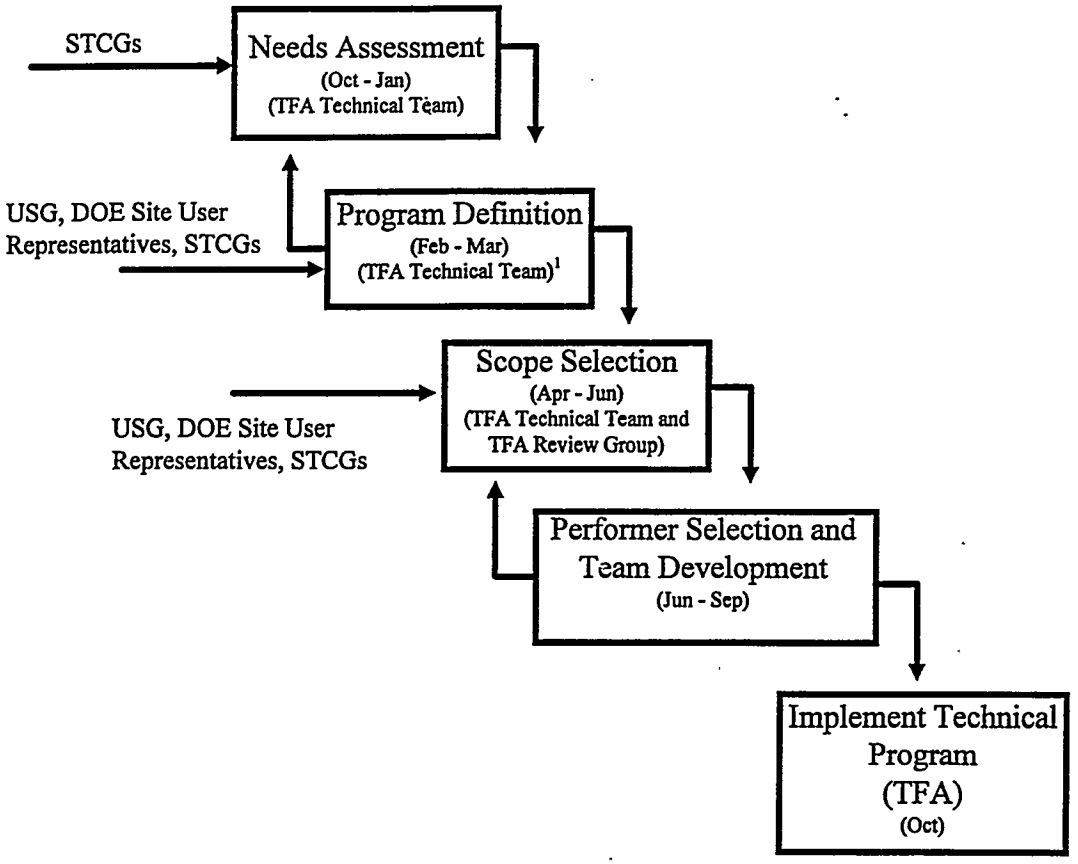
- program definition

- scope selection based on performance requirements of the users

- performer selection and team development.

The needs assessment step was used to develop the TFA needs database and is the focus of this document. As was done last year, the TFA acknowledged site-identified needs and ongoing work by using those data as a starting point for analysis. The TFA also recognizes the need to view the DOE tank remediation issues from an integrating perspective. Thus, the resulting technical recommendations will be grounded in site needs and will be responsive to additional system drivers, such as site priority, potential cost reduction, confidence that technology will make a difference, and broad-based benefit. The program definition, scope selection, and performer selection are described in the companion document, the Multi-Year Program Plan (MYPP).

Section 2 describes the needs database and limitations. Section 3 describes the data collection and evaluation processes. Section 4 summarizes the next steps in the program. Appendix A contains descriptions of the detailed high-impact site needs.



[1] The TFA Technical Team consists of the lead and integration functions at the Pacific Northwest National Laboratory (PNNL), the Technology Integration Managers for the safety, characterization, retrieval and closure, pretreatment, and immobilization functions from other national laboratories and management and operations contractors. The Technical Team has a steering group composed of senior managers from each of these organizations as well.

Figure 1.1. Needs Assessment Program and Recommendations Process

Section 2 - Needs Data Management

This section describes the processes for management of the needs data. Needs data collected from sites was input into a needs database. In addition to the detailed site needs data, the needs database includes needs ranking results, and initial definitions for the program response. The TFA used the previous database as a starting point, since it was anticipated that some needs would be carried over into this year. The data were updated and validated, placed into the TFA Needs Breakdown Structure (NBS), ranked to indicate the high-impact needs, and packaged into problem elements to form the basis for technical program recommendations. For more detail on the process for refining the data in each of these steps, see Section 3.

The limitations associated with the current needs data include the following:

- Needs input from the STCGs varied in detail and the methods by which the specific user and stakeholder needs were collected and updated. In FY 1995, the TFA team has learned much about the organization and functioning of each site. With this experience, even though there was some variability in site input, the TFA was well able to understand the basis for the needs, as well as the context from which the basis derived.

- Specific site needs and priorities will change with time. The TFA realizes the impact of budget changes, as well as evolving remediation baselines, and remains flexible to respond to those changes. The TFA has used the USG, STCG, and DOE site user representatives to provide valuable guidance on the most responsive technical program possible.

The limitations associated with the needs ranking process include the following:

- While the criteria were carefully constructed, TFA judgments on each need against these criteria were largely subjective, albeit based on expert opinion.

- Each STCG used slightly different criteria for prioritizing their needs. The TFA attempted to understand these differences before and during its own prioritization process. To retain site input to the ranking process, the TFA did not modify priorities assigned by the STCGs.

Section 3 - Data Collection and Evaluation Process and Data Summary

The TFA capitalized on lessons learned from the previous year's needs collection effort. The essential elements are site cooperation and participation in the collection of needs, and the sites' validation of the TFA's analysis. The TFA set out the following steps:

Step 1 - Collect and Validate Needs Data

- contacted STCGs for data
- received, processed, and cataloged site data within the NBS
- distributed the cataloged needs to the USG and DOE site user representatives with clarifying questions

Step 2 - Determine Initial Set of High-Impact Needs

- developed high-impact needs criteria
- evaluated needs against criteria to determine initial set of high-impact needs
- reviewed by the USG and DOE site user representatives

Step 3 - Develop a Program Planning Framework

- used systems-based grouping of high-impact needs (problem element structure)
- identified common needs across multiple sites
- integrated needs across problem elements to ensure a systems basis was maintained

Step 4 - Validate High-Impact Needs and Problem Elements - reviewed by DOE site user representatives.

The following sections address each of these steps.

3.1 Needs Data Collection and Validation

3.1.1 Site Needs Data Collection

The TFA already possessed a set of needs collected in FY 1995 from the four major DOE tank sites. The TFA recognized the importance of a similar effort again this year. As a result, the TFA asked each site to review and update the needs collected in FY 1995. Each site was requested to

- delete those needs no longer applicable
- modify those needs that are still valid but require some change
- add new needs
- describe whether the site considers the need as a high, medium, or low priority.

All four sites provided this information, as well as the identification of EM-30/40 funded activities intended to partially or wholly address each need. In addition, each site described the criteria used to determine site priorities. All needs were entered into a new database, separate from the previous year, within the NBS assigned by the site. A total of 273 needs were modified, reaffirmed, or developed and submitted by the sites.

3.1.2 Site Needs Data Validation

After the site needs were cataloged, they were drafted onto site needs templates, similar to those shown in Appendix A. The USG and DOE site user representatives were asked to review the templates, mark up any changes as desired, and confirm that the TFA accurately captured the site input.

3.2 High-Impact Needs Definition

The TFA's challenge was to determine which site needs better reflected complex-wide needs that could form the basis for an integrated tanks technology development program. The first step was to develop the following criteria that would be used to assist in making initial determinations:

- **site priority** - needs identified by the sites as high, medium, or low priority retained those same ratings. The TFA assumed sites considered the urgency of need in their rankings, including responses to regulatory commitments.
- **cost reduction** - needs with an estimated savings of $250M were rated high, between $250M and $50M were rated medium, and less than $50M were rated low.

- **confidence** - the TFA estimated whether research and development responsive to each need would increase the confidence that the site would manage or remediate its tank waste effectively.

  a) A rating of "high" corresponded to needs for which a site could not proceed without a solution.

  b) "Medium" was for needs where there was a possibility that cleanup would be delayed if the need was not met.

  c) "Low" corresponded to needs where a solution would help the site, but would be able to go forward with cleanup without a solution.

- **broad-based** - solutions to each need could be deployed at more than one site or with multiple tanks at a single site.

  a) A rating of "high" was given if all sites had the same need.

  b) A rating of "medium" was given if two or three sites had the same need.

  c) A rating of "low" meant only one site had the need.

These criteria, although initially developed by the TFA, were presented to each of the DOE site user representatives and the USG for comment and recommendation. A few modifications were suggested.

In the second step, with the application of these criteria, the TFA identified a high-impact subset of the needs. In general, the TFA selected nearly all (approximately 95%) site-named high-priority needs, and selected the site-named medium- and low-priority needs on an exception basis after careful review of the needs against the criteria. Of the 273 needs submitted, the TFA designated 130 needs as high impact.

After examining each individual need, the TFA made a complex-wide assessment and determined that there were some additional technology gaps. As a result, the TFA introduced 14 additional needs to the high-impact set, for a total of 144.

3.3 High-Impact Needs Validation

The initial selection of high-impact needs was validated by a meetings and teleconferences with the USG. The USG conducted a detailed review of the high-impact set and accepted the TFA's actions, recommending only minor modifications. In addition, the high-impact set was validated with the DOE site user representatives. This was done by a teleconference in which a number of outstanding issues were resolved and clarified. Several needs were

addressed individually, resulting in the addition and removal of needs from the entire list of needs and the high-impact list.

Following the site teleconference, 278 out of 287 complex-wide needs remained, with 130 designated as high impact. This document only lists and describes those 130 high-impact needs which the TFA considers critical for FY 1997 and FY 1998. The response to those needs forms the basis for the FY 1998 Internal Review Budget (IRB) and the Multi-Year Program Plan (MYPP). Descriptions of each of the 130 high-impact needs are presented in Appendix A. STCGs are being briefed at their request.

3.4 Program Planning Framework Development

The TFA established a framework to begin the program planning process. This framework groups similar or related needs from different sites and allows for technical integration across functions to solve specific problems, as opposed to consolidating needs by technical focus. This activity begins the transition from needs collection and analysis to TFA program development. Program development is addressed in the upcoming revision to the MYPP. To describe the TFA's program planning framework, the problem element structure is introduced here. The problem elements

- provide an updated method to logically group high-impact needs
- assist in sequencing and scheduling needs resolution
- identify the problem elements and the needs within them as baseline, enhancements, or alternatives.

The problem element structure appears in Table 3.1.

WBS#	Problem Element
1.0	Remediate Tanks
1.1	Store Waste
1.1.1	Extend Tank Life
1.1.1.1	Monitor Tank Integrity
1.1.1.2	Avoid Tank Corrosion
1.1.1.3	Remediate Loss of Tank Integrity
1.1.2	Ventilate Tanks
1.1.3	Characterize Waste
1.1.3.1	Characterize Waste In Situ
1.1.3.2	Sample Waste
1.1.3.3	Analyze Waste
1.1.4	Reduce Waste Volume
1.1.4.1	Reduce Source Streams
1.1.4.2	Reduce Recycle Streams
1.2	Process Waste
1.2.1	Retrieve Waste
1.2.1.1	Deploy Equipment
1.2.1.2	Mobilize Bulk Waste
1.2.1.3	Mix Waste
1.2.1.4	Transfer Waste
1.2.1.5	Detect and Mitigate Leaks
1.2.1.6	Monitor & Control Retrieval Process
1.2.1.7	Interface with Pretreatment
1.2.1.8	Mobilize Heel
1.2.2	Pretreat Waste
1.2.2.1	Calcine Waste
1.2.2.2	Dissolve Waste
1.2.2.3	Interface with Retrieval & Transfer
1.2.2.4	Clarify Liquid Stream
1.2.2.5	Remove Radionuclide
1.2.2.6	Interface with LLW Immobilization
1.2.2.7	Process Sludge
1.2.2.8	Interface with HLW Immobilization
1.2.2.9	Monitor & Control Process
1.2.3	Immobilize Waste
1.2.3.1	Process LLW
1.2.3.1.1	Monitor & Control Process
1.2.3.1.2	Prepare Feed
1.2.3.1.3	Immobilize LLW Stream
1.2.3.1.4	Treat Offgas
1.2.3.2	Process HLW
1.2.3.2.1	Monitor & Control Process
1.2.3.2.2	Prepare Secondary Waste from Pretreatment
1.2.3.2.3	Prepare Sludge Feed
1.2.3.2.4	Immobilize HLW Stream
1.2.3.2.5	Treat Offgas
1.3	Store Waste Forms and Close Tanks
1.3.1	Close Tanks
1.3.1.1	Monitor Tank
1.3.1.2	Characterize Heels
1.3.1.3	Define Closure Criteria
1.3.1.4	Interface with Pretreatment
1.3.1.5	Treat Heel in Place
1.3.1.6	Detect Leaks
1.3.1.7	Stabilize Tank for Closure
1.3.1.8	Monitor Site
1.3.2	Dispose of LLW
1.3.2.1	Monitor Waste for Acceptance
1.3.2.2	Determine Performance of Waste Form
1.3.2.3	Provide Disposal System
1.3.3	Store and Dispose HLW
1.3.3.1	Provide Interim Storage HLW
1.3.3.2	Provide Shipping Facilities

Table 3.1. Problem Element Structure

Following selection of high-impact needs and development of the problem elements, the TFA grouped related needs within the problem element structure. As stated earlier, this begins the transition between needs collection and analysis and program development. The high-impact needs shown in the problem element structure are shown in Table 3.2: (In Table 3.2, Site Need consists of a TFA record number and need title.)

3.5 Data Summary

In all, the sites submitted or validated 273 needs. The TFA generated 14 additional needs. The TFA initially selected 144 as high impact. Following USG and site review, there were 278 total needs, with 130 designated as high impact. The number of needs provided by each site and the final prioritization are summarized in Figure 3.1.

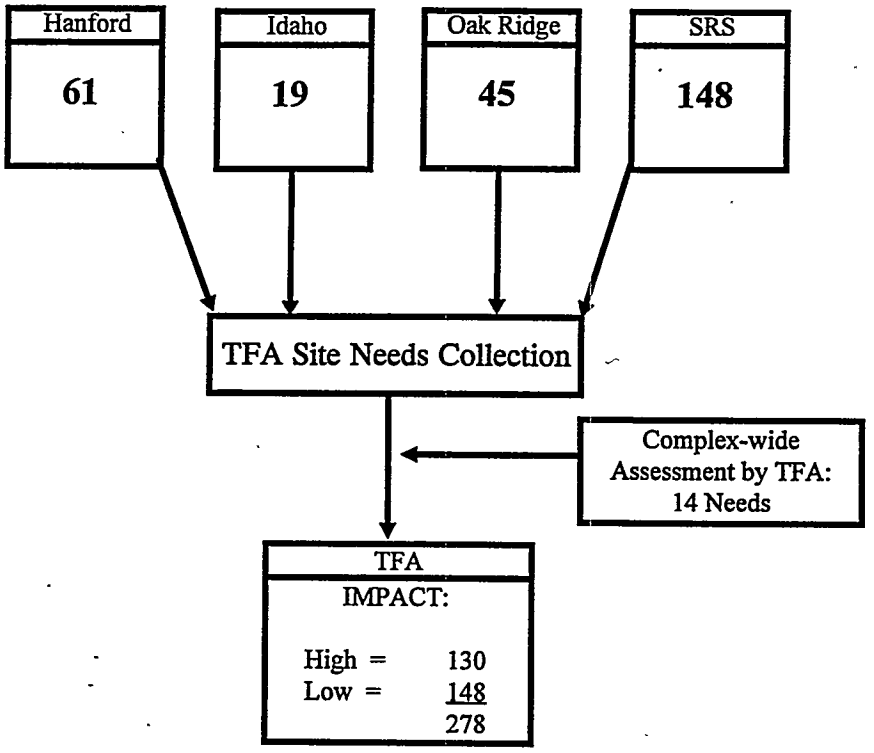


Figure 3.1. Site Needs Input

Site Need	Problem Element
169 - Develop "Fly By" NDE Inspection System/Idaho	Extend Tank Life - Monitor Tank Integrity
363 - Issues with Safe Operation, Decon, and Removal of Tank End Effectors/Idaho	
382 - Develop Real-Time Corrosion Monitoring Techniques/SRS	
601 - Extension of Carbon Steel Tank Life and Minimizing the Imact to Processing/TIM	Avoid Tank Corrosion
514 - Develop Mechanisms and/or Devices to Passively Ventilate Hydrogen and Other Potentially Combustible Vapors from HLW Tanks/SRS	Ventilate Tanks
357 - Field Methods for 3D Mapping of Waste Chemical and Radiological Properties/Oak Ridge	Characterize Waste In Situ
399 - Develop In Situ Sensor to Identify Flammable Gas Species/Idaho	
486 - In Situ Characterization Capability (Minilab)/Idaho	
531 - Development of Direct/Indirect In Situ Waste Energetics Measurement Capability/Hanford	
532 - Instrumentation to Remotely Monitor Low (<5 wt.%) Waste Moisture Concentrations/Hanford	
541 - In Situ Core Drilling-Speciation/Hanford	
530 - Off Riser Sampling/Hanford	Sample Waste
595 - Waste Characterization for Tc/TIM	Analyze Waste
596 - Waste Characterization Strategy (Physical/Chemical) to Support Processing Needs/TIM	
102 - Concentrate Waste - Reducing Water Volume of DWPF/SRS	Reduce Recycle Streams
303 - DWPF Recycle Stream Flow and Composition/SRS	
309 - Methods for Recycle Minimization/SRS	
64 - Heel Waste Retrieval - Vehicle/Oak Ridge	Deploy Equipment
187 - Heel Waste Retrieval/Characterization - LDUA Deployment Systems/Oak Ridge	
346 - Bulk Sludge Mobilization and Slurry Transport - Alternative Mechanical Mobilization Systems/Oak Ridge	
347 - Heel Waste Retrieval - WD&C/Oak Ridge	
363 - Issues with Safe Operation, Decon, and Removal of Tank End Effectors/Idaho	
364 - Issues with Safe Removal, Decon, and Insertion of Retrieval Devices/Oak Ridge	
365 - Issues with Safe Removal, Decon, and Insertion of Retrieval Devices/SRS	
371 - Develop Inspection Technologies for Type I & II Tank Annulus/SRS	

Table 3.2. High-Impact Needs and Problem Elements

Site Need	Problem Element
423 - Develop Removal Techniques for Mired Equipment/SRS	Deploy Equipment
445 - Heel Waste Retrieval/Characterization - LDUA Deployment Systems/Idaho	
530 - Off Riser Sampling/Hanford	
602 - Develop Strategy, Requirements, and Needs for Deployment in Tanks/TIM	
343 - Bulk Sludge Mobilization and Slurry Transport - Mix & Mobilize Sludge/Oak Ridge	Mobilize Bulk Waste
346 - Bulk Sludge Mobilization and Slurry Transport - Alternative Mechanical Mobilization Systems/Oak Ridge	
347 - Heel Waste Retrieval - WD&C/Oak Ridge	
374 - Develop Simulants/Idaho	
375 - Develop Simulants/Oak Ridge	
421 - Outline Mix Requirements and Pump Configuration for Salt Dissolution/Sludge Removal/SRS	
422 - Improve Salt Mining Equipment and Techniques/SRS	
430 - Develop Method to Address Insoluble Solids in Salt Tanks/SRS	
431 - Develop Method to Remove Mixed Salt and Sludge/SRS	
432 - Develop Method to Remove Dry/Hardened Sludge/SRS	
436 - Develop Method to Remove Tank Heels/SRS	
439 - Develop Improved Slurry Pumps to Minimize Addition of Inhibited Water/SRS	
448 - Retrieve Calcine From Bins/Idaho	
487 - Develop Simulants/SRS	
534 - Waste Retrieval Methods Needed for DST Waste Not Amenable to Advanced Design Mixer Pump Retrieval/Hanford	
535 - SST Retrieval Equipment/System Development/Hanford	
569 - Settle Decant Demonstration for Solid-Liquid Separations/Hanford	
575 - Simulant (Retrieval Process Test Material) Development/Hanford	
343 - Bulk Sludge Mobilization and Slurry Transport - Mix & Mobilize Sludge/Oak Ridge	Mix Waste
346 - Bulk Sludge Mobilization and Slurry Transport - Alternative Mechanical Mobilization Systems/Oak Ridge	
347 - Heel Waste Retrieval - WD&C/Oak Ridge	
374 - Develop Simulants/Idaho	
375 - Develop Simulants/Oak Ridge	

Table 3.2. (contd)

Site Need	Problem Element
421 - Outline Mix Requirements and Pump Configuration for Salt Dissolution/Sludge Removal/SRS	Mix Waste
422 - Improve Salt Mining Equipment and Techniques/SRS	
431 - Develop Method to Remove Mixed Salt and Sludge/SRS	
432 - Develop Method to Remove Dry/Hardened Sludge/SRS	
439 - Develop Improved Slurry Pumps to Minimize Addition of Inhibited Water/SRS	
448 - Retrieve Calcine From Bins/Idaho	
487 - Develop Simulants/SRS	
534 - Waste Retrieval Methods Needed for DST Waste Not Amenable to Advanced Design Mixer Pump Retrieval/Hanford	
535 - SST Retrieval Equipment/System Development/Hanford	
575 - Simulant (Retrieval Process Test Material) Development/Hanford	
185 - Bulk Sludge Mobilization and Slurry Transport - Slurry Transport Studies/Oak Ridge	Transfer Waste
343 - Bulk Sludge Mobilization and Slurry Transport - Mix & Mobilize Sludge/Oak Ridge	
346 - Bulk Sludge Mobilization and Slurry Transport - Alternative Mechanical Mobilization Systems/Oak Ridge	
347 - Heel Waste Retrieval - WD&C/Oak Ridge	
374 - Develop Simulants/Idaho	
375 - Develop Simulants/Oak Ridge	
405 - Develop Improved Pump Testing and Maintenance Program/SRS	
422 - Improve Salt Mining Equipment and Techniques/SRS	
431 - Develop Method to Remove Mixed Salt and Sludge/SRS	
432 - Develop Method to Remove Dry/Hardened Sludge/SRS	
439 - Develop Improved Slurry Pumps to Minimize Addition of Inhibited Water/SRS	
448 - Retrieve Calcine From Bins/Idaho	
487 - Develop Simulants/SRS	
575 - Simulant (Retrieval Process Test Material) Development/Hanford	
384 - Develop Leak Repair Techniques/SRS	Detect and Mitigate Leaks
544 - Tank Leak Mitigation Systems/Hanford	
345 - Bulk Sludge Mobilization and Slurry Transport - In-Line Solids Monitoring/Oak Ridge	Monitor & Control Retrieval Process

Table 3.2. (contd)

Site Need	Problem Element
482 - On-Line Monitoring Waste Retrieval Process/Oak Ridge	Monitor & Control Retrieval Process
555 - Real Time Waste Property Measurement System for Waste Transfer/Hanford	
594 - Develop Strategy and Method for Managing Interface Between Functions/TIM	Interface with Pretreatment
597 - Waste Handling at the Interface with Retrieval and Immobilization/TIM	
162 - Retrieval: Robotics, Mixer Pumps, Waste Dislodging and Conveyance/Idaho	Mobilize Heel
437 - Tank Clean and Closure/SRS	
475 - Tank System Closure Demonstration/Oak Ridge	
528 - Tank Closure Demonstration for an Arid Site/Hanford	
501 - Alternative Calcination Process Flowsheet/Idaho	Calcine Waste
502 - On-Line Process Monitor for Elemental Analysis of Calcine Product/Idaho	
591 - Prevent/Remediate Foaming in Process Vessels/TIM	Interface with Retrieval & Transfer
597 - Waste Handling at the Interface with Retrieval and Immobilization/TIM	
598 - Waste Chemistry/TIM	
9 - Removal of Undissolved Solids from Tank Waste & Dissolved Calcine/Idaho	Clarify Liquid Stream
97 - Late Wash Precipitate - Clarification of Liquid Streams/SRS	
176 - Liquids/Solids Separations Studies/Oak Ridge	
403- Optimize Transfer Jet Performance/SRS	
563 - Demonstrate Filtration for Pretreatment Solid-Liquid Separations/Hanford	
569 - Settle Decant Demonstration for Solid-Liquid Separations/Hanford	
247 - Removal of TRU, Sr, Tc, Cs from Tank Waste & Dissolved Calcine/Idaho	Remove Radionuclide
489 - LLLW Supernatant/Oak Ridge	
495 - Sr, Tc, and Ru Removal/Oak Ridge	
498 - Source Treatment/Oak Ridge	
519 - Evaluate Ion Exchange or Precipitation Methods to Selectively Remove Cesium from High Potassium Salts/SRS	
533 - Technetium Removal/Hanford	
539 - Demonstration of TRU/Sr-90 Removal/Hanford	
562 - Demonstrate Cs Removal for Hanford Supernatants/Hanford	

Table 3.2. (contd)

Site Need	Problem Element
597 - Waste Handling at the Interface with Retrieval and Immobilization/TIM	Interface with LLW Immobilization
598 - Waste Chemistry/TIM	
600 - Reduce Volume of LLW by Sodium Nitrate Recovery/TIM	
178 - Sludge Separations/Oak Ridge	Process Sludge
518 - Develop Counter-Current Decantation Process for Sludge Washing/SRS	
538 - Pretreatment Demonstration for Phase I Sludges/Hanford	
553 - Pretreatment Demonstration for Phase II HLW Sludges/Hanford	
574 - Continuous Sludge Leaching and Processing Reactors/Hanford	
517 - Develop Electrochemical Treatment of Salt Solutions for Caustic Recovery and Recycle/SRS	Interface with HLW Immobilization
570 - LLW - Separable Phase Organics/Hanford	
585 - Cost Effective Caustic Recycle/Hanford	
591 - Prevent/Remediate Foaming in Process Vessels/TIM	
597 - Waste Handling at the Interface with Retrieval and Immobilization/TIM	
598 - Waste Chemistry/TIM	
599 - Concentration of Sludge Prior to Immobilization/TIM	
94 - Characterization Methods for Tc-99 and I-129/Oak Ridge	Process LLW - Monitor & Control Process
529 - Waste Acceptance Testing/Hanford	
549 - LLW - On-Line Analysis/Hanford	
593 - Identification of Technology Gaps to Support Privatization/TIM	Prepare LLW Feed
594 - Develop Strategy and Method for Managing Interface Between Functions/TIM	
252 - Develop Grout Process for Sodium Bearing Waste/Idaho	Immobilize LLW Stream
492 - Waste Form Acceptance/Oak Ridge	
493 - Sludge Waste Form Study/Oak Ridge	
494 - Sludge Waste Form Demonstration/Oak Ridge	
524 - Evaluate LLW Vitrification as an Alternative to Saltstone/SRS	
543 - LLW - Offgas Treatment/Hanford	Treat Offgas
594 - Develop Strategy and Method for Managing Interface Between Functions/TIM	
285 - DWPF Analytical Methods for Attainment/SRS	Process HLW - Monitor & Control Process
287 - Improve DWPF Level Probes/SRS	
529 - Waste Acceptance Testing/Hanford	

Table 3.2. (contd)

Site Need	Problem Element
189 - Secondary Waste Immobilization Studies/Oak Ridge	Prepare Secondary Waste from Pretreatment
558 - Process for Immobilization of Tc-Rich Waste Stream/Hanford	
567 - Crystalline Silico-Titanate (CST) in HLW Glass/Hanford	
66 - Prepare Melter Feed - Enhance Pumping/Mixing/SRS	Prepare HLW Feed
266 - DWPF Flowsheet Model/SRS	
269 - Effects of Irradiation on Precipitate/SRS	
310 - Determine Maximum H_2 Evolution/SRS	
316 - Reduce Noble Metal Deposition/SRS	
520 - Optimize Waste Loading for DWPF Glass/SRS	
521 - Identify Alternates to Formic Acid for Melter Feed Redox Adjustment to Reduce H_2 and NH_3 Formation/SRS	
523 - Demonstrate Process for Amalgamation of Mercury which Results in a Nonhazardous Waste/SRS	
554 - Waste Loading Optimization for HLW/Hanford	
593 - Identification of Technology Gaps to Support Privatization/TIM	
594 - Develop Strategy and Method for Managing Interface Between Functions/TIM	
1 - Develop HLW Formulations for the High Activity Fraction of SBW and Calcine/Idaho	Immobilize HLW Stream
4 - Process Control Limits and Model Development for Waste Immobilization/Idaho	
5 - Integrated Demonstration of Immobilization Equipment/Idaho	
315 - Extend Operating Life of DWPF Melter/SRS	
316 - Reduce Noble Metal Deposition/SRS	
501 - Alternative Calcination Process Flowsheet/Idaho	
542 - Radioactive HLW Vitrification Tests - Phase I/Hanford	
561 - Radioactive Small-Scale Vitrification Demonstration (HLW-13)/Hanford	
592 - Smaller, Cheaper Melters/TIM	
282 - Cold Cap/Offgas Thermodynamics Model/SRS	Treat Offgas
594 - Develop Strategy and Method for Managing Interface Between Functions/TIM	
169 - Develop "Fly By" NDE Inspection System/Idaho	Monitor Tank

Table 3.2. (contd)

Site Need	Problem Element
445 - Heel Waste Retrieval/Characterization - LDUA Deployment Systems/Idaho	Characterize Heels
165 - Determination of a Generalized Risk-Based Closure Criteria/Idaho	Define Closure Criteria
435 - Determine Zeolite Removal Requirements/SRS	
437 - Tank Clean and Closure/SRS	
454 - Stabilization and Closure Analysis Tools/SRS	
455 - Establish Clean-Up Standard/Criteria/Oak Ridge	
459 - Data for Closure/SRS	
475 - Tank System Closure Demonstration/Oak Ridge	
528 - Tank Closure Demonstration for an Arid Site/Hanford	
382 - Develop Real-Time Corrosion Monitoring Techniques/SRS	Interface with Pretreatment
419 - Determine Salt Dissolution Kinetics/SRS	
594 - Develop Strategy and Method for Managing Interface Between Functions/TIM	
598 - Waste Chemistry/TIM	
500 - In Situ Sludge Treatment Capability Studies/Oak Ridge	Treat Heel in Place
546 - Testing of Capillary Breaks/Hanford	Stabilize Tank for Closure
547 - Getter Materials/Hanford	
578 - Long-Term Testing of Surface Barrier/Hanford	
529 - Waste Acceptance Testing/Hanford	Monitor Waste for Acceptance
540 - Contaminant Release from Waste Form/Hanford	Determine Performance of Waste Form
545 - In Situ Testing of LLW Glass Release/Hanford	
590 - Establish Waste Acceptance for Idaho Grout/TIM	
87 - Manage Disposal of Tank Farm Failed Equipment/SRS	Provide Disposal System
462 - Close LLW Storage Vaults/SRS	
482 - On-Line Monitoring Waste Retrieval Process/Oak Ridge	
546 - Testing of Capillary Breaks/Hanford	
547 - Getter Materials/Hanford	
578 - Long-Term Testing of Surface Barrier/Hanford	
589 - Need for Consistent Waste Acceptance Criteria for Private Vendors/TIM	

Table 3.2. (contd)

Section 4 - Next Steps

The TFA considers the needs assessment the starting point for the annual refinement and redefinition of its technical program. The grouping of needs within the problem element structure permits a problem-oriented analysis from a complex-wide perspective. When matched with present and ongoing technical activities related to each of the needs, as well as the schedule drivers for the needs, the TFA expects likely technology targets to emerge. The proposed TFA technical response is the product of the following steps:

Step 1 - Complete Needs Assessment

Step 2 - Map Site Schedules to High-Impact Needs

Step 3 - Identify Products and Need Activities for FY 1997 and FY 1998 Required to Meet Schedules

Step 4 - Map Planned Technical Work within EM-30, 40, and 50 to FY 1997 and FY 1998 Activities to Identify Gaps

Step 5 - Describe Scope and Products Required in FY 1998

Step 6 - Document in the TFA MYPP.

4.1 Complete Needs Assessment

The identification and validation of high-impact needs is presented in this document. This information is used as the basis for subsequent steps that lead to technical program definition.

4.2 Map Site Schedules to High-Impact Needs

Site schedule information pertinent to the needs are collected from site documents and validated by DOE site user representatives. These schedules are driven by both Federal Facility Agreements and programmatic timetables. These drivers are taken into account to describe impacts if needs are not met due to budget or other constraints. This information is used to sequence complex-wide needs in a manner that delivers integrated technical solutions on time for technology transfer to the user.

4.3 Identify FY 1997 and FY 1998 Activities Required to Meet Needs

There are generally two types of products required to close a site-identified needs: data or hardware. Cost and performance data are frequently required by the sites to support decisions associated with selection of technology for implementation. After the decision to

use a particular technology or technical approach is made, first of a kind hardware may need to be delivered to conduct integrated testing in support of technology transfer to the user. For each of the high-impact needs, a determination on the type of product required is made and the type of technical activities required to deliver this product are identified.

4.4 Map Planned Technical Work

The DOE site user representatives provided input on the planned FY 1997 activities supported by their site's EM-30 or EM-40 programs for many of the needs that were submitted. The TFA maps planned EM-50 work for the high-impact needs. A gap analysis is then conducted to identify key needs that are not being met by planned EM-30, 40, and 50 programs. Subsequently, recommendations are made for adjustments and impacts are identified where shortfalls still exist.

4.5 Describe Scope and Products Required in FY 1998

Based on the information developed in the preceding steps, the general scope and product required for delivery in FY 1998 and beyond are defined. This information is based on the knowledge of likely technical solutions that could be applied and delivered to the user within the required time frame and the understanding of the maturity of that technology. This information can then be used to develop generic workscope based on user performance requirements that comprise the basis for the MYPP and calls for proposals. In the IRB process, the required linking to EM-30 and EM-40 programs to ensure transfer of the technology to the users will be accomplished. Part of this process includes the linking of Risk Data Sheets (RDS) between EM-30, 40, and 50. Therefore, the TFA response to the site needs forms the basis for the FY 1998 IRB and the MYPP.

4.6 Multi-Year Program Plan

The companion document to this one is the TFA MYPP. It documents the results of the preceding planning steps and is the basis for complementary planning between EM-30, 40, and 50 in future years, which is reflected in the IRB process. This approach is consistent with the TFA goal of defining and implementing an integrated technical program.

Section 5 - References

Tanks Focus Area (TFA). 1995. *TFA Site Needs Data Assessment.* Pacific Northwest Laboratory, Richland, Washington.

Appendix A - Site Needs Database

The following detailed needs templates describe the high-impact set submitted by the sites and selected by the TFA. The TFA assigns an identification number, called a "Record Number," to each submitted need. For audit trail purposes, this number remains with the need, and the number is not duplicated. Therefore, needs submitted last year retained their own distinctive Record Number, and new needs this year received a new number. A summary of all high-impact needs is shown in Table A.1. The needs are grouped by site. Individual detail sheets for each need follow Table A.1. For ease of use, these sheets appear order of Record Number.

#	Need Title	Function	Site
529	Waste Acceptance Testing	Characterization	Hanford
530	Off Riser Sampling	Characterization	Hanford
531	Development of Direct/Indirect In Situ Waste Energetics Masurement Capability	Characterization	Hanford
541	In-Situ Core Drilling-Speciation	Characterization	Hanford
555	Real Time Waste Property Measurement System for Waste Transfer	Characterization	Hanford
540	Contaminant Release from Waste Form	Immobilization	Hanford
542	Radioactive HLW Vitrification Tests - Phase I	Immobilization	Hanford
543	LLW - Offgas Treatment	Immobilization	Hanford
545	In-Situ Testing of LLW Glass Release	Immobilization	Hanford
549	LLW - On-line Analysis	Immobilization	Hanford
554	Waste Loading Optimization for HLW	Immobilization	Hanford
558	Process for Immobilization of Tc-Rich Waste Stream	Immobilization	Hanford
561	Radioactive Small-Scale Vitrification Demonstration (HLW-13)	Immobilization	Hanford
567	Crystalline Silico-Titanate (CST) in HLW Glass	Immobilization	Hanford
533	Technetium Removal	Pretreatment	Hanford
538	Pretreatment Demonstration for Phase I Sludges	Pretreatment	Hanford
539	Demonstration of TRU/Sr-90 Removal	Pretreatment	Hanford
553	Pretreatment Demonstration for Phase II HLW Sludges	Pretreatment	Hanford
562	Demonstrate Cs Removal for Hanford Supernatants	Pretreatment	Hanford
563	Demonstrate Filtration for Pretreatment Solid-Liquid Separations	Pretreatment	Hanford
569	Settle Decant Demonstration for Solid-Liquid Separations	Pretreatment	Hanford
574	Continuous Sludge Leaching and Processing Reactors	Pretreatment	Hanford
585	Cost Effective Caustic Recycle	Pretreatment	Hanford
534	Waste Retrieval Methods Needed for DST Waste Not Amenable to Avanced Design Mixer Pump Retrieval	Retrieval	Hanford
535	SST Retrieval Equipment/System Development	Retrieval	Hanford
575	Simulant (Retrieval Process Test Material) Development	Retrieval	Hanford
532	Instrumentation to Remotely Monitor Low (<5 wt.%) Waste Moisture Concentrations	Safety	Hanford
544	Tank Leak Mitigation Systems	Safety	Hanford
570	LLW - Separable Phase Organics	Safety	Hanford
528	Tank Closure Demonstration for an Arid Site	Stabilization/Closure	Hanford
546	Testing of Capillary Breaks	Stabilization/Closure	Hanford
547	Getter Materials	Stabilization/Closure	Hanford
578	Long-term Testing of Surface Barrier	Stabilization/Closure	Hanford
399	Develop In Situ Sensor to Identify Flammable Gas Species	Characterization	Idaho
486	In Situ Characterization Capability (Minilab)	Characterization	Idaho
1	Develop HLW Formulations for the High Activity Fraction of SBW and Calcine	Immobilization	Idaho
4	Process Control Limits and Model Development for Waste Immobilization	Immobilization	Idaho
5	Integrated Demonstration of Immobilization Equipment	Immobilization	Idaho
252	Develop Grout Process for Sodium Bearing Waste	Immobilization	Idaho
9	Removal of Undissolved Solids from Tank Waste & Dissolved Calcine	Pretreatment	Idaho
247	Removal of TRU, Sr, Tc, Cs from Tank Waste & Dissolved Calcine	Pretreatment	Idaho
501	Alternative Calcination Process Flowsheet	Pretreatment	Idaho
502	On-line Process Monitor for Elemental Analysis of Calcine Product	Pretreatment	Idaho
162	Retrieval of Waste Heel at Idaho	Retrieval	Idaho
169	Develop "Fly By" NDE Inspection System	Retrieval	Idaho
363	Issues with Safe Operation, Decon, and Removal of Tank End Effectors	Retrieval	Idaho
374	Develop Simulants	Retrieval	Idaho
445	Heel Waste Retrieval/Characterization - LDUA Deployment Systems	Retrieval	Idaho
448	Retrieve Calcine From Bins	Retrieval	Idaho
165	Determination of a Generalized Risk-Based Closure Criteria	Stabilization/Closure	Idaho

Table A.1 High-Impact Needs by Site

#	Need Title	Function	Site
94	Characterization Methods for Tc-99 and I-129	Characterization	Oak Ridge
357	Field Methods for 3D Mapping of Waste Chemical and Radiological Properties	Characterization	Oak Ridge
482	On-line Monitoring Waste Retrieval Process	Characterization	Oak Ridge
189	Secondary Waste Immobilization Studies	Immobilization	Oak Ridge
492	Waste Form Acceptance	Immobilization	Oak Ridge
493	Sludge Waste Form Study	Immobilization	Oak Ridge
494	Sludge Waste Form Demonstration	Immobilization	Oak Ridge
176	Liquids/Solids Separations Studies	Pretreatment	Oak Ridge
178	Sludge Separations	Pretreatment	Oak Ridge
489	LLLW Supernatant	Pretreatment	Oak Ridge
495	Sr, Tc, and Ru Removal	Pretreatment	Oak Ridge
498	Source Treatment	Pretreatment	Oak Ridge
64	Heel Waste Retrieval - Vehicle	Retrieval	Oak Ridge
185	Bulk Sludge Mobilization and Slurry Transport - Slurry Transport Studies	Retrieval	Oak Ridge
187	Heel Waste Retrieval/Characterization - LDUA Deployment Systems	Retrieval	Oak Ridge
343	Bulk Sludge Mobilization and Slurry Transport - Mix & Mobilize Sludge	Retrieval	Oak Ridge
345	Bulk Sludge Mobilization and Slurry Transport - In-line Solids Monitoring	Retrieval	Oak Ridge
346	Bulk Sludge Mobilization and Slurry Transport - Alternative Mechanical Mobilization Systems	Retrieval	Oak Ridge
347	Heel Waste Retrieval - WD&C	Retrieval	Oak Ridge
364	Issues with Safe Removal, Decon, and Insertion of Retrieval Devices	Retrieval	Oak Ridge
375	Develop Simulants	Retrieval	Oak Ridge
455	Establish Clean-up Standard/Criteria	Stabilization/Closure	Oak Ridge
500	In Situ Sludge Treatment Capability Studies	Stabilization/Closure	Oak Ridge
475	Tank System Closure Demonstration	Stabilization/Closure	Oak Ridge
382	Develop Real-Time Corrosion Monitoring Techniques	Characterization	SRS
66	Prepare Melter Feed - Enhance Pumping/Mixing	Immobilization	SRS
266	DWPF Flowsheet Model	Immobilization	SRS
269	Effects of Irradiation on Precipitate	Immobilization	SRS
282	Cold Cap/Offgas Thermodynamics Model	Immobilization	SRS
285	DWPF Analytical Methods for Attainment	Immobilization	SRS
287	Improve DWPF Level Probes	Immobilization	SRS
315	Extend Operating Life of DWPF Melter	Immobilization	SRS
316	Reduce Noble Metal Deposition	Immobilization	SRS
520	Optimize Waste Loading for DWPF glass	Immobilization	SRS
521	Identify Alternates to Formic Acid for Melter Feed Redox Adjustment to Reduce H_2 and NH_3 Formation	Immobilization	SRS
523	Demonstrate Process for Amalgamation of Mercury which Results in a Nonhazardous Waste	Immobilization	SRS
524	Evaluate LLW Vitrification as an Alternative to Saltstone	Immobilization	SRS
97	Late Wash Precipitate - Clarification of Liquid Streams	Pretreatment	SRS
102	Concentrate Waste - Reducing Water Volume of DWPF	Pretreatment	SRS
303	DWPF Recycle Stream Flow and Composition	Pretreatment	SRS
309	Methods for Recycle Minimization	Pretreatment	SRS
517	Develop Electrochemical Treatment of Salt Solutions for Caustic Recovery and Recycle	Pretreatment	SRS
518	Develop Counter-current Decantation Process for Sludge Washing	Pretreatment	SRS
519	Evaluate Ion Exchange or Precipitation Methods to Selectively Remove Cesium from High Potassium Salts	Pretreatment	SRS
365	Issues with Safe Removal, Decon, and Insertion of Retrieval Devices	Retrieval	SRS
384	Develop Leak Repair Techniques	Retrieval	SRS
403	Optimize Transfer Jet Performance	Retrieval	SRS
405	Develop Improved Pump Testing and Maintenance Program	Retrieval	SRS

Table A.1 (contd)

#	Need Title	Function	Site
419	Determine Salt Dissolution Kinetics	Retrieval	SRS
421	Outline Mix Requirements and Pump Configuration for Salt Dissolution/Sludge Removal	Retrieval	SRS
422	Improve Salt Mining Equipment and Techniques	Retrieval	SRS
423	Develop Removal Techniques for Mired Equipment	Retrieval	SRS
430	Develop Method to Address Insoluble Solids in Salt Tanks	Retrieval	SRS
431	Develop Method to Remove Mixed Salt and Sludge	Retrieval	SRS
432	Develop Method to Remove Dry/Hardened Sludge	Retrieval	SRS
435	Determine Zeolite Removal Requirements	Retrieval	SRS
436	Develop Method to Remove Tank Heels	Retrieval	SRS
439	Develop Improved Slurry Pumps to Minimize Addition of Inhibited Water	Retrieval	SRS
487	Develop Simulants	Retrieval	SRS
87	Manage Disposal of Tank Farm Failed Equipment	Safety	SRS
371	Develop Inspection Technologies for Type I & II Tank Annulus	Safety	SRS
514	Develop Mechanisms and/or Devices to Passively Ventilate Hydrogen and Other Potentially Combustible Vapors from HLW Tanks	Safety	SRS
437	Tank Clean and Closure	Stabilization/Closure	SRS
454	Stabilization and Closure Analysis Tools	Stabilization/Closure	SRS
459	Data for Closure	Stabilization/Closure	SRS
462	Close LLW Storage Vaults	Stabilization/Closure	SRS
595	Waste Characterization for Tc	Characterization	TIM
596	Waste Characterization Strategy (Physical/Chemical) to Support Processing Needs	Characterization	TIM
589	Need for Consistent Waste Acceptance Criteria for Private Vendors	Immobilization	TIM
590	Establish Waste Acceptance for Idaho Grout	Immobilization	TIM
592	Smaller, Cheaper Melters	Immobilization	TIM
593	Identification of Technology Gaps to Support Privatization	Immobilization	TIM
594	Develop Strategy and Method for Managing Interface Between Functions	Immobilization	TIM
591	Prevent/Remediate Foaming in Process Vessels	Pretreatment	TIM
597	Waste Handling at the Interface with Retrieval and Immobilization	Pretreatment	TIM
598	Waste Chemistry	Pretreatment	TIM
599	Concentration of Sludge Prior to Immobilization	Pretreatment	TIM
600	Reduce Volume of LLW by Sodium Nitrate Recovery	Pretreatment	TIM
602	Develop Strategy, Requirements, and Needs for Deployment in Tanks	Retrieval	TIM
601	Extension of Carbon Steel Tank Life and Minimizing the Impact to Processing	Safety	TIM

Table A.1 (contd)

Tanks Focus Area Site Needs	Need Title:	Develop HLW Formulations for the High Activity Fraction of SBW and Calcine
	Site Name:	Idaho
	NBS#:	1.2.4.1.1

Primary Technical Integration Area: Immobilization

Need Description:
Immobilize the HLW fraction resulting from the pretreatment of the liquid and calcine wastes stored at the ICPP. Also evaluate direct immobilization of ICPP waste to support a systems analysis comparative evaluation. All final immobilized forms must meet applicable requirements for HLW storage and disposal.

Solution Required by: 1095/12/99

Drivers:
Consent and court orders require the ICPP to remove liquid waste from tank farm storage within specified time frames. Future FFCA requirements define the need to remove, process and immobilize HLW calcine existing in ICPP storage bins. Technologies to achieve these requirements have been selected as required by the orders and involve partitioning of radionuclides from acidic liquid feeds (liquid waste or dissolved calcine), and subsequent immobilization of the high and low level waste streams.

Driver Reference:
- US District Court Opinion and Order of Dec 22, 1993
- Modified Notice of Noncompliance Consent Order between the State of Idaho and DOE, March 22, 1994.
- Federal Facilities Compliance Act
- Pending Site-Wide INEL Environmental Impact Statement, Record of Decision

Record Number: 1

Tanks Focus Area Site Needs	Need Title:	Process Control Limits and Model Development for Waste Immobilization
	Site Name:	Idaho
	NBS#:	1.2.4.1.3.1

Primary Technical Integration Area: Immobilization

Need Description:
Immobilize the HLW fraction resulting from the pretreatment of the liquid and calcine wastes stored at the ICPP. Also evaluate direct immobilization of ICPP waste to support a systems analysis comparative evaluation. All final immobilized forms must meet applicable requirements for HLW storage and disposal.

Solution Required by: 9/09-9/19

Drivers:
Consent and court orders require the ICPP to remove liquid waste from tank farm storage within specified time frames. Future FFCA requirements define the need to remove, process and immobilize HLW calcine existing in ICPP storage bins. Technologies to achieve these requirements have been selected as required by the orders and involve partitioning of radionuclides from acidic liquid feeds (liquid waste or dissolved calcine), and subsequent immobilization of the high and low level waste streams. Need eight years before Consent Order.

Driver Reference:
- US District Court Opinion and Order of Dec 22, 1993
- Modified Notice of Noncompliance Consent Order between the State of Idaho and DOE, March 22, 1994.
- Federal Facilities Compliance Act
- Pending Site-Wide INEL Environmental Impact Statement, Record of Decision

Record Number: 4

Tanks Focus Area Site Needs		
	Need Title:	Integrated Demonstration of Immobilization Equipment
	Site Name:	Idaho
	NBS#:	1.2.4.1.5

Primary Technical Integration Area: Immobilization

Need Description:
Need to provide a facility to immobilize liquid waste and calcine granular waste stored at the ICPP that will allow DOE to comply with the NON Consent Order and the FFCA schedule to be negotiated.

Provide development facility modifications and new space to ensure immobilization technologies are developed to meet user needs schedule.

Solution Required by: 10/95-12/99

Drivers:
- Modified NON Consent Order dated 3/17/94
- FFCA site treatment plan, with a facility completion date to be negotiated with the state oversight department.
- Provides DOE with lowest life cycle cost option.

Driver Reference:
- Modified NON Consent Order dated 3/17/94
- FFCA site treatment plan

Record Number: 5

Tanks Focus Area Site Needs		
	Need Title:	Removal of Undissolved Solids from Tank Waste & Dissolved Calcine
	Site Name:	Idaho
	NBS#:	1.2.2.1.1

Primary Technical Integration Area: Pretreatment

Need Description:
A method to separate undissolved solids from sodium bearing waste or dissolved calcine is needed. If the undissolved solids are not adequately removed, the solvent extraction and ion-exchange processes used for TRU, Cs, Sr, and Tc separation will have a high probability of failure.

Solution Required by: 10/96-9/99

Drivers:

Driver Reference:

Record Number: 9

Tanks Focus Area Site Needs	Need Title:	Heel Waste Retrieval - Vehicle
	Site Name:	Oak Ridge
	NBS#:	1.2.1.7.2.4

Primary Technical Integration Area: Retrieval

Need Description:
Oak Ridge has horizontal and vertical steel and concrete storage tanks which will require remediation. Removal of heels of hard sludge and debris will be required. The first tanks to be remediated are the ORNL Gunite tanks, 50 year old concrete unlined tanks, containing both TRU and non-TRU wastes. These tanks are located on Central Avenue in Waste Area Group 1 at ORNL. This area is in the center of ORNL in a high traffic, highly populated area. The largest of these tanks are 50 feet in diameter, 12 feet high at the walls, 18 feet high at the dome and buried under approximately 6 feet of overburden. In the early 1980's approximately 90% of the sludge was removed from these tanks by sluicing. The soil in this area is highly contaminated. A several foot deep supernatant layer of liquid covers the sludge in all but one tank. The total volume of sludge remaining is not well known but is less than 100,000 gallons. A variety of waste forms will be retrieved from the ORNL Gunite tanks. Sludge will range from very soft silt texture to blocks as hard as concrete. A small amount of in-tank hardware and debris will be retrieved. Chunks of the concrete wall that have spalled from the wall and concrete chips resulting from removal of the most contaminated part of the tank floor and walls will need to be removed. Videos of the waste surface show some areas of crystalline structure on the top of the sludge. Contaminated equipment currently in the risers will have to be removed. A Treatability Study is underway to demonstrate and evaluate alternative retrieval techniques. Although the most likely means of mobilizing the sludge will be hydraulic mining of some sort, i.e., sluicing or water-jet cutting, an alternative approach is required for retrieval of the debris, hard sludge, and removal of contaminated floor and wall segments. A remotely operable deployment system and end-effector tools are required to access the tank walls, floor and waste surfaces for waste retrieval and cleaning of the tank surfaces. Because the tanks have only a residual heel remaining either arm-based or vehicle-based retrieval systems could be considered during the Treatability Study. Current plans are to explore both approaches although no currently available arm or vehicle can meet the requirements. Modification of existing systems or development of new systems will be required.

Solution Required by: 1998

Drivers:
The Treatability Study for the Gunite tanks is intended to both demonstrate and evaluate the alternative technologies for remediation of the Gunite tanks. Alternatives demonstrated should represent a range of cleanup performance and implementation cost, within reason, so that the cost and resultant performance for final remediation can be extrapolated from the Treatability Study results. The Treatability Study will be completed by approximately FY 1998 to meet the Gunite Tank Operable Unit Remediation Schedule.

Driver Reference:
a. Tennessee Department of Environment and Conservation (TDEC) Commissioner's Order for the Oak Ridge Reservation (ORR) Site Treatment Plan (STP)
b. Oak Ridge National Laboratory Waste Area Grouping 1 Gunite and Associated Tanks Operable Unit Treatability Study Work Plan, DOE/OR/02-1300&D1

Record Number: 64

Tanks Focus Area Site Needs	Need Title:	Prepare Melter Feed - Enhance Pumping/Mixing
	Site Name:	SRS
	NBS#:	1.2.4.1.2.2

Primary Technical Integration Area: Immobilization

Need Description:

Solution Required by: Immediate

Drivers:
Improved process/product reliability

Driver Reference:
EPA and DOE, "Federal Facility Compliance Agreement," EPA Administrative Docket Number 91-01-FFR, EPA ID Number SCI 890 008 89, Effective 3/13/91.
EPA, SCDHEC, and DOE, Federal Facility Agreement under Section 120 of CERCLA and 3008 (h) and 6001 of RCRA, "EPA Administrative Docket Number 89-05-FE," effective 8/16/93

Record Number: 66

Tanks Focus Area Site Needs	Need Title:	Manage Disposal of Tank Farm Failed Equipment
	Site Name:	SRS
	NBS#:	1.2.2.5.2

Primary Technical Integration Area: Safety

Need Description:
Package, characterize, and ship solid waste in a manner that meets solid waste disposal acceptance criteria.

Also includes the following scope from Record Number 525: Macroencapsulation is the process of immobilizing radioactive contamination by application of surface coatings, such as polymeric organics or a jacket of organic materials. The coating can be applied in a number of ways, such as: dipping, spraying, or pouring resin around the contaminated materials in a container or form. This coating acts to reduce surface exposure and the leaching potential. This would benefit the HLW system, because decontamination and secondary waste generation or disposal would be minimized.

Several studies by SRTC have addressed the feasibility of encapsulation via formation of a polymeric barrier to reduce/fix contamination. See, for example, Rankin (1987) - involving foam injection in contaminated piping and Orebaugh (1993) - involving polymeric resin coating of lead bricks. Specifically, proposed technology development to address this issue is described in the Proposed Site Treatment Plan (PSTP), WSRC-TR-94-0608.

Discussions with J.H. Blankenhorn of SWE indicated that macroencapsulation of HW/MW can be used in a variety of instances when the waste falls under the Debris Rule (diameter < 60 mm). The Debris Rule lists 17 different methods for treatment. Macroencapsulation was set up specifically for the case of lead waste.

- Characterize job control waste and other solid wastes sent to E-Area and the Consolidated Incinerator Facility for disposal.
- Improve decontamination techniques.
- Enhance tracking of radio nuclides based on enhanced process knowledge and previous sampling.
- Develop macroencapsulation techniques for disposal of mixed waste.
- Develop improved size reduction techniques for failed equipment.
- Develop source treatment of waste (decon, etc.) to reduce volume.
- Evaluate alternative solid waste assay techniques.
- Evaluate disposal of failed equipment in Saltstone vaults.
- Evaluate disposal of failed equipment in Tank 16 and grouting in place during tank closure.

Solution Required by: 10/96-9/97

Drivers:
Public and worker health and safety, cost, FFA, FFCA; Tank 19

Driver Reference:
- EPA and DOE, "Federal Facility Compliance Agreement, "EPA Administrative Docket Number 91-01-FFR, EPA ID Number SCI 890 008 89," Effective 3/13/91.
- EPA, SCDHEC, and DOE, Federal Facility Agreement under section 120 of CERCLA and 3008 (h) and 6001 of RCRA, "EPA Administrative Docket Number 89-05-FE," Effective 8/16/93.

Record Number: 87

Tanks Focus Area Site Needs	Need Title:	Characterization Methods for Tc-99 and I-129
	Site Name:	Oak Ridge
	NBS#:	1.1.3.1

Primary Technical Integration Area: Characterization

Need Description:
Development of radiological and chemical characterization methods for minor constituents, such as Tc-99 and I-129, in 4M sodium nitrate solutions with high contamination levels of transuranics, Cs-137, and Sr-90. Present standard equipment and methods do not allow accurate measurements to the levels of detection necessary for waste acceptance at disposal facilities. Accurate contamination levels are required to determine what levels of treatment and immobilization are required for disposal of LLLW.

Solution Required by: 1998

Drivers:
Proper characterization is needed to determine treatment and stabilization requirements to meet WIPP disposal waste acceptance criteria. Needed to meet Gunite Tanks Remediation schedule and schedule for treatment of mixed waste to meet LDR.

Driver Reference:
a. DOE Order 5820.2
b. WIPP Waste Acceptance Criteria
c. WIPP Performance Assessment

Record Number: 94

Tanks Focus Area Site Needs	Need Title:	Late Wash Precipitate - Clarification of Liquid Streams
	Site Name:	SRS
	NBS#:	1.2.2.1.3

Primary Technical Integration Area: Pretreatment

Need Description:
Reprecipitate cesium, reduce the nitrite concentration and remove soluble organics to meet feed specifications for the precipitate reactor in the DWPF Salt Processing Cell.

- Provide the technical basis for the revised Late Wash Facility design and operation.
- Prepare technical bases document.
- Conduct tests on lab scale cross-flow filters.
- Conduct tests on engineering scale cross-flow filters.
- Evaluate the effectiveness of sparging to remove benzene from the filtrate on pilot scale.
- Study mechanisms for filter tube pluggage.
- Develop even propagation model based on only sampling Tank 49.
- Determine Henry's law constants for benzene in late wash permeate.
- Re-evaluate STPB precipitate degradation.
- Assist with filtration and benzene stripping testing at USC Late Wash Filter Demonstration.
- Develop on line nitrite/benzene monitors.
- Provide development, testing, assembly and installation assistance for instrumentation.
- Evaluate irradiated versus non-irradiated feeds for testing.
- Determine methods to improve the cesium decontamination factor.
- Evaluate STPB Addition to Tank 49.
- Test alternative filter technology.

Solution Required by: 10/95-1/96

Drivers:
Safety, Cost, ITP Startup (3/95)

Driver Reference:
- EPA and DOE, "Federal Facility Compliance Agreement," EPA Administrative Docket Number 91-01-FFR, EPA ID Number SCI 890 008 89, Effective 3/13/91.
- EPA, SCDHEC, and DOE, "Federal Facility Agreement under Section 120 of CERCLA and 3008 (h) and 6001 of RCRA", EPA Administrative Docket Number 89-05-FE, Effective 8/16/93.

Record Number: 97

Tanks Focus Area Site Needs	Need Title:	Concentrate Waste - Reducing Water Volume of DWPF
	Site Name:	SRS
	NBS#:	1.1.4

Primary Technical Integration Area: Pretreatment

Need Description:
Remove excess water from liquid waste to reduce volume.

- Improve definition of evaporator operating parameters.
- Study feed characteristics and scaling/foaming potential.
- Evaluate "partial" evaporation to minimize saltcake formation.
- Develop new radiation/temperature hardened feed pumps.
- Develop improved antifoam agents.
- Evaluate methods to minimize/easily clear pluggage of gravity drain line.
- Quantify benefits of more corrosion resistant (e.g., Hastelloy) tube bundles (installed in 2H Evaporator in 1995).
- Evaluate Licon portable evaporator demonstration.
- Evaluate other alternative volume reduction and waste concentration methods.
- Centrifugal separation
- Wiped film evaporators (local tank evaporators)
- Low vacuum evaporators

Solution Required by: 10/96-9/00

Drivers:

Driver Reference:
- EPA and DOE, "Federal Facility Compliance Agreement," EPA Administrative Docket Number 91-01-FFR, EPA ID Number SCI 890.008.89," Effective 3/13/91.
- EPA SCDHEC, and DOE, Federal Facility Agreement under section 120 of CERCLA and 3008(h) and 6001 of RCRA, "EPA administrative docket #89-05-FE," effective 8/16/93.

Record Number: 102

Tanks Focus Area Site Needs		
	Need Title:	Retrieval: Robotics, Mixer Pump, Waste Dislodging and Conveyance
	Site Name:	Idaho
	NBS#:	1.2.1.7.2.1

Primary Technical Integration Area: Retrieval

Need Description:
- There is a need for a robotics system, mixer pumps, and a Waste Dislodging and Conveyance (WD&C) end effector.
- There is a need to create a scale model mockup to demonstrate the ability of the mixer pump technology to sufficiently suspend solids for waste heel removal and to demonstrate the confined sluicing end effector integrated with a robotic arm. The confined sluicing mockup will demonstrate break up and retrieval technologies of the remaining waste heel not removed by mixer pumps and demonstrate the ability to direct waste to the primary removal system. This will include creating a waste simulant of the INEL waste heel and a section of the storage tank. This demonstration will also assist in proper sizing of a mixer pump.

Solution Required by: 10/95-9/99

Drivers:
- Resource Conservation and Recovery Act (RCRA) Part A Permit for ICPP Tank Farm.
- 40 CFR 265 Subpart G (40 CFR 265.110-.120) Closure and Post-Closure.
- U.S. Department of Energy Order 5480.11, Radiation Protection for Occupational Workers.

Driver Reference:
- Notice of Noncompliance Issued to the INEL Jointly by the U.S. Environmental Protection Agency and the State of Idaho Department of Health and Welfare, Dated: January 29, 1990.
- Consent Order to, "Cease Use," Between the Idaho Department of Health and Welfare and the U.S. Department of Energy, Dated: April 3, 1992.

Record Number: 162

Tanks Focus Area Site Needs	Need Title:	Determination of a Generalized Risk-Based Closure Criteria
	Site Name:	Idaho
	NBS#:	1.3.1.3

Primary Technical Integration Area: Stabilization/Closure

Need Description:
There is a need for adoption of a complex-wide performance standard that presents quantifiable and uniform criteria for the levels to which tanks must be cleaned prior to closure. This criterion is needed to form a base for permitting and closure design. INEL needs a risk-based criteria for both RCRA closure and CERCLA remediation efforts. It is important to consider other factors such as economic constituents when determining such performance standards.

Solution Required by: 6/96-9/10

Drivers:
- INEL Consent Order, April 1992
- 40 CFR 265, Subpart G, "Closure and Post-closure"
- 40 CFR 265, Subpart J, "Tank Systems," 265.197 "Closure and post-closure care."

Driver Reference:
- Notice of Noncompliance, U.S. EPA and State of Idaho, Department of Health and Welfare (IDHW), January 1990.
- INEL Consent Order, April 1992
- 40 CFR 265, Subpart G, "Closure and Post-closure"
- 40 CFR 265, Subpart J, "Tank Systems," 265.197 "Closure and post-closure care."

Record Number: 165

Tanks Focus Area Site Needs	Need Title:	Develop "Fly By" NDE Inspection System
	Site Name:	Idaho
	NBS#:	1.2.1.6.1

Primary Technical Integration Area: Retrieval

Need Description:
- There is a need to perform visual inspections of the tank walls to determine if corrosion of the walls has occurred.
- Non-destructive examination (NDE) techniques are needed to inspect tank walls and knuckle regions. The inspections will be used to gather information needed to ensure safety of current tank configurations and to evaluate side loading limits and other constraints for future remediation activities.
- There is a need for in situ characterization of liquids and solids of the heel and information regarding flammability of head space.

Solution Required by: 6/95-6/99

Drivers:
- Resource Conservation and Recovery Act (RCRA) Part A Permit for ICPP Tank Farm
- 40 CFR 265 Subpart G (40 CFR 265.110-.120) Closure and Post-Closure.
- 40 CFR 265 Subpart J (40 CFR 265.190-.201), Tank Systems.
- U.S. Department of Energy Order 5480.11, Radiation Protection for Occupational Workers.

Driver Reference:
- Notice of Noncompliance Issued to the INEL Jointly by the U.S. Environmental Protection Agency and the State of Idaho Department of Health and Welfare, Dated: January 29, 1990.
- Consent Order to "Cease Use," Between the Idaho Department of Health and Welfare and the U.S. Department of Energy, Dated: April 3, 1992.

Record Number: 169

Tanks Focus Area Site Needs

Need Title: Liquids/Solids Separations Studies
Site Name: Oak Ridge
NBS#: 1.2.2.1.1

Primary Technical Integration Area: Pretreatment

Need Description:
Liquid/solids separation studies are needed for a variety of applications for treating ORNL LLLW waste. Equipment to separate TRU sludges from nonTRU supernatants will be needed to minimize the volumes of TRU disposed of by ORNL. Several separations processes presently being considered for treatment of ORNL LLLW involve separations of treated liquid from fine precipitants which will be disposed of as a solid waste. Treatability studies performed to date indicate that standard clarification/filtration equipment will not be adequate for these separations needs. More advanced separations processes, such as cross-flow filtration, will be needed.

Solution Required by: 9/97

Drivers:
- Federal Facilities Agreement to remediate noncompliant USTID
- Federal Facilities Compliance Agreement to treat mixed waste
- DOE Order 5820.2A requiring treatment of TRU waste for disposal at WIPP
- CERCLA

Driver Reference:
a. Tennessee Department of Environment and Conservation (TDEC) Commissioner's Order for the Oak Ridge Reservation (ORR) Site Treatment Plan (STP)
b. Oak Ridge National Laboratory Waste Area Grouping 1 Gunite and Associated Tanks Operable Unit Treatability Study Work Plan, DOE/OR/02-1300&D1

Record Number: 176

Tanks Focus Area Site Needs	Need Title:	Sludge Separations
	Site Name:	Oak Ridge
	NBS#:	1.2.2.2

Primary Technical Integration Area: Pretreatment

Need Description:
Sludge separations will be required to pretreat tank sludges to meet feed acceptance criteria for the solidification system (glass and grout are being considered). This may include sludge washing as well as solids/liquid separations.

Solution Required by: 9/99

Drivers:
- Federal Facilities Agreement to remediate noncompliant USTID
- Federal Facilities Compliance Agreement to treat mixed waste
- DOE Order 5820.2A requiring treatment of TRU waste for disposal at WIPP
- CERCLA

Driver Reference:
a. Tennessee Department of Environment and Conservation (TDEC) Commissioner's Order for the Oak Ridge Reservation (ORR) Site Treatment Plan (STP)
b. Oak Ridge National Laboratory Waste Area Grouping 1 Gunite and Associated Tanks Operable Unit Treatability Study Work Plan, DOE/OR/02-1300&D1.

Record Number: 178

Tanks Focus Area Site Needs		
	Need Title:	Bulk Sludge Mobilization and Slurry Transport - Slurry Transport Studies
	Site Name:	Oak Ridge
	NBS#:	1.2.1.5

Primary Technical Integration Area: Retrieval

Need Description:
Bulk quantities for sludge will be transported for miles through pipelines for existing storage tanks to new storage tanks and/or treatment facilities, and monitor solids content to assure that pipelines are not plugged. Surry transport studies are needed to design pipeline transport systems for ORNL LLLW sludges

Solution Required by: 1998

Drivers:
- Federal Facilities Agreement to remediate noncompliant USTID
- Federal Facilities Compliance Agreement to treat mixed waste
- DOE Order 5820.2A requiring treatment of TRU waste for disposal at WIPP
- CERCLA

Driver Reference:
a. Tennessee Department of Environment and Conservation (TDEC) Commissioner's Order for the Oak Ridge Reservation (ORR) Site Treatment Plan (STP)
b. Oak Ridge National Laboratory Waste Area Grouping 1 Gunite and Associated Tanks Operable Unit Treatability Study Work Plan, DOE/OR/02-1300&D1

Record Number: 185

Tanks Focus Area Site Needs

Need Title: Heel Waste Retrieval/Characterization - LDUA Deployment Systems
Site Name: Oak Ridge
NBS#: 1.2.1.7.2.2

Primary Technical Integration Area: Retrieval

Need Description:
The first Oak Ridge tanks to be remediated are the ORNL gunite tanks, 50 year old concrete unlined tanks, containing both TRU and non-TRU wastes. These tanks are located on Central Avenue in Waste Area Group 1 at ORNL. This area is in the center of ORNL in a high traffic, highly populated area. The largest of these tanks are 50 feet in diameter, 12 feet high at the walls, 18 feet high at the dome and buried under approximately 6 feet of overburden. In the early 1980's approximately 90% of the sludge was removed from these tanks by sluicing. The soil in this area is highly contaminated. A several foot deep supernatant layer of liquid covers the sludge in all but one tank. The total volume of sludge remaining is not well known but is less than 100,000 gallons. A variety of waste forms will be retrieved from the ORNL Gunite tanks. Sludge will range from very soft silt texture to blocks as hard as concrete. A small amount of in-tank hardware and debris will be retrieved. Chunks of the concrete wall that have spalled from the wall and concrete chips resulting from removal of the most contaminated part of the tank floor and walls will need to be removed. Videos of the waste surface show some areas of crystalling structure on the top of the sludge. Contaminated equipment currently in the risers will have to be removed. A Treatability Study is underway to demonstrate and evaluate alternative retrieval techniques. Although the most likely means of mobilizing the sludge will be hydraulic mining of some sort, i.e., sluicing or water-jet cutting, an alternative approach is required for retrieval of the debris, hard sludge, and removal of contaminated floor and wall segments. A remotely operable deployment system and end-effector tools are required to access the tank walls, floor and waste surfaces for waste retrieval and cleaning of tank surfaces. Because the tanks have only a residual heel remaining, either arm-based or vehicle-based retrieval systems could be considered during the Treatability Study. Current plans are to explore both approaches, although no currently available arm or vehicle can meet the requirements. Modification of existing systems or development of new systems will be required.

Solution Required by: 1998

Drivers:
The Treatability Study for the Gunite tanks is intended to both demonstrate and evaluate the alternative technologies for remediation of the Gunite tanks. Alternatives demonstrated should represent a range of cleanup performance and implementation cost, within reason, so that the cost and resultant performance for final remediation can be extrapolated from the Treatability Study results. The Treatability Study will be completed by approximately FY 1998 to meet Gunite Tank Remediation schedule.

Driver Reference:
- Federal Facilities Agreement Implementation Plan
- Oak Ridge National Laboratory Waste Area Grouping 1 Gunite and Associated Tanks Operable Unit Treatability Study Work Plan, DOE/OR/02-1300&D1
- Tennessee Department of Environment and Conservation (TDEC) Commissioner's Order for the Oak Ridge Reservation (ORR) Site Treatment Plan (STP).

Tanks Focus Area Site Needs	Need Title:	Secondary Waste Immobilization Studies
	Site Name:	Oak Ridge
	NBS#:	1.2.3.3

Primary Technical Integration Area: Immobilization

Need Description:
The secondary waste streams which result in the treatment of ORNL LLLW is presently being defined. They will depend on the characteristics of the original waste stream and the waste acceptance criteria for the final disposal facility for the bulk waste streams. However, secondary waste streams that result from waste processing are likely to be small-volume, highly contaminated waste streams such as precipitates, filter media, and ion exchange resins or regenerate solutions. Immobilization technologies and disposal facilities for these streams must be identified.

Solution Required by: 1999

Drivers:
- Federal Facilities Agreement to remediate noncompliant USTID
- Federal Facilities Compliance Agreement to treat mixed waste
- DOE Order 5820.2A requiring treatment of TRU waste for disposal at WIPP
- CERCLA

Driver Reference:
a. Tennessee Department of Environment and Conservation (TDEC) Commissioner's Order for the Oak Ridge Reservation (ORR) Site Treatment Plan (STP)
b. Oak Ridge National Laboratory Waste Area Grouping 1 Gunite and Associated Tanks Operable Unit Treatability Study Work Plan, DOE/OR/02-1300&D1
c. DOE Order 5820.2A

Record Number: 189

Tanks Focus Area Site Needs		
	Need Title:	Removal of TRU, Sr, Tc, Cs from Tank Waste & Dissolved Calcine
	Site Name:	Idaho
	NBS#:	1.2.2.1.3

Primary Technical Integration Area: Pretreatment

Need Description:
Solvent extraction and ion-exchange technologies must be demonstrated on actual INEL HLW feed streams to ensure that full-scale process will adequately recover the HLW constituents (TRU, Sr, Tc, Cs) to convert the bulk of the tank waste and dissolved calcine to LLW.

Solution Required by: 10/95-9/99

Drivers:

Driver Reference:

Record Number: 247

Tanks Focus Area Site Needs	Need Title:	Develop Grout Process for Sodium Bearing Waste
	Site Name:	Idaho
	NBS#:	1.2.3.2

Primary Technical Integration Area: Immobilization

Need Description:
Immobilize the LLW fraction resulting from the pretreatment (separations) of radioactive liquid sodium and high-level calcine wastes at the ICPP. Final stabilized form must meet all required and applicable, DOE, NRC, and EPA regulations as well as be developed utilizing a systems approach to ensure a cost effective alternative agreeable to all applicable stakeholders.

Solution Required by: 10/95-12/99

Drivers:
Consent and court orders require the ICPP to remove liquid sodium waste from tank farm storage within specific timeframes. Future FFCA requirements define need to remove, treat and immobilize HLW calcine existing in ICPP storage bins.

Technologies to achieve these order requirements have been selected as required by the orders. Technologies chosen will separate liquid into high and low activity fractions. Low activity fractions must be immobilized prior to final disposition.

Consent Order; tech selection

Driver Reference:
- US District Court's Opinion and Order of 12/22/93.
- Modified Notice of Noncompliance Consent Order between the Idaho Department of Health and Welfare and DOE, 3/22/94.
- Federal Facilities Compliance Act
- Pending Site-Wide INEL Environmental Impact Statement, Record of Decision.

Record Number: 252

Tanks Focus Area Site Needs	Need Title:	DWPF Flowsheet Model
	Site Name:	SRS
	NBS#:	1.2.4.1.3.1

Primary Technical Integration Area: Immobilization

Need Description:
See parent need, Record Number 512 (NBS 1.2.4.1.3.1).

Solution Required by: 10/95-

Drivers:
Key document controlling process

Driver Reference:
- EPA and DOE, "Federal Facility Compliance Agreement," EPA Administrative Docket Number 91-01-FFR, EPA ID Number SCI 890 008 89, Effective 3/13/91.
- EPA, SCDHEC, and DOE, Federal Facility Agreement under Section 120 of CERCLA and 3008 (h) and 6001 of RCRA, "EPA Administrative Docket Number 89-05-FE, Effective 8/16/93.

Record Number: 266

Tanks Focus Area Site Needs	Need Title:	Effects of Irradiation on Precipitate
	Site Name:	SRS
	NBS#:	1.2.4.1.3.1

Primary Technical Integration Area: Immobilization

Need Description:
See parent need, Record Number 512 (NBS 1.2.4.1.3.1).

Solution Required by: 10/95-

Drivers:
Enhancement in cost, safety, process reliability

Driver Reference:

Record Number: 269

Tanks Focus Area Site Needs	Need Title:	Cold Cap/Offgas Thermodynamics Model
	Site Name:	SRS
	NBS#:	1.2.4.1.3.1

Primary Technical Integration Area: Immobilization

Need Description:

Solution Required by: 10/95-

Drivers:
Enhancement in cost, safety, process reliability

Driver Reference:

Record Number: 282

Tanks Focus Area Site Needs	Need Title: DWPF Analytical Methods for Attainment Site Name: SRS NBS#: 1.2.4.1.2.1

Primary Technical Integration Area: Immobilization

Need Description:

Solution Required by:

Drivers:

Driver Reference:

Record Number: 285

Tanks Focus Area Site Needs	Need Title:	Improve DWPF Level Probes
	Site Name:	SRS
	NBS#:	1.2.4.1.2.1

Primary Technical Integration Area: Immobilization

Need Description:
See parent need, Record Number 512 (NBS 1.2.4.1.3.1).

Solution Required by: ? to 2028

Drivers:
Programmatic driver to improve on measure volume of liquids in tanks & vessels

Driver Reference:

Record Number: 287

Tanks Focus Area Site Needs	Need Title:	DWPF Recycle Stream Flow and Composition
	Site Name:	SRS
	NBS#:	1.2.4.1.4

Primary Technical Integration Area: Pretreatment

Need Description:
See parent need, Record Number 511 (NBS 1.2.4.1.2.2).

Solution Required by: 10/96-9/00

Drivers:

Driver Reference:
EPA and DOE, "Federal Facility Compliance Agreement," EPA Administrative Docket Number 91-01-FFR, EPA ID Number SCI 890.008.89, Effective 3/13/91.
EPA, SCDHEC, and DOE, Federal Facility Agreement under Section 120 of CERCLA and 3008 (h) and 6001 of RCRA, "EPA Administrative Docket Number 89-05-FE," effective 8/16/93

Record Number: 303

Tanks Focus Area Site Needs	Need Title:	Methods for Recycle Minimization
	Site Name:	SRS
	NBS#:	1.2.4.1.4

Primary Technical Integration Area: Pretreatment

Need Description:

Solution Required by: 10/96-9/00

Drivers:

Driver Reference:
EPA and DOE, "Federal Facility Compliance Agreement," EPA Administrative Docket Number 91-01-FFR, EPA ID Number SCI 890 008 89, Effective 3/13/91.
EPA, SCDHEC, and DOE, Federal Facility Agreement under Section 120 of CERCLA and 3008 (h) and 6001 of RCRA, "EPA Administrative Docket Number 89-05-FE," Effective 8/16/93

Record Number: 309

Tanks Focus Area Site Needs	Need Title:	Extend Operating Life of DWPF Melter
	Site Name:	SRS
	NBS#:	1.2.4.1.2.3

Primary Technical Integration Area: Immobilization

Need Description:
Includes Record Numbers 322 and 323.

Solution Required by: Immediate

Drivers:
Enhancement in cost

Driver Reference:

Record Number: 315

Tanks Focus Area Site Needs	Need Title:	Reduce Noble Metal Deposition
	Site Name:	SRS
	NBS#:	1.2.4.1.3.1

Primary Technical Integration Area: Immobilization

Need Description:

Solution Required by: 10/95-

Drivers:
Enhancement in cost, safety, process reliability

Driver Reference:

Record Number: 316

Tanks Focus Area Site Needs

Need Title: Bulk Sludge Mobilization and Slurry Transport - Mix & Mobilize Sludge
Site Name: Oak Ridge
NBS#: 1.2.1.7.1.1

Primary Technical Integration Area: Retrieval

Need Description:
Development of systems to mix and mobilize bulk quantities of sludge in ORNL horizontal steel underground storage tanks, slurry transport studies to design pipeline transport systems for ORNL LLLW sludges. Design of enhanced submerged jet systems are underway to mix/mobilize bulk quantities of sludge in horizontal tanks. Evaluation of alternative mechanical mobilization systems (e.g., floating pump, AEA Technologies' jet pump, pulsed air pump, etc.) is also under consideration.

Solution Required by: 1998

Drivers:
- Federal Facilities Agreement to remediate noncompliant USTID
- Federal Facilities Compliance Agreement to treat mixed waste
- DOE Order 5820.2A requiring treatment of TRU waste for disposal at WIPP

Driver Reference:
a. Tennessee Department of Environment and Conservation (TDEC) Commissioner's Order for the Oak Ridge Reservation (ORR) Site Treatment Plan (STP)
b. DOE Order 5820.2A

Record Number: 343

Tanks Focus Area Site Needs

Need Title: Bulk Sludge Mobilization and Slurry Transport - In-Line Solids Monitoring
Site Name: Oak Ridge
NBS#: 1.2.1.2

Primary Technical Integration Area: Retrieval

Need Description:
Demonstration of in-line solids monitors is needed to assure accurate slurry content when transferring sludges in pipeline for miles between tanks and treatment facilities to avoid pipeline plugging.

Solution Required by: 1998

Drivers:
- Federal Facilities Agreement to remediate noncompliant USTID
- Federal Facilities Compliance Agreement to treat mixed waste
- DOE Order 5820.2A requiring treatment of TRU waste for disposal at WIPP

Driver Reference:
a. Tennessee Department of Environment and Conservation (TDEC) Commissioner's Order for the Oak Ridge Reservation (ORR) Site Treatment Plan (STP)
b. DOE Order 5820.2A

Record Number: 345

Tanks Focus Area Site Needs		
	Need Title:	Bulk Sludge Mobilization and Slurry Transport - Alternative Mechanical Mobilization Systems
	Site Name:	Oak Ridge
	NBS#:	1.2.1.7.3.2

Primary Technical Integration Area: Retrieval

Need Description:
Development of systems to mix and mobilize bulk quantities of sludge in ORNL horizontal steel underground storage tanks, slurry transport studies to design pipeline transport systems for ORNL LLLW sludges. Design of enhanced submerged jet systems are underway to mix/mobilize bulk quantities of sludge in horizontal tanks. Evaluation of alternative mechanical mobilization systems (e.g., floating pump, AEA Technologies' jet pump, pulsed air pump, etc.) is also under consideration.

Solution Required by: 1998

Drivers:
- Federal Facilities Agreement to remediate noncompliant USTID
- Federal Facilities Compliance Agreement to treat mixed waste
- DOE Order 5820.2A requiring treatment of TRU waste for disposal at WIPP

Driver Reference:
a. Tennessee Department of Environment and Conservation (TDEC) Commissioner's Order for the Oak Ridge Reservation (ORR) Site Treatment Plan (STP)
b. DOE Order 5820.2A

Record Number: 346

Tanks Focus Area Site Needs	Need Title:	Heel Waste Retrieval - WD&C
	Site Name:	Oak Ridge
	NBS#:	1.2.1.7.2.1

Primary Technical Integration Area: Retrieval

Need Description:
Oak Ridge has horizontal and vertical steel and concrete storage tanks which will require remediation. Removal of heels of hard sludge and debris will be required. The first tanks to be remediated are the ORNL gunite tanks, 50 year old concrete unlined tanks, containing both TRU and non-TRU wastes. These tanks are located on Central Avenue in Waste Area Group 1 at ORNL. This area is in the center of ORNL in a high traffic, highly populated area. The largest of these tanks are 50 feet in diameter, 12 feet high at the walls, 18 feet high at the dome and buried under approximately 6 feet of overburden. In the early 1980's approximately 90% of the sludge was removed from these tanks by sluicing. The soil in this area is highly contaminated. A several foot deep supernatant layer of liquid covers the sludge in all but one tank. The total volume of sludge remaining is not well known but is less than 100,000 gallons. A variety of waste forms will be retrieved from the ORNL gunite tanks. Sludge will range from very soft silt texture to blocks as hard as concrete. A small amount of in-tank hardware and debris will be retrieved. Chunks of the concrete wall that have spalled from the wall and concrete chips resulting from removal of the most contaminated part of the tank floor and walls will need to be removed. Videos of the waste surface show some areas of crystalline structure on the top of the sludge. Contaminated equipment currently in the risers will have to be removed. A Treatability Study is underway to demonstrate and evaluate alternative retrieval techniques. Although the most likely means of mobilizing the sludge will be hydraulic mining of some sort, i.e., sluicing or water-jet cutting, an alternative approach is required for retrieval of the debris, hard sludge, and removal of contaminated floor and wall segments. A remotely operable deployment system and end-effector tools are required to access the tank walls, floor and waste surfaces for waste retrieval and cleaning of the tank surfaces. Because the tanks have only a residual heel remaining, either arm-based or vehicle-based retrieval systems could be considered during the Treatability Study. Current plans are to explore both approaches, although no currently available arm or vehicle can meet the requirements. Modification of existing systems or development of new systems will be required.

Solution Required by: 1998

Drivers:
- Federal Facilities Agreement to remediate noncompliant USTID
- Federal Facilities Compliance Agreement to treat mixed waste
- DOE Order 5820.2A requiring treatment of TRU waste for disposal at WIPP
- CERCLA

Driver Reference:
a. Tennessee Department of Environment and Conservation (TDEC) Commissioner's Order for the Oak Ridge Reservation (ORR) Site Treatment Plan (STP)
b. Oak Ridge National Laboratory Waste Area Grouping 1 Gunite and Associated Tanks Operable Unit Treatability Study Work Plan, DOE/OR/02-1300&D1
c. DOE Order 5820.2A

Record Number: 347

Tanks Focus Area Site Needs

Need Title: Field Methods for 3D Mapping of Waste Chemical and Radiological Properties
Site Name: Oak Ridge
NBS#: 1.1.3.1.2

Primary Technical Integration Area: Characterization

Need Description:
A wide variety of characterization needs can be identified for the ORNL liquid low-level waste (LLLW) tanks. Both characterization systems (sensors, samplers) and the means to deploy these systems are needed. Techniques that generate characterization data in situ are greatly needed to reduce the cost of sample handling and analytical tasks in hot cell laboratories. Current capabilities for liquid sampling and analysis are adequate but could be improved. Capabilities for sludge sampling and characterization of floors, walls, and other in-tank structures is severely limited by access constraints. Data requirements include chemical, physical, and radiological properties for the liquids, sludges, debris, tank walls, floor, domes, piping, valve boxes, surrounding soils and contaminant plumes. Core samples of soft sludge have been obtained, but access to hard sludge and debris areas has been unavailable. Since the total volume of sludge and distribution of sludge and debris in the Oak Ridge tanks are not well known, it would be particularly helpful to have a sludge/debris surface mapping capability that could profile the surfaces below the supernatant liquid. This liquid is typically several feet deep and can be up to nearly 12 feet deep at worst case. This is needed for vertical Gunite tanks as well as horizontal steel tanks.

Solution Required by: 1998

Drivers:
- Federal Facilities Agreement to remediate noncompliant USTID
- Federal Facilities Compliance Agreement to treat mixed waste
- DOE Order 5820.2A requiring treatment of TRU waste for disposal at WIPP
- CERCLA

Driver Reference:
a. Tennessee Department of Environment and Conservation (TDEC) Commissioner's Order for the Oak Ridge Reservation (ORR) Site Treatment Plan (STP)
b. Oak Ridge National Laboratory Waste Area Grouping 1 Gunite and Associated Tanks Operable Unit Treatability Study Work Plan, DOE/OR/02-1300&D1
c. DOE Order 5820.2A

Record Number: 357

Tanks Focus Area Site Needs		
	Need Title:	Issues with Safe Operation, Decon, and Removal of Tank End Effectors
	Site Name:	Idaho
	NBS#:	1.2.1.1.1.4

Primary Technical Integration Area: Retrieval

Need Description:
Additional development is needed for sensors to measure flammable gas species in the tank head space during LDUA operations and methods for decontamination, removal, and transfer of end effectors from tank to tank.

Solution Required by: 10/96-9/99

Drivers:
Cease Use Tanks

Driver Reference:

Record Number: 363

Tanks Focus Area Site Needs	Need Title:	Issues with Safe Removal, Decon, and Insertion of Retrieval Devices
	Site Name:	Oak Ridge
	NBS#:	1.2.1.1.1.4

Primary Technical Integration Area: Retrieval

Need Description:
Processes for removal and decontamination of in-tank hardware and temporarily installed retrieval devices are needed.

Solution Required by: 3/97

Drivers:
GAAT Treatability Study and Remediation Schedule

Driver Reference:
a. Tennessee Department of Environment and Conservation (TDEC) Commissioner's Order for the Oak Ridge Reservation (ORR) Site Treatment Plan (STP)
b. Oak Ridge National Laboratory Waste Area Grouping 1 Gunite and Associated Tanks Operable Unit Treatability Study Work Plan, DOE/OR/02-1300&D1
c. DOE Order 5820.2A

Record Number: 364

Tanks Focus Area Site Needs	Need Title:	Issues with Safe Removal, Decon, and Insertion of Retrieval Devices
	Site Name:	SRS
	NBS#:	1.2.1.1.1.4

Primary Technical Integration Area: Retrieval

Need Description:

Solution Required by: 10/95-9/99

Drivers:
Tank 8

Driver Reference:

Record Number: 365

Tanks Focus Area Site Needs		
	Need Title:	Develop Inspection Technologies for Type I & II Tank Annulus
	Site Name:	SRS
	NBS#:	1.2.1.6.1

Primary Technical Integration Area: Safety

Need Description:

Solution Required by: 10/97-9/99

Drivers:
Safe Storage

Driver Reference:

Record Number: 371

Tanks Focus Area Site Needs	Need Title:	Develop Simulants
	Site Name:	Idaho
	NBS#:	1.2.1.3

Primary Technical Integration Area: Retrieval

Need Description:
To retrieve tank heels, sludge behavior and interaction with retrieval equipment will need to be determined. Simulants which approximate the tank sludge rheology are needed to design and test equipment performance prior to hot application. The tasks of cleaning sludge from the bottom of the tank and around cooling cools will be especially difficult to achieve.

Solution Required by: 10/94-9/99

Drivers:
Cease Use

Driver Reference:

Record Number: 374

Tanks Focus Area Site Needs	Need Title:	Develop Simulants
	Site Name:	Oak Ridge
	NBS#:	1.2.1.3

Primary Technical Integration Area: Retrieval

Need Description:
Chemical and physical simulants of Oak Ridge tank sludges are needed which represent the range of compositions in the actual tanks for waste retrieval and pretreatment/immobilization studies.

Solution Required by: 1997

Drivers:
- Federal Facilities Agreement to remediate noncompliant USTID
- Federal Facilities Compliance Agreement to treat mixed waste
- DOE Order 5820.2A requiring treatment of TRU waste for disposal at WIPP
- CERCLA

Driver Reference:
a. Tennessee Department of Environment and Conservation (TDEC) Commissioner's Order for the Oak Ridge Reservation (ORR) Site Treatment Plan (STP)
b. Oak Ridge National Laboratory Waste Area Grouping 1 Gunite and Associated Tanks Operable Unit Treatability Study Work Plan, DOE/OR/02-1300&D1
c. DOE Order 5820.2A

Record Number: 375

Tanks Focus Area Site Needs

Need Title: Develop Real-Time Corrosion Monitoring Techniques

Site Name: SRS

NBS#: 1.2.1.6.1

Primary Technical Integration Area: Characterization

Need Description:

Solution Required by: 6/96-6/99

Drivers:
None Indicated

Driver Reference:

Record Number: 382

Tanks Focus Area Site Needs	Need Title:	Develop Leak Repair Techniques
	Site Name:	SRS
	NBS#:	1.2.1.6.1

Primary Technical Integration Area: Retrieval

Need Description:

Solution Required by: 1/97-6/99

Drivers:

Driver Reference:

Record Number: 384

Tanks Focus Area Site Needs	Need Title:	Develop In Situ Sensor to Identify Flammable Gas Species
	Site Name:	Idaho
	NBS#:	1.2.1.2

Primary Technical Integration Area: Characterization

Need Description:
The flammable gas detector on the minilab will be for generic detection of hyrocarbons and non-specific for species. Species-specific detectors are needed to monitor the tank environment during waste retrieval and characterization activities to ensure that unsafe conditions are not being generated.

Solution Required by: 10/96-9/99

Drivers:
For use on planned LDUA deployment

Driver Reference:

Record Number: 399

Tanks Focus Area Site Needs	Need Title: Optimize Transfer Jet Performance Site Name: SRS NBS#: 1.2.1.5

Primary Technical Integration Area: Retrieval

Need Description:

Solution Required by:

Drivers:
Public and worker health and safety, cost, FFA, FFCA

Driver Reference:
- EPA and DOE, "Federal Facility Compliance Agreement," EPA Administrative Docket Number 91-01-FFR, EPA ID Number SCI 890.008.89, Effective 3/13/91.
- EPA, SCDHEC, and DOE, Federal Facility Agreement under section 120 of CERCLA and 3008 (h) and 6001 of RCRA, "EPA Administrative Docket Number 89-05-FE," Effective 8/16/93.

Record Number: 403

Tanks Focus Area Site Needs

Need Title: Develop Improved Pump Testing and Maintenance Program

Site Name: SRS

NBS#: 1.2.1.5

Primary Technical Integration Area: Retrieval

Need Description:

Solution Required by: ASAP

Drivers:

Driver Reference:

Record Number: 405

Tanks Focus Area Site Needs	Need Title:	Determine Salt Dissolution Kinetics
	Site Name:	SRS
	NBS#:	1.2.1.1

Primary Technical Integration Area: Retrieval

Need Description:
See parent need, Record Number 506 (NBS 1.2.1).

Solution Required by:

Drivers:
- EPA and DOE, "Federal Facility Compliance Agreement," EPA Administrative Docket Number 91-01-FFR, EPA ID Number SCI 890 008 89, Effective 3/13/91.
- EPA, SCDHEC, and DOE, Federal Facility Agreement under Section 120 of CERCLA and 3008 (h) and 6001 of RCRA, "EPA Administrative Docket Number 89-05-FE, Effective 8/16/93.

Driver Reference:
- EPA and DOE, "Federal Facility Compliance Agreement, "EPA Administrative Docket Number 91-01-FFR, EPA ID Number SCI 890.008.89," Effective 3/13/91.
- EPA, SCDHEC, and DOE Federal Facility Agreement under Section 120 of CERCLA and 3008 (h) and 6001 of RCRA, "EPA Administrative Docket Number 89-05-FE," Effective 8/16/93.

Record Number: 419

Tanks Focus Area Site Needs	Need Title:	Outline Mix Requirements and Pump Configuration for Salt Dissolution/Sludge Removal
	Site Name:	SRS
	NBS#:	1.2.1.1

Primary Technical Integration Area: Retrieval

Need Description:

Solution Required by: 10/95-9/97

Drivers:
Tank 41

Driver Reference:

Record Number: 421

Tanks Focus Area Site Needs	Need Title:	Improve Salt Mining Equipment and Techniques
	Site Name:	SRS
	NBS#:	1.2.1.7.3.1

Primary Technical Integration Area: Retrieval

Need Description:
See parent need, Record Number 506 (NBS 1.2.1).

Solution Required by: 10/95-9/97

Drivers:
Tank 41

Driver Reference:

Record Number: 422

Tanks Focus Area Site Needs	Need Title:	Develop Removal Techniques for Mired Equipment
	Site Name:	SRS
	NBS#:	1.2.1.7.3.4

Primary Technical Integration Area: Retrieval

Need Description:

Solution Required by: 10/96-9/99

Drivers:
Mixer Pumps

Driver Reference:

Record Number: 423

Tanks Focus Area Site Needs

Need Title: Develop Method to Address Insoluble Solids in Salt Tanks

Site Name: SRS

NBS#: 1.2.1.7.3.1

Primary Technical Integration Area: Retrieval

Need Description:
See parent need, Record Number 506 (NBS 1.2.1).

Solution Required by: 10/95-9/98

Drivers:
Tank 41

Driver Reference:

Record Number: 430

Tanks Focus Area Site Needs	Need Title:	Develop Method to Remove Mixed Salt and Sludge
	Site Name:	SRS
	NBS#:	1.2.1.7.3.1

Primary Technical Integration Area: Retrieval

Need Description:
See parent need, Record Number 506 (NBS 1.2.1).

Solution Required by: 10/95-12/99

Drivers:
Tank 8

Driver Reference:

Record Number: 431

Tanks Focus Area Site Needs	Need Title:	Develop Method to Remove Dry/Hardened Sludge
	Site Name:	SRS
	NBS#:	1.2.1.7.3.2

Primary Technical Integration Area: Retrieval

Need Description:

Solution Required by: 10/95-12/99

Drivers:
Tank 8

Driver Reference:

Record Number: 432

Tanks Focus Area Site Needs	Need Title:	Determine Zeolite Removal Requirements
	Site Name:	SRS
	NBS#:	1.2.1.1

Primary Technical Integration Area: Retrieval

Need Description:

Solution Required by: 8/95-9/96

Drivers:
Tank 19

Driver Reference:

Record Number: 435

Tanks Focus Area Site Needs	Need Title:	Develop Method to Remove Tank Heels
	Site Name:	SRS
	NBS#:	1.2.1.7.3

Primary Technical Integration Area: Retrieval

Need Description:

Solution Required by: 10/95-9/99

Drivers:
Tank 19

Driver Reference:

Record Number: 436

Tanks Focus Area Site Needs	Need Title:	Tank Clean and Closure
	Site Name:	SRS
	NBS#:	1.3.1.3

Primary Technical Integration Area: Stabilization/Closure

Need Description:
There is an overall need to define "How Clean is Clean?" This question could also be phrased "How clean is clean enough for the final site end-user?" The answer to this question is fundamental to the approaches used and the extent of the retrieval operations conducted on the Waste Storage Tanks. If all the tanks must be cleaned to the level of SRT Tank-16 (>99% waste removed), there will be large economic costs for the retrieval operations as well as a larger cost associated with the down-stream processing of the dilute waste stream from several water and acid wastes of this extensive retrieval effort. Early resolution to this fundamental question with the regulators is vital since the answer will directly affect all remediation functions.

Solution Required by: 10/95-9/97

Drivers:
Tank 19; Safety, cost, FFA Milestones, site closure regulatory criteria

Driver Reference:
- EPA and DOE "Federal Facility Compliance Agreement," EPA Administrative Docket Number 91-01-FFR, EPA ID Number SCI 890.008.89, Effective 3/31/91
- EPA, SCDHEC, & DOE, FFA under section 120 of CERCLA and 3008(h) and 6001 of RCRA, "EPA Administrative Docket Number 89-05-FE," Effective 8/16/93

Record Number: 437

Tanks Focus Area Site Needs

Need Title: Develop Improved Slurry Pumps to Minimize Addition of Inhibited Water

Site Name: SRS

NBS#: 1.2.1.7.1.2

Primary Technical Integration Area: Retrieval

Need Description:
(As a result of TIM/USG meetings Jan 29-Feb2, 1996, this Need was determined to include the Need expressed in Record Number 442.)

Solution Required by: 10/94-9/98

Drivers:
Need now

Driver Reference:

Record Number: 439

Tanks Focus Area Site Needs	Need Title:	Heel Waste Retrieval/Characterization - LDUA Deployment Systems
	Site Name:	Idaho
	NBS#:	1.2.1.7.2.2

Primary Technical Integration Area: Retrieval

Need Description:
Methodologies and platforms for deploying heel retrieval equipment (i.e., sluicing, washing, hose equipment, transport lines, ventilation, shielding, containment, sampling) need to be developed which are compatible with the LDUA. The retrieval equipment would be deployed down one riser and the LDUA down another and the LDUA used to manipulate the equipment.

Solution Required by: 10/95-9/99

Drivers:
Cease Use

Driver Reference:

Record Number: 445

Tanks Focus Area Site Needs	Need Title:	Retrieve Calcine From Bins
	Site Name:	Idaho
	NBS#:	1.2.1.8

Primary Technical Integration Area: Retrieval

Need Description:
Based on the current planning scenario, technology for calcine retrieval would need to be developed by about 2005 for Title 1 design. Bin set #1 has no accessible risers and complete retrieval from the other bin sets (over 32 m from top to bottom of the vaults) will require highly customized retrieval equipment to reach the bin set bottoms.

Solution Required by: 10/03-9/10

Drivers:

Driver Reference:

Record Number: 448

Tanks Focus Area Site Needs	Need Title:	Stabilization and Closure Analysis Tools
	Site Name:	SRS
	NBS#:	1.3.1.1

Primary Technical Integration Area: Stabilization/Closure

Need Description:
There is a need for systematic and complete set of analysis tools to : explore regulatory drivers; understand how these drivers result in remediation criteria; develop closure system optional designs; and perform studies to understand the cost-benefits trade-offs from different remediation levels of the tank as well as different site closure approaches.

Solution Required by: 8/95-9/97

Drivers:
Tank 19; Safety, cost, FFA Milestones, site closure regulatory criteria

Driver Reference:
- EPA and DOE "Federal Facility Compliance Agreement, "EPA Administrative Docket Number 91-01-FFR, EPA ID Number SCI 890.008.89," Effective 3/31/91
- EPA, SCDHEC, & DOE, FFA under section 120 of CERCLA and 3008(h) and 6001 of RCRA, "EPA Administrative Docket Number 89-05-FE," Effective 8/16/93

Record Number: 454

Tanks Focus Area Site Needs	Need Title:	Establish Clean-up Standard/Criteria
	Site Name:	Oak Ridge
	NBS#:	1.3.1.3

Primary Technical Integration Area: Stabilization/Closure

Need Description:
There is a need at ORNL to develop criteria against which to verify the adequacy of the tank isolation decontamination and residual contamination immobilization against the requisite criteria. This need statement is closely related to the required standards to which tanks must be remediated. First, a clean-up criterion must be established and then strategies developed to clean-up the tanks and to then verify compliance. Inherent in this need is the need to develop a complex-wide standard methodology for such evaluation.

Solution Required by: 1997

Drivers:
- Federal Facilities Agreement to remediate noncompliant USTID
- Federal Facilities Compliance Agreement to treat mixed waste
- DOE Order 5820.2A requiring treatment of TRU waste for disposal at WIPP
- CERCLA

Driver Reference:
a. Tennessee Department of Environment and Conservation (TDEC) Commissioner's Order for the Oak Ridge Reservation (ORR) Site Treatment Plan (STP)
b. Oak Ridge National Laboratory Waste Area Grouping 1 Gunite and Associated Tanks Operable Unit Treatability Study Work Plan, DOE/OR/02-1300&D1
c. DOE Order 5820.2A

Record Number: 455

Tanks Focus Area Site Needs	Need Title:	Data for Closure
	Site Name:	SRS
	NBS#:	1.3.1.2

Primary Technical Integration Area: Stabilization/Closure

Need Description:
Inherent in the development of validated and accepted analysis tools is the development of requisite data on crucial parameters as radionuclide movement through the SRS soil and water structures as well as consequence effects of long-lived isotopes (e.g., TC-99, I-129, etc.). Due to large uncertainties that exist today in these key data, over conservative assumptions must be used in the performance acceptance analysis resulting in over prediction of eventual consequences of unremediated wastes. More accurately determining these crucial parameters will allow more realistic options to be developed and analyzed.

Solution Required by: 10/95-12/99

Drivers:
- GAAT; Safety, cost, FFA Milestones, site closure regulatory criteria
- Tank 19 & beyond

Driver Reference:
- EPA and DOE "Federal Facility Compliance Agreement, "EPA Administrative Docket Number 91-01-FFR, EPA ID Number SCI 890.008.89, Effective 3/31/91
- EPA, SCDHEC, & DOE, FFA under section 120 of CERCLA and 3008(h) and 6001 of RCRA, "EPA Administrative Docket Number 89-05-FE," Effective 8/16/93

Record Number: 459

Tanks Focus Area Site Needs	Need Title:	Close LLW Storage Vaults
	Site Name:	SRS
	NBS#:	1.3.2.1

Primary Technical Integration Area: Stabilization/Closure

Need Description:
Backfill around the vaults and cap with a layer of clean grout.

- Improve predictive models for vault temperature/time relationship
- Provide performance requirements for new vault structure.
- Review closure designs.
- Model long-term performance assessment scenarios.
- Address issues required for final approval of radiological performance assessment.
- Maintain radiological performance assessment.
- Evaluate closure concepts with model.
- Support permit renewal application.
- Conduct ground water sampling and lysimeter studies.
- Improve vault roof design.
- Upgrade television camera system.
- Provide capability to cool raw materials and salt solution.
- Redesign vaults to allow cooling.

Solution Required by: 3/1/95

Drivers:
Safety, cost, FFA Milestones, site closure regulatory criteria

Driver Reference:
- EPA and DOE "Federal Facility Compliance Agreement, "EPA Administrative Docket Number 91-01-FFR, EPA ID Number SCI 890.008.89," Effective 3/31/91
- EPA, SCDHEC, & DOE, FFA under section 120 of CERCLA and 3008(h) and 6001 of RCRA, "EPA Administrative Docket Number 89-05-FE," Effective 8/16/93

Record Number: 462

Tanks Focus Area Site Needs	Need Title:	Tank System Closure Demonstration
	Site Name:	Oak Ridge
	NBS#:	1.3.4

Primary Technical Integration Area: Stabilization/Closure

Need Description:
There is a need to plan, design, execute and operate a large Tank System Closure Demonstration at the ORNL site. This demonstration would allow development of closure strategies and approaches for large, Low-Level Waste Tanks; cost of closure data; and, more importantly, closure performance data.

Solution Required by: 1997

Drivers:
- GAAT Treatability Study and Remediation Schedule
- Federal Facility Compliance Agreement
- CERCLA

Driver Reference:
a. Tennessee Department of Environment and Conservation (TDEC) Commissioner's Order for the Oak Ridge Reservation (ORR) Site Treatment Plan (STP)
b. Oak Ridge National Laboratory Waste Area Grouping 1 Gunite and Associated Tanks Operable Unit Treatability Study Work Plan, DOE/OR/02-1300&D1

Record Number: 475

Tanks Focus Area Site Needs	Need Title:	On-line Monitoring Waste Retrieval Process
	Site Name:	Oak Ridge
	NBS#:	1.2.1.2

Primary Technical Integration Area: Characterization

Need Description:
Characterization tools are needed for on-line monitoring of the waste retrieval processes and for final verification of the tank conditions following cleanup activities.

Solution Required by: 1998

Drivers:
GAAT-OU Remediation Schedule

Driver Reference:
a. Tennessee Department of Environment and Conservation (TDEC) Commissioner's Order for the Oak Ridge Reservation (ORR) Site Treatment Plan (STP)
b. Oak Ridge National Laboratory Waste Area Grouping 1 Gunite and Associated Tanks Operable Unit Treatability Study Work Plan, DOE/OR/02-1300&D1

Record Number: 482

Tanks Focus Area Site Needs	Need Title:	In Situ Characterization Capability (Minilab)
	Site Name:	Idaho
	NBS#:	1.2.1.2

Primary Technical Integration Area: Characterization

Need Description:
The minilab is needed as the first LDUA end effector (EE) to perform various tasks during tank inspection. These tasks include sensing flammable/explosive gases, surveying the radiation field, cursory visual inspection of the tank interior, and in-situ physical/chemical measurements on liquids and sludges.

Solution Required by: 10/95-9/99

Drivers:
For use on planned LDUA deployment

Driver Reference:

Record Number: 486

Tanks Focus Area Site Needs	Need Title:	Develop Simulants
	Site Name:	SRS
	NBS#:	1.2.1.3

Primary Technical Integration Area: Retrieval

Need Description:
See parent need, Record Number 506 (NBS 1.2.1).

Solution Required by: 10/95-9/98

Drivers:
Tank 19

Driver Reference:

Record Number: 487

Tanks Focus Area Site Needs	Need Title: LLLW Supernatant Site Name: Oak Ridge NBS#: 1.2.2.1.3

Primary Technical Integration Area: Pretreatment

Need Description:
Removal of cesium from ORNL LLLW supernatant solution, primarily 4M sodium nitrate, to the level required for on-site disposal or for disposal at the Nevada Test Site (NTS). Emphasis must be given to the efficiency of ion exchange material in the presence of varying concentrations of potassium, and to stabilization/disposal options of the separated cesium.

Solution Required by: 10/95-9/97

Drivers:
Worker health and safety, costs, disposal site waste acceptance criteria, and limited storage capacity.

Driver Reference:
Tennessee Department of Environment and Conservation (TDEC) Commissioner's Order for the Oak Ridge Reservation (ORR) Site Treatment Plan (STP).

Record Number: 489

Tanks Focus Area Site Needs	Need Title: Waste Form Acceptance Site Name: Oak Ridge NBS#: 1.2.3

Primary Technical Integration Area: Immobilization

Need Description:
Methods are needed for acceptance inspection and testing of immobilized waste forms to verify conformance with waste storage/disposal facility specifications. Performance assessments and waste acceptance processes are needed to demonstrate appropriate verification approaches for assuring acceptability of products for disposal for Nevada Test Site, Waste Isolation Pilot Plant, and >Class C repositories.

Solution Required by: 1997

Drivers:
Gunite Tank Treatability Study and Remediation Schedule

Driver Reference:
a. Tennessee Department of Environment and Conservation (TDEC) Commissioner's Order for the Oak Ridge Reservation (ORR) Site Treatment Plan (STP)
b. Oak Ridge National Laboratory Waste Area Grouping 1 Gunite and Associated Tanks Operable Unit Treatability Study Work Plan, DOE/OR/02-1300&D1

Record Number: 492

Tanks Focus Area Site Needs	Need Title:	Sludge Waste Form Study
	Site Name:	Oak Ridge
	NBS#:	1.2.3

Primary Technical Integration Area: Immobilization

Need Description:
Laboratory-scale vitrification and grouting studies are needed with surrogates and actual waste samples to define the operational envelopes for these waste forms for the range of sludge compositions within the Oak Ridge tank systems, and select immobilization process formulations for Oak Ridge waste. Studies should include performance testing of best formulations with actual waste samples to confirm viability of process/product.

Solution Required by: 1996

Drivers:
- Federal Facilities Agreement to remediate noncompliant USTID
- Federal Facilities Compliance Agreement to treat mixed waste
- DOE Order 5820.2A requiring treatment of TRU waste for disposal at WIPP
- CERCLA

Driver Reference:
a. Tennessee Department of Environment and Conservation (TDEC) Commissioner's Order for the Oak Ridge Reservation (ORR) Site Treatment Plan (STP)
b. Oak Ridge National Laboratory Waste Area Grouping 1 Gunite and Associated Tanks Operable Unit Treatability Study Work Plan, DOE/OR/02-1300&D1

Record Number: 493

Tanks Focus Area Site Needs	Need Title:	Sludge Waste Form Demonstration
	Site Name:	Oak Ridge
	NBS#:	1.2.3

Primary Technical Integration Area: Immobilization

Need Description:
Full-scale vitrification and grouting studies are needed with actual sludges to support selection of immobilization processes for Oak Ridge waste. Studies should verify bench-scale processing characteristics, product properties, waste loadings, and process flowsheet operations. Studies should be performed in conjunction with retrieval demonstrations and produce waste forms suitable for interim storage on the Oak Ridge Reservation and disposal at an off-site disposal facility such as Nevada Test Site or the Waste Isolation Pilot Plant.

Solution Required by: 1998

Drivers:
- Federal Facilities Agreement to remediate noncompliant USTID
- Federal Facilities Compliance Agreement to treat mixed waste
- DOE Order 5820.2A requiring treatment of TRU waste for disposal at WIPP
- CERCLA

Driver Reference:
a. Tennessee Department of Environment and Conservation (TDEC) Commissioner's Order for the Oak Ridge Reservation (ORR) Site Treatment Plan (STP)
b. Oak Ridge National Laboratory Waste Area Grouping 1 Gunite and Associated Tanks Operable Unit Treatability Study Work Plan, DOE/OR/02-1300&D1

Record Number: 494

Tanks Focus Area Site Needs	Need Title:	Sr, Tc, and Ru Removal
	Site Name:	Oak Ridge
	NBS#:	1.2.2.1

Primary Technical Integration Area: Pretreatment

Need Description:
Baseline assumptions are that ORNL tank supernate will be solidified for disposal at the Nevada Test Site or Waste Isolation Pilot Plant. If supernate is not accepted at these sites and/or waste is treated for on-site disposal in the future, Sr, Tc, and Ru (as well as Cs) must be removed to meet on-site disposal prior to solidification.

Solution Required by: 10/96-9/98

Drivers:
- Federal Facilities Agreement to remediate noncompliant USTID
- Federal Facilities Compliance Agreement to treat mixed waste
- DOE Order 5820.2A requiring treatment of TRU waste for disposal at WIPP
- CERCLA

Driver Reference:
a. Tennessee Department of Environment and Conservation (TDEC) Commissioner's Order for the Oak Ridge Reservation (ORR) Site Treatment Plan (STP)
b. Oak Ridge National Laboratory Waste Area Grouping 1 Gunite and Associated Tanks Operable Unit Treatability Study Work Plan, DOE/OR/02-1300&D1

Record Number: 495

Tanks Focus Area Site Needs	Need Title:	Source Treatment
	Site Name:	Oak Ridge
	NBS#:	1.2.2.1.3

Primary Technical Integration Area: Pretreatment

Need Description:
To meet waste minimization and future waste disposal requirements, cesium removal capabilities are needed at the major generators. Cesium will be removed at the source prior to the waste being discharged to the LLLW system where it will be mixed with other newly-generated waste and treated for on-site disposal.

Solution Required by: 10/95-9/98

Drivers: Waste miminization

Driver Reference:

Record Number: 498

Tanks Focus Area Site Needs	Need Title:	In Situ Sludge Treatment Capability Studies
	Site Name:	Oak Ridge
	NBS#:	1.3.1.1

Primary Technical Integration Area: Stabilization/Closure

Need Description:
Capabilities are needed for in situ stabilization of the sludge heels left in tanks after sluicing to support tank remediation. This option is being considered for closure of low-risk tanks in the North and South Tank farms.

Solution Required by: 1997

Drivers:
- Federal Facilities Agreement to remediate noncompliant USTID
- Federal Facilities Compliance Agreement to treat mixed waste
- DOE Order 5820.2A requiring treatment of TRU waste for disposal at WIPP
- CERCLA

Driver Reference:
a. Tennessee Department of Environment and Conservation (TDEC) Commissioner's Order for the Oak Ridge Reservation (ORR) Site Treatment Plan (STP)
b. Oak Ridge National Laboratory Waste Area Grouping 1 Gunite and Associated Tanks Operable Unit Treatability Study Work Plan, DOE/OR/02-1300&D1

Record Number: 500

Tanks Focus Area Site Needs	Need Title:	Alternative Calcination Process Flowsheet
	Site Name:	Idaho
	NBS#:	1.2.2.6

Primary Technical Integration Area: Pretreatment

Need Description:
The INEL must cease use of all HLW tanks by 2012. About 1.5 million gallons of waste with high sodium nitrate levels must be converted to calcined waste particles and pneumatically transported to a storage facility. The sodium bearing waste is not compatible with fluidized bed calcination at 500 degrees C because of incomplete conversion of the nitrates to oxides and formation of agglomerated particles in the calcine. Alternative flowsheets which use sugar and/or higher calcination temperatures are under development.

Solution Required by: 10/95-9/99

Drivers:

Driver Reference:

Record Number: 501

Tanks Focus Area Site Needs	Need Title:	On-line Process Monitor for Elemental Analysis of Calcine Product
	Site Name:	Idaho
	NBS#:	1.2.2.6

Primary Technical Integration Area: Pretreatment

Need Description:
An alternative flowsheet for sodium-bearing tank waste is under development to provide full-scale Title 1 design by the year 2000. Process control monitoring to detect process upset conditions or out-of-spec combination of compounds will be needed. Development of real-time process control monitoring will be needed to (a) measure hydrocarbon and nitrate compounds (as elemental carbon and nitrogen) in the off-gas fines and (b) measure elemental species in the calcine product (Na, Al, Fe, Ca, F, K and RCRA metals).

Solution Required by: 9/96-6/01

Drivers:
Programmatic driver to improve process control on calciner. State/DOE-ID Agreement to "Start-up NWCF for Processing SBW 6/01 and operate thru 12/12"

Driver Reference:

Record Number: 502

Tanks Focus Area Site Needs

Need Title: Develop Mechanisms and/or Devices to Passively Ventilate Hydrogen and Other Potentially Combustible Vapors from HLW Tanks

Site Name: SRS

NBS#: 1.1.2.1

Primary Technical Integration Area: Safety

Need Description:
Hydrogen and other combustible gases are generated in HLW tanks by radiolysis and/or chemical reaction. As a result, the majority of HLW tanks have active ventilation systems to maintain hydrogen and combustible gas mixtures at inherently safe levels. When these ventilation systems are out-of-service, more frequent hydrogen measurements are required and depending on the hydrogen/combustible gas level, portable ventilation may be required. Simple, passive devices could be designed to provide venting capability in the event of ventilation system inoperability.

Solution Required by: 6/96-6/98

Drivers:

Driver Reference:

Record Number: 514

Tanks Focus Area Site Needs		
	Need Title:	Develop Electrochemical Rreatment of Salt Solutions for Caustic Recovery and Recycle
	Site Name:	SRS
	NBS#:	1.2.2.1.2

Primary Technical Integration Area: Pretreatment

Need Description:
Large quantities of chemicals (chiefly sodium salts of nitrate, nitrite, hydroxide, and aluminate) are present in salt solution that will be disposed in saltstone. Recovery of the chemicals of value from the salt solution would significantly reduce the volume of waste disposed in saltstone. Electrochemcial technology exists to separate salts from aqueous waste streams. An electrochemical membrane process has the potential to recover the sodium from salt solution as sodium hydroxide. The recovered sodium hydroxide would be used on site to neutralize fresh waste thus reducing the quantity of new chemicals into waste management systems. To realize significant saltstone volume reductions, offsite customers of the sodium hydroxide would be required. In addition to sodium recovery, nitrates, nitrites, and organic compounds would be destroyed. Nitrate and nitrite removal would eliminate the release of the major environmental contaminants from saltstone. Also, it is possible to remove hazardous metals (e.g., Cr, Hg, Cd, and Ag and certain radionuclides (e.g., 99Tc and 106Ru)).

Solution Required by: 10/95-9/99

Drivers:

Driver Reference:

Record Number: 517

Tanks Focus Area Site Needs	Need Title:	Develop Counter-current Decantation Process for Sludge Washing
	Site Name:	SRS
	NBS#:	1.2.2.2.1

Primary Technical Integration Area: Pretreatment

Need Description:
The counter-current decantation process for Extended Sludge Processing (ESP) should produce much lower levels of dissolved salts (<0.1M soluble Na) in sludge while using very much less wash water (1/5 as much versus 1 cowash, 1/10 as much versus no cowash). The Counter Current Decantation (CCD) circuit uses six thickeners (estimated 7ft diameter), one feed and one product tank (9,000 gal each, 15ft diameter by 7ft high). The feed tank is equipped to do Al dissolution. The sludge treatment rate is 3 ga/min. The proposed process steps are:

- Sludge recovered by waste removal is transferred to a Type III tank for storage, blending and decanting.
- Sludge is transferred to the CCD feed tank to make a batch sized to be one transfer to DWPF (8,000 gal).
- If required, the sludge is fed to the CCD circuit @ 3 gal/min for washing. In the CCD circuit, the advancing wash water moves by gravity, the sludge by pumping. The wash water product is pumped to waste tanks. The washed sludge is accumulated in the product tank until it is full and the feed tank is empty. The washed sludge is transferred to DWPF.
- The efficiency of this process needs to be demonstrated with actual sludge samples.

Solution Required by: 10/95-9/98

Drivers:

Driver Reference:

Record Number: 518

Tanks Focus Area Site Needs

Need Title: Evaluate Ion Exchange or Precipitation Methods to Selectively Remove Cesium from High Potassium Salts

Site Name: SRS

NBS#: 1.2.2.1.3

Primary Technical Integration Area: Pretreatment

Need Description:
The use of ion exchange (IX) media, as an alternative to the tetraphenylborate precipitation process, holds promise for significant life cycle cost reductions for the Savannah River Site's (SRS) High Level Waste System (HLWS). However, the capital and project expenditures to establish ion exchange as a direct replacement for the reference process, given 'sunk' cost, makes direct substitution of the technology prohibitive in the current constrained budget environment. Rather, economically acceptable implementation of the technology at SRS would likely evolve through a large scale demonstration on single tanks or via use of a portable demonstration system. Two waste types serve as likely targets in this implementation strategy:

(1) tanks with radionuclide contents such that processing through the In-Tank Precipitation facility would be prohibitive without virtue of blending (i.e., wastes with greater than 39 Ci/gal Cs-137 equivalent);

(2) tanks with high potassium to cesium (K/Cs) ratios that would result in production of tetraphenylborate with relatively low radionuclide content (and, hence, low 'curie content' in the resultant glass canisters).

Treatment of either waste type in the reference process bears larger than 'stream average' incremental costs, the savings of which would offset the capital and project costs for implementing the ion exchange option. Demonstration of large scale 'at tank' processing for either type of waste would simplify waste removal.

Solution Required by: 10/95-6/96

Drivers:

Driver Reference:

Record Number: 519

Tanks Focus Area Site Needs	Need Title:	Optimize Waste Loading for DWPF Glass
	Site Name:	SRS
	NBS#:	1.2.4.1.3.1

Primary Technical Integration Area: Immobilization

Need Description:
If the current flowsheets, sludge washing and blending strategies and glass making constraints are used, DWPF will take 70 years to make approximately 5,720 canisters at a life-cycle operating cost of $7.1 billion and a cost of $250,000 per canister to store them in the proposed Federal Repository. The largest life cycle cost reduction available would be through adequately funding a rational schedule for waste removal; however, if more waste can be put in fewer cans, a significant amount of money can be saved. These approaches were analyzed:

1. Increased sludge washing to decrease the volume of waste vitrified.
2. Use of trim chemicals to increase waste loading.
3. Increasing the acceptable leach rate (durability) of glass 20% to increase waste loading.
4. Use of cheaper dry chemicals instead of frit to reduce material cost.

Glass which is 8% oxides from salt compounds and 26.8% oxides from sludge compounds was assumed to balance the feed streams so that neither sludge only nor salt only glass are produced. The quantity of precipitate and sludge calculated from this assumption was assumed to be the waste inventory. Making (a little more) saltstone was assumed to have a small cost compared to the savings.

Solution Required by: 10/95-

Drivers:
Enhancement in cost

Driver Reference:

Record Number: 520

Tanks Focus Area Site Needs

Need Title: Identify Alternates to Formic Acid for Melter Feed Redox Adjustment to Reduce H2 and NH3 Formation

Site Name: SRS

NBS#: 1.2.4.1.2.2

Primary Technical Integration Area: Immobilization

Need Description:
Sludge feed preparation steps in the Defense Waste Processing Facility utilize formic acid to reduce mercury and, in combination with nitric acid, to adjust the melter feed redox. These reactions are carried out principally in the Slurry Receipt Adjustment Tank. The H2 and NH3 are undesirable products from these reactions. While DWPF has been modified to safely handle these gases, identification of alternatives for redox adjustment would be advantageous.

Solution Required by: Immediate

Drivers:
Enhancement in cost, safety

Driver Reference:

Record Number: 521

Tanks Focus Area Site Needs	Need Title:	Demonstrate Process for Amalgamation of Mercury which Results in a Nonhazardous Waste
	Site Name:	SRS
	NBS#:	1.2.4.1.4

Primary Technical Integration Area: Immobilization

Need Description:
No process currently exists to amalgamate mercury in batches greater than 10-20 ml. Production of waste mercury at DWPF may exceed 100 liters per year within the next 5-10 years. Expansion of laboratory-scale amalgamation techniques is not practical to treat large volumes. A treatment process that can successfully amalgamate larger volumes of mercury will eliminate the need for a labor intensive operation of multiple laboratory-scale processes.

The process must be capable of mixing waste mercury with the appropriate inorganic material (e.g., copper or sulfur) to form an amalgam that will pass the TCLP (i.e., mercury concentration in the extract < 0.2 mg/lt.).

The process also must provide for packaging the amalgam in a disposal container that meets the LLW disposal facility waste acceptance criteria.

Solution Required by: Immediate

Drivers:
FFA

Driver Reference:

Record Number: 523

Tanks Focus Area Site Needs	Need Title:	Evaluate LLW Vitrification as an Alternative to Saltstone
	Site Name:	SRS
	NBS#:	1.2.3.2.2.2

Primary Technical Integration Area: Immobilization

Need Description:
The current saltstone process creates 1.6 volume units of treated waste for every volume unit of waste feed. A large part of the waste management cost is, therefore, for the storage facilities for the wasteform. The proposal is to replace the saltstone process with a proven waste treatment process which greatly reduces the treated waste form volume. Preliminary estimates indicate that a vitrified waste form would occupy less than one fifth the space of the current waste form. To avoid any up front capital costs to the company the proposal is to privatize the vitrification process as has been demonstrated in M-Area. It is assumed that the vitrified waste form would be stored in a saltstone-type vault. The vitrified waste could be poured into square drums, as is planned at Idaho Falls, which could then be close packed in the vault.

Solution Required by: TBD

Drivers:
Enhancement based on cost

Driver Reference:

Record Number: 524

Tanks Focus Area Site Needs	Need Title:	Tank Closure Demonstration for an Arid Site
	Site Name:	Hanford
	NBS#:	1.3.4

Primary Technical Integration Area: Stabilization/Closure

Need Description:
Description of Technology Need: The Single-Shell Tank Closure Work Plan (DOE/RL-89-16) will receive and incorporate the results of the closure demonstration and of each separate analysis. The need is to develop criteria for closing tanks at an arid site. Tank closure criteria impose performance requirements for waste retrieval systems, since the purpose of waste retrieval under the Tri-Party Agreement is to remove sufficient waste to allow tank farms to be closed. Accordingly this work is necessary to provide a technical basis for performance specifications for waste retrieval systems for the AAS Phase 2 contract. Also this work will test the regulatory process for closing tanks. The Single-Shell Tank Closure Work Plan (DOE/RL-89-16) will receive and incorporate the results of this analysis.

Description of Problem to be Solved: Develop waste tank closure criteria for an arid site. This proposed work involves demonstration of closure for such a tank. This work scope would complement the tank closure demonstration in Tank 19 at SRS by focusing on those aspects of closure most pertinent for an arid site (i.e., Hanford, INEL), but probably not applicable to sites such as SRS or West Valley where tanks are located within or very near the water table. Detailed engineering, equipment procurement, and actual tank closure is probably not feasible until after FY 1998. However a number of preliminary activities are necessary to provide the technical basis for actual demonstration of tank closure, which includes Contaminant Transport Modeling in Support of Tank Closure Demonstration; Tank Fill Analysis and Development in Support of Tank Closure Demonstration; Development of Criteria for Tradeoffs of Health and Safety Risk between Workers and the Public, Short-Term and Long-Term; Hanford Barrier Asphalt Durability and Shear Resistance Testing.

Solution Required by: 8/96-9/00

Drivers:
HTI - Check date P2 Privatization; TPA target milestone for submittal of a closure plan for the first SST farm to be closed, due November 2004 (TPA M-45-06-T01). More immediately, it supports definition of performance requirements for waste retrieval systems for the first SST farm to be retrieved, and therefore is a necessary input to the retrieval system design completion for the first SST farm, due December 2000 (TPA M-45-03). Failure to evaluate enhancements to the current baseline, will constrain Phase I and Phase II cost and production, impact completion of the TPA M-45-03 milestone for 99% SST retrieval demonstration, and limit closure alternatives.

Driver Reference:
Tank C-106 Heel Removal, TPA Milestone M-45-03-T02, and ISSTR concept design, TPA Milestone M-45-04A.

Record Number: 528

Tanks Focus Area Site Needs	Need Title:	Waste Acceptance Testing
	Site Name:	Hanford
	NBS#:	1.2.3.1.6

Primary Technical Integration Area: Characterization

Need Description:
Description of Technology Need: Methods for acceptance inspection and testing of immobilized waste products (LLW and HLW) are needed to verify conformance with specifications prior to taking custody of the product(s) from the immobilization vendors. In FY 1996, the baseline program is developing the product acceptance strategy for the immobilized products and is identifying potential methods for inspection and testing. Product characteristics that may be determined include internal cracking surface area, secondary phase formation including devitrification, void volume, free liquids, chemical and radiochemical composition, homogeneity, and container integrity. Potential inspection and testing methods include radiography, density measurements, x-ray fluorescence, x-ray computed tomography (CT), isotopic-based CT, electromagnetic techniques, and ultrasonic techniques. Based on the evaluations conducted in FY 1996 as part of the "addbacks," the most promising techniques will be tested, adapted, developed as necessary to assure that the tools are available for qualification testing and operations.

Description of Problem to be Solved: This work will provide the inspection and testing tools necessary to verify conformance with specifications prior to taking custody of the LLW and HLW products from the immobilization vendors.

Solution Required by: 10/97-9/01

Drivers:
Supports TPA M-51-03 and M-51-00; Phase I privatization, Phase II RFP

Driver Reference:
Phase I privatization RFP

Record Number: 529

Tanks Focus Area Site Needs	Need Title: Off Riser Sampling Site Name: Hanford NBS#: 1.1.3.1.1

Primary Technical Integration Area: Characterization

Need Description:
Description of Technology Need: Gather data on single shell and double shell tanks, in areas where conventional core sampling is not effective. Data gathered will support both stabilization and retrieval functions. This technology was ranked high due to the urgency and importance of providing this data.

Description of Problem to be Solved: Currently, the truck core sampling systems (ie, rotary and push mode core trucks) have difficulty in attaining samples, sometimes. If there are sections (layers) of the tank that waste sample material is not available for analysis, critical information may be missing that is necessary to understand the tank contents, and ultimately dispose of the tank contents.

Solution Required by: 10/96-9/99

Drivers:
Programmatic driver to obtain more representative sampling. TPA Milestone #M-44-09, "Characterize TWRS Tank Waste." Data is needed on all of the tanks, to understand their contents sufficiently to retrieve them, and ultimately dispose of them. In areas where the core sampling is ineffective this data will be missing unless an alternative is developed.

Part of HTI, otherwise 2004 (1.1.1.3.01.03) TWRS Tank Closure (1/04)

Driver Reference:
DNFSB 93-5

Record Number: 530

Tanks Focus Area Site Needs	Need Title:	Development of Direct/Indirect In Situ Waste Energetics Measurement Capability
	Site Name:	Hanford
	NBS#:	1.1.3.4

Primary Technical Integration Area: Characterization

Need Description:
Description of Technology Need: Safe storage of tank wastes and reduction of costs.

Description of Problem to be Solved: Because of suspected and/or potential degradation of direct under-riser located wastes, there is a need to make off-riser measurements. With direct under-riser measurements, there are generally too few accessible risers to achieve a 95% confidence level for energetics and moisture measurements that are accurate and representative of the tank wastes.

Solution Required by: 10/97-9/01

Drivers:
Programmatic driver to avoid core sampling. TPA Milestone M-40-0- "Closure USQ" subtask "Resolve Organic Issues"; Low moisture content requires low energetics to assure reaction could not occur. If reaction did occur, unacceptable release of contamination to personnel is possible. Each year deployment is delayed would increase sampling need substantially.

Driver Reference:
WHC-SD-WM-SAR-03, "Preliminary Safety Criteria for Organic Watch List Tanks"

Record Number: 531

Tanks Focus Area Site Needs		
	Need Title:	Instrumentation to Remotely Monitor Low (<5 wt.%) Waste Moisture Concentrations
	Site Name:	Hanford
	NBS#:	1.1.3.1.2

Primary Technical Integration Area: Safety

Need Description:
Description of Technology Need: To avoid the cost and issues of sampling, and support economic, long-term waste management, the development of a low moisture sensor for the in situ, remote tank wastes is needed.

Description of Problem to be Solved: Current techniques for measuring moisture concentrations of the waste are not adequate for assuring the safety of the tanks. New instrumentation is required to provide this information, in-situ.

Solution Required by:

Drivers:
Moisture content of >5% will preclude waste tank reactions from occurring. If reaction did occur, unacceptable release of contamination to personnel is possible. Each year deployment is delayed would increase a sampling need substantially.

Driver Reference:
WHC-SD-WM-SARR-033 "Preliminary Safety Criteria For Organic Watchlist Tanks"

Record Number: 532

Tanks Focus Area Site Needs	Need Title:	Technetium Removal
	Site Name:	Hanford
	NBS#:	1.2.2.1.4

Primary Technical Integration Area: Pretreatment

Need Description:
Description of Technology Need: Basic testing will be done with ion exchange resins and precipitation with sulfide for the removal of technetium in FY 1996 with a DSSF composition waste simulant and actual DSSF waste. In FY 1997/1998 more testing with simulants and actual waste of "other" compositions, e.g., NCAW, CC, and/or other Phase 1 wastes is required.

Description of Problem to be Solved: A technically viable, practical approach needs to be demonstrated for removal of technetium from DSSF, CC, and other DST supernatants. Technetium removal is a requirement for Phase 1 Privatization to produce a low activity waste product with a Class A concentration for technetium. No technology has been demonstrated to remove technetium from Hanford wastes.

Solution Required by: 10/95-1/98

Drivers:
There are two drivers for technetium removal. The first driver for technetium removal is the production of Phase 1 low activity waste product with Class A concentration of technetium. The second driver for technetium removal is to meet low activity waste disposal system performance assessment requirements. This technology development is needed to reduce the technical risk of Phase 1 by providing a technical approach to achieve a major Phase 1 pretreatment objective.

Driver Reference:
"Bader" Letter: 95-PRI-073, "Tank Waste Remediation System (TWRS) Guidance for Update of the Multi-Year Program Plan (MYPP)-Supplemental Guidance for the Disposal Program," from C.P. Bader to A.L. Trego, July 26 1995
TWRS Privatization Request For Proposals Draft, DE-RP06-96RL13308, November 1995, Department of Energy, Richland, Washington

Record Number: 533

Tanks Focus Area Site Needs

Need Title: Waste Retrieval Methods Needed for DST Waste Not Amenable to Advanced Design Mixer Pump Retrieval
Site Name: Hanford
NBS#: 1.2.1.7.3

Primary Technical Integration Area: Retrieval

Need Description:
Description of Technology Need: Retrieval of SY-102 using two mixer pumps is not expected to provide sufficient cleanout due to the strength, or resistance to mobilization, of the sludge. Emptying the TRU sludge from SY-102 is required to provide clean staging of complexed supernates from SST stabilization in the west area (M-41-00) Prior to cross site transfer. A sonic probe uses low frequency sonic vibration to effectively lower the shear strength of the sludge. By reducing the strength of the sludge, the mixer pumps will provide adequate mobilization to meet the waste removal needs. The sonic probe was developed as an alternate to the mixer pump technology for mitigation of tank SY-101. The waste consolidation demonstration will support those activities associated with retrieval during AAS Phase 2.

Description of Problem to be Solved: Waste retrieval methods are needed for DST waste not amenable to Advanced Design Mixer Pump retrieval. Install and evaluate alternate retrieval methods such as the sonic probe to improve the waste retrieval system performance in the SY-102 sludge. While mixer pump retrieval performance is expected to be adequate for waste consolidation and pretreatment operations, SY-102 must be made exceptionally clean to act as the 200 West Area staging tank for SST stabilization supernates. Additional waste mobilization beyond mixer pumps are required must be deployed to adequately retrieve the TRU waste sludges.

Solution Required by: 10/96-9/00

Drivers:
SY102; M-41-00; This activity provides for an additional retrieval system that may be required to remove the remaining wastes in some DSTs.

Driver Reference:
A sonic probe design was completed for Tank 241-SY-101.

Record Number: 534

Tanks Focus Area Site Needs	Need Title:	SST Retrieval Equipment/System Development
	Site Name:	Hanford
	NBS#:	1.2.1.7.1.1

Primary Technical Integration Area: Retrieval

Need Description:
Description of Technology Need: Early results will provide cost and performance data comparing alternate and enhanced sluicing retrieval methods to the performance of past-practice sluicing. Data will be applied to the selection of retrieval systems for 1) Tank C-106 Heel Removal, 2) Phase I M&I retrieval, 3) ISSTRS concept design M-45-04A, 4/97, 4) "Phase II risk reduction", and 5) performance assessment for SST closure. Supports Core Competency by providing expertise in the application of retrieval tools, regardless of the implementor.

Description of Problem to be Solved: Higher pressure sluicing systems are expected to be able to dislodge harder sludge (heel) than past-practice sluicing methods. High pressure systems could achieve higher retrieval rates over past practice sluicing for difficult to retrieve waste types thus enhancing baseline retrieval technologies. This activity will compare the performance of past-practice sluicing and higher pressure, enhanced systems, including cost, schedule and retrieval rates for each of the TWRS Manage Waste functions, deploy, mobilize, convey and transfer.

Solution Required by: 10/94-9/00

Drivers:
M-4J-03; Failure to evaluate enhancements to the current baseline will constrain Phase I and II cost and production, impact completion of the TPA M-45-03 milestone for 99% SST retrieval demonstration, and limit closure alternatives.

Driver Reference:
Tank C-106 Heel Removal, TPA Milestone M-45-03-T02, and ISSTRS concept design, TPA Milestone M-45-04A

Record Number: 535

Tanks Focus Area Site Needs	Need Title:	Pretreatment Demonstration for Phase I Sludges
	Site Name:	Hanford
	NBS#:	1.2.2.2.2

Primary Technical Integration Area: Pretreatment

Need Description:
Description of Technology Need: Experimentation with radioactive sludge samples from tanks 101AZ, 102AZ, 101AY, and 106C will be conducted so that the M&O contractor can establish the procedures for preparing the HLW sludges for Phase I privatization. The preparation of these wastes will occur in Hanford's double-shell tanks. Testing will involve contacting the sludges and sludge blends with water and caustic to establish the efficiency for removal of soluble salts and radioactive material. Settling of the sludge mixtures will be measured to qualitatively predict performance in the large scale tanks. The residual sludges and resultant supernatants will be analyzed to establish a preferred approach for the sludge washing operations.

Description of Problem to be Solved: The behavior of the HLW waste sludges identified for Phase I (101AZ, 102AZ, 101AY and 106C) during sludge washing and caustic leaching needs to be understood to provide the basis for establishing in-tank sludge treatment procedures, and estimating the mass and composition of the Phase I HLW feed.

Solution Required by: 10/95-2/98

Drivers:
Supports negotiation of the Phase I-B privatization contract for HLW Vitrification (2/98) by establishing the HLW mass and composition to be vitrified.

Driver Reference:
Request for Proposal for Phase I of the TWRS privatization contract (draft)

Record Number: 538

Tanks Focus Area Site Needs	Need Title:	Demonstration of TRU/Sr-90 Removal
	Site Name:	Hanford
	NBS#:	1.2.2.1.4

Primary Technical Integration Area: Pretreatment

Need Description:

Description of Problem to be Solved: To date only extremely slow low temperature complexant destruction processes or very high pressure, high temperature complexant destruction processes have been demonstrated as possible candidate technologies for removal of TRU and strontium from complexed waste. Both are impractical technologies to apply to this problem. The low temperature processes have reaction times exceeding a year. The high temperature processes are very expensive and provide significant safety challenges to overcome. Precipitation with hydrated iron oxide has shown promise in some very preliminary experiments. Further tests are needed to demonstrate TRU/Sr-90 removal from actual complexant concentrate waste using hydrated iron oxide to achieve a LLW product that meets the Class C criterion for TRU and criterion that will agree with NRC for Sr-90. A practical cost-effective technology approach needs to be demonstrated for this Phase I feed type.

Solution Required by: 10/95-1/98

Drivers:
This activity reduces the risk of Phase I vendors by proving a practical cost-effective technology approach to removing TRU and possibly Sr-90 from complexant concentrate waste contained in tank 241-AN-107 and/or 241-AN-102. TRU must be removed to meet Class C. Sr-90 may need to be removed to meet NRC incidental waste criterion which will be negotiated in the future.

Driver Reference:
"Bader" Letter: 95-PRI-073, "Tank Waste Remediation System(TWRS) Guidance for Update of the Multi-Year Program Plan (MYPP)-Supplemental Guidance for the Disposal Program," from C.P. Bader to A.L. Trego, July 26 1995

Record Number: 539

Tanks Focus Area Site Needs	Need Title:	Contaminant Release from Waste Form
	Site Name:	Hanford
	NBS#:	1.3.2.2

Primary Technical Integration Area: Immobilization

Need Description:
Description of Technology Need: Determine contaminate release (not just waste form durability) over thousands of years. Experimentation and computer simulation will be needed to determine the durability of the waste form and then the chemical interactions which will retard the radionuclides near the waste form. The experimentation will take many years as the waste form evolves over the time of the experiment. The work will build on existing efforts at PNNL and ANL.

Description of Problem to be Solved: The first and (in many scenarios) most important barrier to radionuclide contamination of the human environment is the physical barrier of the waste form. This work (combined with inventory) will provide the source term for safety and environmental analyses.

Solution Required by: 6/97

Drivers:
Support of Phase 1 Privatization; LLW Performance Assessment, TPA to complete disposal of LLW

Driver Reference:
WHC-SD-WM-PAP-062, "LLW Performance Assessment Statement of Work"

Record Number: 540

Tanks Focus Area Site Needs	Need Title:	In Situ Core Drilling-Speciation
	Site Name:	Hanford
	NBS#:	1.1.3.1.2

Primary Technical Integration Area: Characterization

Need Description:
Description of Technology Need: Adapt the Raman instrumentation package, that is currently being developed by Lawrence Livermore National Laboratory (LLNL) for use on the Cone Penetrometer, for use on the Rotary Mode, and Push Mode Core sampling Systems.

Description of Problem to be Solved: Currently the core sampling systems (ie, rotary and push mode core trucks have difficulty in attaining samples, sometimes. If there are sections (layers) of the tank that waste sample material is not available for analysis, critical information may be missing that is necessary to understand the tank contents, and ultimately dispose of the tank contents.

Solution Required by: 10/98-6/03

Drivers:
Programmatic driver to avoid core sampling. TPA Milestone M-44-09 "Characterize TWRS Tank Waste"; Data is needed on all of the tanks, to understand their contents sufficiently to retrieve them, and ultimately dispose of them. In areas where the core sampling is ineffective this data will be missing unless an alternative is developed.

Driver Reference:
DNFSB 93-5

Record Number: 541

Tanks Focus Area Site Needs	Need Title:	Radioactive HLW Vitrification Tests - Phase I
	Site Name:	Hanford
	NBS#:	1.2.4.1.1

Primary Technical Integration Area: Immobilization

Need Description:
Description of Technology Need: Radioactive vitrification tests using small quantities of actual washed tank sludge from the sludge washing studies was initiated in FY 1996. Continuation of this critical work is required. Laboratory-scale processing and product data must be characterized and compared to the nonradioactive simulant and product tested as part of the Phase I HLW glass formulation testing. The behavior of technetium during vitrification testing must also be characterized.

Description of Problem to be Solved: Testing is needed to validate the actual high-level wastes behave similarly to the simulants with which the vitrification process and glass formulation was developed. Testing is specifically required for Phase I high-level waste feed from Tanks 101AZ, 102AZ, 106C, and 102AY and/or blends of these wastes.

Solution Required by: 10/96

Drivers:
Privatization; Supports negotiation of the Phase I-B privatization contract for HLW vitrification (2/98) by establishing the glass formulation envelope(s) needed to vitrify the waste.

Driver Reference:
Request for Proposal for Phase I of the TWRS privatization contract (draft)

Record Number: 542

Tanks Focus Area Site Needs	Need Title:	LLW - Offgas Treatment
	Site Name:	Hanford
	NBS#:	1.2.3.1.2.3

Primary Technical Integration Area: Immobilization

Need Description:
Description of Technology Need: Lab scale tests are needed to demonstrate the chloride removal system and thus validate results generated in ASPEN material and energy balances for the TWRS process flowsheet. Demonstration would encompass obtaining separation factors, number of theoretical stages, and operational parameters (i.e., reflux ratio, boilup ratio, etc.) for the partitioning of HCl and HF from a HCL-HF-HN03-NaN03 mixture in a primary multistage column at varying compositions. the overheads from the first column would be further separated in a second column. This second multistage column would be used to obtain separation factors, number of theoretical stages, and operational parameters for the resulting HCL-HF-HN03 overheads to determine the overall efficiency of the process to remove HCl from the other volatile. The feed mixture may also contain HI which would provide data as to the final disposition of the radioactive iodine. The results from this work will be entered into the ASPEN data banks in order to better simulate the columns' performances and will be used to develop the final disposal method for the chloride (i.e., grout, adsorption, etc.).

Description of Problem to be Solved: Removal of chlorides and fluorides is necessary to prevent build-up to corrosive levels in the LLW melter. Emission requirements prevent discharge of this hazardous substance. An FY 1995 trade study identified distillation as the preferred alternative for removing chlorides and fluorides. Distillation was subsequently incorporated into the flowsheet. This activity validates separation efficiencies that were assumed in the reference flowsheet document.

Solution Required by: 7/02

Drivers:
Startup of vitrification facilities; this activity is required for the design by DOE and its contractors as a contingency should the alternate acquisition strategy prove unsuccessful. It enables cost-effective materials of construction to be used by ensuring there is no build up to corrosive levels of chlorides and fluorides in the melter.

Driver Reference:
Orme, R.E., TWRS process Flowsheet, WHC-SD-WM-TI-613, Rev 1, August 1995, Westinghouse Hanford Company, Richland, Washington.

Record Number: 543

Tanks Focus Area Site Needs	Need Title: Tank Leak Mitigation Systems Site Name: Hanford NBS#: 1.2.1.6

Primary Technical Integration Area: Safety

Need Description:
Description of Technology Need: Provisions for leak monitoring and mitigation is prerequisite to actions required for removing waste from leaking tanks. TPA Milestone M-45-08 requires measures for leak monitoring and mitigation be included in the design of the Initial SST Retrieval System (ISSTRS). Mitigating leaks applies to all SST retrieval, including AAS Phase I and Phase 2. Concepts from this task will be applied to the ISSTRS design.

Description of Problem to be Solved: Leak mitigation technologies need to be evaluated for possible application during SST retrieval operations. This evaluation will incorporate demonstrations, including private industry, to provide recommendations for testing of leak mitigation technologies. Concepts include sheet barriers, close-coupled grout injection barriers, and dry-air containment barriers and retrieval methods which minimize leaking tank configurations.

Solution Required by: 6/96-6/97

Drivers:
This supports TPA milestones for submitting annual progress reports on the development of waste tank leak monitoring/detection and mitigation activities. The first such report is due 9/30/96 (TPA M-45-09A).

Driver Reference:
Preparation of closure plan for closing SST farms.

Record Number: 544

Tanks Focus Area Site Needs	Need Title:	In Situ Testing of LLW Glass Release
	Site Name:	Hanford
	NBS#:	1.3.2.2

Primary Technical Integration Area: Immobilization

Need Description:
Description of Technology Need: A fully-instrumented, in-situ, field experiment is proposed for the purpose of validating computational models that are being used to calculate fluid-flow, release of contaminants from glass, and solute transport through Hanford soils. The experiment will not necessarily be designed to directly simulate expected disposal conditions. Water injection rates and waste form release properties may be selected to shorten the time required to achieve measurable results.

Description of Problem to be Solved: Completion of this work will significantly improve confidence in the models that are being used to calculate radionuclide release rates from fractured glass monoliths in an unsaturated environment, particularly at a scale that is not readily attainable in a laboratory setting. Hence, this work will reduce the risk associated with the preparation of the Phase 2 RFP and implementation of full scale production.

Solution Required by: 6/97

Drivers:
Support of Phase 1 Privatization

Driver Reference:
WHC-SD-WM-PAP-062, "LLW Performance Assessment Statement of Work for FY 1996 to 2001"

Record Number: 545

Tanks Focus Area Site Needs	Need Title: Testing of Capillary Breaks Site Name: Hanford NBS#: 1.3.2.2

Primary Technical Integration Area: Stabilization/Closure

Need Description:
Description of Technology Need: Work should consist of gathering data for various capillary barrier designs. Initial work would be based on laboratory scale testing. Large scale field testing would be conducted on one or two designs that tested well in the laboratory. All tests would evaluate properties of the barriers and failure mechanisms. These barriers would be applicable to disposal sites in the western United States.

Description of Problem to be Solved: Models show that a capillary barrier can be an important part of a disposal facility design. The capillary barrier diverts moisture away from the waste forms. However, there are extremely little experimental data available to support the modeling. Also, a current disposal concept contains a long capillary barrier which may fail due to its size. Data are needed to show that the capillary barrier works well and can be large. If the capillary barrier works well, DOE may be able to relax the specifications for the Phase 2 RFP. The data are also needed to support the preliminary and final Performance Assessment efforts which need to be based on actual data.

Solution Required by: 10/96-9/99

Drivers:
LLW Performance Assessment, Phase II privatization RFP

Driver Reference:
WHC-SD-WM-PAP-062, "LLW Performance Assessment Statement of Work"

Record Number: 546

Tanks Focus Area Site Needs	Need Title:	Getter Materials
	Site Name:	Hanford
	NBS#:	1.3.2.1

Primary Technical Integration Area: Stabilization/Closure

Need Description:
Description of Technology Need: To continue work being done at Sandia National Laboratory on getter material. This material could be used as a filler material inside the disposal facility. Getters for Tc, Se, and I will be the major focus for this work.

Description of Problem to be Solved: The purpose of work is to develop getter materials for important radionuclides that could be released from the waste form. The getter material could interact with the radionuclides. Thus the getter material becomes a chemical barrier to the contaminant transport and may be a very important positive contributor to successful long-term performance of the disposal system. Concrete is a known chemical barrier to uranium.

Solution Required by: 10/96-9/99

Drivers:
Grout Performance Assessment, Phase II privatization RFP

Driver Reference:
WHC-SD-WM-PAP-062, "LLW Performance Assessment Statement of Work"

Record Number: 547

Tanks Focus Area Site Needs	Need Title: LLW - On-line Analysis Site Name: Hanford NBS#: 1.2.3.1.3

Primary Technical Integration Area: Immobilization

Need Description:
Description of Technology Need: Analytical support or process instrumentation would be developed which is capable of providing on-line analysis to ensure waste product quality is adequately controlled. Analysis of melter feed, pretreatment feed, glass melt, and glass pour stream should be considered. This activity would include the testing of potential instruments which could be used.

Description of Problem to be Solved: On-line analysis is needed to allow adequate product quality to be achieved with an acceptable total operating efficiency.

Solution Required by: 10/96-9/02

Drivers:
Programmatic driver (?) to improve process control during LLW grouting. Supported by milestone to "Complete DWPF activities by 2028"?

Driver Reference:
"Bader" Letter: 95-PRI-073, "Tank Waste Remediation System (TWRS) Guidance for Update of the Multi-Year Program Plan (MYPP) - Supplemental Guidance for the Disposal Program," from C.P. Bader to A.L. Trego, July 26, 1995

TWRS Privatization Request for Proposals Draft, DE-RP06-96RL13308, November 1995, Department of Energy, Richland, Washington

Record Number: 549

Tanks Focus Area Site Needs	Need Title:	Pretreatment Demonstration for Phase II HLW Sludges
	Site Name:	Hanford
	NBS#:	1.2.2.2.2

Primary Technical Integration Area: Pretreatment

Need Description:
Description of Technology Need: Sludge washing and caustic leaching studies, combined with sludge dissolution thermodynamic studies, will be conducted through the year 2003 to provide the technical basis to estimate the mass and composition of HLW requiring vitrification in Phase II privatization. This information will also be used to establish feasible sludge pretreatment and blending strategies to manage the tank farms. These test results, combined with experimental work on vitrification of sludges, will provide information to support engineering studies that will allow the DOE to specify the requirements for the Phase II privatization and to determine a value for the requested HLW vitrification contract.

The experimental work on sludge washing is directed at collecting data on the behavior of important non-radioactive (Al, Cr, P, Bi and Na) and radioactive (Cs, Sr, Tc, and TRU) sludge components during water washing and caustic leaching.

Description of Problem to be Solved: Pretreatment testing of the Hanford tank sludges is needed in order to provide the technical basis, i.e., mass and composition of the sludges, for the DOE to establish the requirements for the Phase II HLW vitrification contract.

Solution Required by: 10/95-9/00

Drivers:
Phase 2 Release Date; Provides technical basis for preparation of feed specifications to be used in the Phase II privatization Request for Proposal.

Driver Reference:
Bader letter, 95-PRI-073, dated 7/26/95

Record Number: 553

Tanks Focus Area Site Needs	Need Title: Waste Loading Optimization for HLW Site Name: Hanford NBS#: 1.2.4.1.1.1

Primary Technical Integration Area: Immobilization

Need Description:
Description of Technology Need: The ability of the FACT model to predict liquidus temperature, with special emphasis on spinels, nepheline, and zirconium-containing phases, needs to be established. Available data will be used to formulate and test a limited number of glasses to validate maximum waste loading model predictions. Empirical models for important crystalline phases, e.g., nepheline, may need to be developed, if the FACT model does not have the needed accuracy.

Description of Problem to be Solved: The maximum glass waste loading for a variety of HLW waste blends and compositions needs to be determined and the resulting quality of the glass, i.e., leach resistance, demonstrated.

Solution Required by: 7/02

Drivers:
Startup of vitrification facilities; Provides technical basis for establishing higher waste oxide loading limits in the product specification for the Request for Proposal Phase II privatization.

Provide information to resolve Systems Requirements Review finding.

Driver Reference:
Bader letter, 95-PRI-073, dated 7/26/95

TWRS System Requirements Review Action Plan, DOE/RL-95-74, Rev. 1, dated 9/18/95

Record Number: 554

Tanks Focus Area Site Needs		
	Need Title:	Real Time Waste Property Measurement System for Waste Transfer
	Site Name:	Hanford
	NBS#:	1.2.1.1.2

Primary Technical Integration Area: Characterization

Need Description:
Description of Technology Need: The instrumentation capability will be needed to assure that pipeline transfers of waste meet requirements, regardless of performing organization. Waste transfer monitoring is required for any GOCO retrieval as well as any privatized retrieval which utilizes pipeline transfers of waste.

Description of Problem to be Solved: Demonstrate Real Time waste property measurement is required to assure compliance with procedures for hazards relating to waste transfers, including 1) postulated leaks and line breaks, 2) mass imbalance, 3) trapped gas, 4) criticality, 5) energetics, and 6) line plugging. This effort is to perform a demonstration of the ability to measure pertinent waste parameters. Pertinent waste properties are percent solids, pH, and Reynolds Number. Reynolds Number is a calculated number based on velocity, pipe geometry, and kinematics viscosity.

Solution Required by: 10/95-9/98

Drivers:
M-45-04A; The work should be complete, and design concepts with conceptual level cost estimates prepared to feed the 4/97 First Farm Design Concept TPA milestone M-45-04A. To incorporate the overall system concept the work must be completed prior to 1 Dec 96. Continued transfer analyses will be applied to the transfer system requirements.

Driver Reference:
Project W-058, Cross-site Transfer Line requirements.

Record Number: 555

Tanks Focus Area Site Needs	Need Title:	Process for Immobilization of Tc-Rich Waste Stream
	Site Name:	Hanford
	NBS#:	1.2.4.1.1

Primary Technical Integration Area: Immobilization

Need Description:
Description of Technology Need: A vitrification process to immobilize Tc-rich wastes with a retention efficiency up to 99% needs to be developed and demonstrated. Most of the Tc volatility loss during normal vitrification processes occurs before the TcOx species dissolve into the glass melt. A proposed two stage process would reduce Tc volatility by using a low-temperature process (200 degrees C to 500 degrees C) to first melt the Tc into a low volatility precursor waste form. In the second stage, the precursor waste form would be melted with glass former additives to produce a durable glass that melts below 1000 degrees C (below the temperature where Tc volatilizes from the precursor or final glass). Rhenium would be used as a surrogate for Tc during initial development to reduce cost. The technology must be demonstrated in both crucible and bench-scale melter testing with Tc.

Description of Problem to be Solved: Immobilization of technetium in glass presents a particularly difficult problem because of its high volatility. The RFP for Phase I privatization is currently requesting the vendor to remove Tc from the supernatant. The separated Tc will then need to be immobilized for deep geologic disposal. Waste forms are also needed for secondary process wastes containing Tc that may be produced during LLW vitrification. No existing waste forms or processes currently exist to handle these Tc-rich wastes.

Solution Required by: 10/95-7/02

Drivers:
Startup of vitrification facilities; Risk reduction associated with preparation of the Request for Proposal for Phase II privatization.

Driver Reference:
Bader letter, 95-PRI-073, dated 7/26/95

Record Number: 558

Tanks Focus Area Site Needs	Need Title:	Radioactive Small-Scale Vitrification Demonstration (HLW-13)
	Site Name:	Hanford
	NBS#:	1.2.4.1.5

Primary Technical Integration Area: Immobilization

Need Description:
Description of Technology Need: A small-scale vitrification demonstration test using HLW tank sludge is needed to verify that radioactive feed behaves the same as the simulant feeds used in process development studies.

Description of Problem to be Solved: Design of a vitrification facility to immobilize Hanford HLW slurries will be based primarily on testing conducted with nonradioactive simulants of Hanford HLW. It is important that the immobilization process and facility design be validated with radioactive waste. If the actual waste does not behave similarly to the nonradioactive simulant used for process development, the process may not operate as designed. Unacceptable process behavior or safety hazard that requires process and/or equipment changes may result.

Solution Required by: 6/97

Drivers:
Support of Phase 2, Privatization; probably could slip

Driver Reference:
SRR Action Plan, DOE-RL-95-74, dated 9/18/95

Bader letter, 95-PRI-073, dated 7/26/95

Record Number: 561

Tanks Focus Area Site Needs	Need Title:	Demonstrate Cs Removal for Hanford Supernatants
	Site Name:	Hanford
	NBS#:	1.2.2.1.3

Primary Technical Integration Area: Pretreatment

Need Description:
Description of Technology Need: Cs removal from Hanford supernatants and dissolved salt cakes is one of the principal pretreatment functions which enables the disposal of the low-level waste portion of the tank wastes. Currently existing and emerging technologies have not been adequately demonstrated with actual waste tests for Hanford applications as planned in the privatization approach. This places technical risk on the viability of the privatization approach. This work would involve actual waste tests to evaluate alternative ion-exchange materials for the removal fo Cs from selected Hanford supernatants.

Description of Problem to be Solved: Effective removal of radio-cesium for the major supernatant groups present in the Hanford tanks which include: Double-Shell Slurry Feed, Complexant Concentrate wastes, Neutralized Current Acid waste and dissolved salt cakes.

Solution Required by: 10/95-2/98

Drivers:
Cs removal from the Hanford LLW stream is required as part of the NRC's position on "incidental waste."

No data exists to support the ability of current Cs removal technology to meet the Cs removal requirements specified in the Phase I Privatization Request for Proposal, information needed prior to Feb 1998.

Driver Reference:
TWRS Privatization Request for Proposals Draft, DE-RP06-96RL13308, November 1995, Department of Energy, Richland, Washington

Record Number: 562

Tanks Focus Area Site Needs	Need Title:	Demonstrate Filtration for Pretreatment Solid-Liquid Separations
	Site Name:	Hanford
	NBS#:	1.2.2.1.1

Primary Technical Integration Area: Pretreatment

Need Description:
Description of Technology Need: Filtration tests which evaluate a select number of filtration equipment systems (cross-flow, dead-end and etched disc) with actual wastes will be conducted. These tests will be focused on evaluating equipment performance as a function of filter type, operation conditions and waste characteristics. From this work the basis for identification of the filtration equipment system and operating conditions will be provided.

Description of Problem to be Solved: Separation of fine solids and colloidal particles from Hanford supernatants is required to assure that the low-level waste stream will have acceptably low concentrations of insoluble radioactive material, principally Sr and TRU radioisotopes.

Solution Required by: 10/95-1/98

Drivers:
Assure acceptable Sr/TRU separation from retrieval solutions, supernatants and wash solutions for the Phase I Privatization contract by Feb 1998 and the Phase 2 contract by 2005. Assure operability of ion-exchange process systems for the removal of soluble radioactive material.

Driver Reference:
TWRS Privatization Request for Proposals Draft, DE-RP06-96RL13308, November 1995, Department of Energy, Richland, Washington

Record Number: 563

Tanks Focus Area Site Needs	Need Title:	Crystalline Silico-Titanate (CST) in HLW Glass
	Site Name:	Hanford
	NBS#:	1.2.4.1.1

Primary Technical Integration Area: Immobilization

Need Description:
Description of Technology Need: Tests are required to determine the solubility of CST components in Phase II HLW glasses to ensure that the glass waste product volume is not significantly impacted if CST is used to remove cesium from the LLW.

Description of Problem to be Solved: Crystalline silico-titante (CST) is currently being evaluated for its ability to remove cesium from tank waste supernatants. The Cs-loaded CST would be incorporated into the HLW glass. The solubility of CST components in the glass will limit the glass waste loading. Studies have indicated that TiO2 could be included up to 5 wt% and less than 8 wt% in an all-blend waste glass without precipitating crystalline material containing titanium. The solubility of CST loading in glass will vary depending on the waste composition.

Solution Required by: 10/95-7/02

Drivers:
Startup of vitrification facilities

Driver Reference:
Kirkbride letter, "Evaluation of the Impact of the Use of Crystalline Silicotitanate Ion Exchanger on High-Level Waste Glass Production," 71210-95-011, April 25, 1995

Record Number: 567

Tanks Focus Area Site Needs	Need Title:	Settle Decant Demonstration for Solid-Liquid Separations
	Site Name:	Hanford
	NBS#:	1.2.2.2.4

Primary Technical Integration Area: Pretreatment

Need Description:
Description of Technology Need: Conduct bench-scale settle decant experiments with kilogram amounts of actual sludge to verify that retrieved and washed sludges will settle at acceptable rates in double-shell tanks. Identify the chemical regimes that will assure acceptable settling properties including settling rates, sludge compaction densities and the avoidance of nonseparable colloidal phase formation.

Description of Problem to be Solved: Verify that settle decant will be an acceptable solid-liquid separations approach for the preparation of the Phase 1 high-level wastes feeds and support sludge consolidation operations.

Solution Required by: 8/96-10/97

Drivers:
Phase I Privatization

Driver Reference:
TWRS Privatization Request For Proposals Draft, DE-RPO6-96RL13308, November 1995, Department of Energy, Richland, Washington.

Record Number: 569

Tanks Focus Area Site Needs	Need Title:	LLW - Separable Phase Organics
	Site Name:	Hanford
	NBS#:	1.1.2.1.2

Primary Technical Integration Area: Pretreatment

Need Description:
Description of Technology Need: Methods to remove entrained separable phase organic from aqueous slurry after the sludge washing operations and/or from aqueous supernatant liquid will be evaluated in FY 1997. Results would be used to design, construct, and test a bench scale unit in FY 1998.

The proposed work would also involve laboratory testing and evaluation of the electrochemical and batch hydrothermal methods for destruction of separable phase organic. A survey of destruction methods and feasibility testing of candidate methods will be performed in FY 1997. If FY 1997 testing is successful, a batch demo unit would be procured, assembled, and installed in a suitable location in FY 1998 and processing all or part of the organic in tank 241-C-103 would be initiated.

Description of Problem to be Solved: Tank 241-C-103 contains 15,000 - 20,000 L of a floating organic layer from past PUREX operation. Additional separable phase organic is believed to be in the supernatant and interstitial liquid of SSTs. The recommended alternative for interim stabilization of tank 241-C-103 is to pump the NPH-TBP organic and aqueous phases to a single DST for storage and subsequent treatment by a process to be determined. There are no provisions in the TWRS flowsheet for handling this organic. The extent of this problem needs to be characterized. Separation of the organic followed by destruction of the organic will be required for those tanks having the separable phase organic.

Solution Required by:

Drivers:
The driver for this activity is the preparation of the Phase 2 RFP in 2003. This activity will reduce the technical risk of Phase 2 by demonstrating a technology to deal with separable phase organics.

Driver Reference:
"Bader" Letter: 95-PRI-073, "Tank Waste Remediation System(TWRS) Guidance for Update of the Multi-Year Program Plan (MYPP)-Supplemental Guidance for the Disposal Program", from C.P. Bader to A.L. Trego, July 26 1995

Record Number: 570

Tanks Focus Area Site Needs	Need Title:	Continuous Sludge Leaching and Processing Reactors
	Site Name:	Hanford
	NBS#:	1.2.2.2.2

Primary Technical Integration Area: Pretreatment

Need Description:
Description of Technology Need: A recent engineering trade study recommended that sludges be treated out-of-tank using novel leaching processes and equipment configurations to reduce the size of the processing system, increase sludge pretreatment process throughput, and reduce cost compared to the TWRS Baseline process of pretreating the sludges in existing double-shell tanks. The mass of sludge requiring pretreatment is approximately 45,000 metric tons currently being stored in a volume of about 20 million gallons.

Dynamically active vessels which rely on efficient flow-assisted continuous reactions (as compared to gravity-induced batch reactions) will be developed. These sludge treatment vessels will utilize enhanced mixing through turbulence, generating flow geometries to enhance leaching efficiency, maintain slurry suspension, and remove solids while performing these operations continuously.

Description of Problem to be Solved: Out-of-tank performance of sludge washing and leaching operations in specially designed process vessels could potentially improve the process efficiency and reduce costs associated with the pretreatment of the Hanford tank sludges.

Solution Required by: 10/95-9/00

Drivers:
Phase 2 Release Date; Potential unavailability of sufficient double-shell tanks to support TWRS's disposal mission.

Contingency should Phase I privatization be unsuccessful.

Driver Reference:
Initial Pretreatment Module (IPM) Project Trade Study, "In-Tank vs. Out-of-Tank Pretreatment," E/B-SD-W236B-RPT-017, Rev 1, March 3, 1995.

Record Number: 574

Tanks Focus Area Site Needs	Need Title:	Simulant (Retrieval Process Test Material) Development
	Site Name:	Hanford
	NBS#:	1.2.1.3

Primary Technical Integration Area: Retrieval

Need Description:
Description of Technology Need: Resulting simulants will be applied to validate and evaluate performance of candidate retrieval systems by measurement of properties characterized in the simulant. The waste properties identified for the simulants will be applied to waste tank characterization.

Current waste simulant recipes are characterized as extremes of SST waste forms, i.e., soft sludge and hard saltcake. These simulants have limited correlation to the range of actual waste properties. Recipes that represent intermediate physical strength properties of the waste are needed to evaluate retrieval system performance over the entire range of waste properties and demonstrate that the effectiveness of the tested processes are consistent with tank sampling and operational experience.

Description of Problem to be Solved: User approved waste simulants (retrieval process test materials) are needed to consistently test and evaluate retrieval process technologies e.g., high-pressure, 1500 psi water jet, and compare to past-practice sluicing to identify and qualify the best available commercial retrieval practices.

Solution Required by: 10/94-9/00

Drivers:
M-45-04A; First SST Retrieval System; Phase 2 Retrieval Operations.

User supplied and approved process test simulants or recipes are required for consistent comparison of the results of testing done at differing institutions and times of both commercial and EM-50 developed technologies.
M-45-04A, 4/97 Initial SST Retrieval Sys. Concept
M-45-04-T01, 2003 Initial SST farm retrieval.

Driver Reference:
Technology Need RET-3: SST Retrieval Equipment/System Development; Tank C-106 Heel Removal, TPA Milestone M-45-03-T02, and ISSTRS concept design, TPA Milestone M-45-04A.

Record Number: 575

Tanks Focus Area Site Needs	Need Title:	Long-term Testing of Surface Barrier
	Site Name:	Hanford
	NBS#:	1.3.2.2

Primary Technical Integration Area: Stabilization/Closure

Need Description:
Description of Technology Need: The purpose of this work is to monitor the long-term performance of the surface barrier. Long-term testing will indicate the possible life time of the barrier. Accelerated testing, such as simulating a 500 year storm, can show weakness and strengths of the design. Testing will indicate if the barrier is an asset for the disposal facility. The barrier is also planned to be used for other closure activities (for example, closure of the single and double-shell tank farms).

Description of Problem to be Solved: A surface barrier is an important part of a below-surface disposal facility. The surface barrier will do the following:

1. Support plants which intake moisture, thus reduce the recharge rate

2. Contain materials to discourage human, plant, and animal intrusion

3. Has a water diverter layer to help divert moisture away from the disposal facility.

Long-term data on the performance of this barrier is not available. Although the design life of the surface barrier is 1,000 years, there are no data which shows that the design life is possible.

Solution Required by: 10/96-9/99

Drivers:
TPA Closure Plan

Driver Reference:
WHC-SD-WM-PAP-062, "LLW Performance Assessment Statement of Work"

Record Number: 578

Tanks Focus Area Site Needs	Need Title:	Cost Effective Caustic Recycle
	Site Name:	Hanford
	NBS#:	1.2.2.2

Primary Technical Integration Area: Pretreatment

Need Description:
Description of Technology Need: Current process technology for the separation of caustic (salt splitting) is unreliable, lacks flexibility in operation and is difficult to maintain in high radiation environments. Advancements in the commercial sector and DOE technology programs offer potential membrane technologies that can complete the process function of caustic recycle with greater efficiencies. The purpose of this work would be to experimentally evaluate and demonstrate a preferred technology.

Description of Problem to be Solved: Demonstration of a cost effective, flexible and reliable technology for the recovery of caustic from supernatants and wash solutions, to reduce the chemical requirements, and ultimately disposal costs associated with the TWRS waste pretreatment mission.

Solution Required by: 10/95-7/00

Drivers:
A caustic recycle approach to minimize low activity waste volume needed for Phase 2 by 2005.

Driver Reference:
None

Record Number: 585

Tanks Focus Area Site Needs

Need Title: Need for Consistent Waste Acceptance Criteria for Private Vendors

Site Name: TIM

NBS#:

Primary Technical Integration Area: Immobilization

Need Description:

Solution Required by: 12/00

Drivers:
Consent Order; tech selection

Driver Reference:

Record Number: 589

Tanks Focus Area Site Needs	Need Title: Establish Waste Acceptance for Idaho Grout Site Name: TIM NBS#:

Primary Technical Integration Area: Immobilization

Need Description:
To develop the form and process, requirements for the waste form must be established.

Solution Required by: 12/00

Drivers:
Consent Order; tech selection

Driver Reference:

Record Number: 590

Tanks Focus Area Site Needs	Need Title: Prevent/Remediate Foaming in Process Vessels Site Name: TIM NBS#:

Primary Technical Integration Area: Pretreatment

Need Description:
Foaming occurs in SRS tanks and DWPF process vessels that could slow processing and contaminate evaporator overloads.

Solution Required by: 10/96-9/00

Drivers:

Driver Reference:

Record Number: 591

Tanks Focus Area Site Needs	Need Title: Smaller, Cheaper Melters Site Name: TIM NBS#:

Primary Technical Integration Area: Immobilization

Need Description:
Development of smaller, less expensive, more easily replaceable melters would facilitate more rapid and flexible processing. Includes Record Numbers 322 and 323.

(As a result of TIM/USG meetings Jan 29-Feb2, 1996, this Need was determined to include the Needs expressed in Record Numbers 323, 559, 560.)

Solution Required by: 9/03

Drivers:

Driver Reference:

Record Number: 592

Tanks Focus Area Site Needs	Need Title: Identification of Technology Gaps to Support Privatization
	Site Name: TIM
	NBS#:

Primary Technical Integration Area: Immobilization

Need Description:
What technologies do not exist that are necessary to assure success of privatization?

Solution Required by: Immediate

Drivers:
Privatization

Driver Reference:

Record Number: 593

Tanks Focus Area Site Needs

Need Title: Develop Strategy and Method for Managing Interface Between Functions

Site Name: TIM

NBS#:

Primary Technical Integration Area: Immobilization

Need Description:
Need to develop strategy and methods for handling interface between retrieval and pretreatment, and pretreatment and immobilization (M&I/private interfaces).

Solution Required by: 10/96-9/98

Drivers:

Driver Reference:

Record Number: 594

Tanks Focus Area Site Needs	Need Title: Waste Characterization for Tc Site Name: TIM NBS#:

Primary Technical Integration Area: Characterization

Need Description:
Need to identify the amount of Tc in the waste, and what impacts that may have upon pretreatment processing and subsequent waste form composition and disposal requirements.

Solution Required by:

Drivers:

Driver Reference:

Record Number: 595

Tanks Focus Area Site Needs	Need Title: Waste Characterization Strategy (Physical/Chemical) to Support Processing Needs
	Site Name: TIM
	NBS#:

Primary Technical Integration Area: Characterization

Need Description:
There is a need for a strategy for obtaining characterization data to support processing (physical and chemical properties), including retrieval, pretreatment, and immobilization.

Solution Required by: 8/96-12/28

Drivers:
TPA Milestones M-60-00, M-50-00, & M-51-00

Driver Reference:

Record Number: 596

Tanks Focus Area Site Needs

Need Title: Waste Handiling at the Interface with Retreival and Immobilization

Site Name: TIM

NBS#:

Primary Technical Integration Area: Pretreatment

Need Description:
The need exists to understand waste behavior and effects on overall treatment systems due to waste processing interface.

Solution Required by: 10/96-9/98

Drivers:

Driver Reference:

Record Number: 597

Tanks Focus Area Site Needs	Need Title: Waste Chemistry Site Name: TIM NBS#:

Primary Technical Integration Area: Pretreatment

Need Description:
There is a need for fundamental understanding of waste chemistry, including mineralization, aging, and unusual speciation to successfully retrieve and process waste.

Solution Required by: 10/95-9/05

Drivers:

Driver Reference:

Record Number: 598

Tanks Focus Area Site Needs	Need Title: Concentration of Sludge Prior to Immobilization Site Name: TIM NBS#:

Primary Technical Integration Area: Pretreatment

Need Description:
Most solid/liquid separation work has been directed toward clarification of a liquid stream. A need exists to remove liquid from sludges in order to provide a more concentrated stream.

Solution Required by: 10/95-7/00

Drivers:

Driver Reference:

Record Number: 599

Tanks Focus Area Site Needs

Need Title: Reduce Volume of LLW by Sodium Nitrate Recovery
Site Name: TIM
NBS#:

Primary Technical Integration Area: Pretreatment

Need Description:
Sodium nitrate is the single largest mass component of tank waste. A need exists to separate out this bulk constituent as a re-usable chemical, thereby greatly reducing final waste volume.

Solution Required by: 10/95-7/00

Drivers:

Driver Reference:

Record Number: 600

Tanks Focus Area Site Needs	Need Title:	Extension of Carbon Steel Tank Life and Minimizing the Impact to Processing
	Site Name:	TIM
	NBS#:	

Primary Technical Integration Area: Safety

Need Description:
Waste tanks have exceeded, or may be needed beyond their design lifetimes. There is a need for corrosion monitoring, alternate inhibitors, and other methods to optimize the use of existing tank resources and minimize effects on downstream processing.

Solution Required by: 6/96-6/99

Drivers:

Driver Reference:

Record Number: 601

Tanks Focus Area Site Needs	Need Title: Develop Strategy, Requirements, and Needs for Deployment in Tanks Site Name: TIM NBS#:

Primary Technical Integration Area: Retrieval

Need Description:
There is a need to gain access to tanks to deploy tools (for retrieval, characterization, etc.) in a cost effective and expeditious manner.

(As a result of TIM/USG meetings Jan 29-Feb2, 1996, this Need was determined to include the Need expressed in Record Number 391.)

Solution Required by: 10/96-9/02

Drivers:

Driver Reference:

Record Number: 602

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