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Pacific Northwest
National Laboratory
Operated by Battelle for the
U.S. Department of Energy

Tanks Focus Area Site Needs Assessment

FY 2001

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April 2001

Prepared for the U.S. Department of Energy
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Executive Summary

The Tanks Focus Area's (TFA's) mission is to work with users to deliver, develop, and implement technical solutions – through an integrated approach – to safely and efficiently accomplish tank waste remediation at five major Department of Energy (DOE) sites: Hanford Site, Idaho National Engineering and Environmental Laboratory (INEEL), Oak Ridge Reservation (ORR), Savannah River Site (SRS), and West Valley Demonstration Project (WVDP). The TFA also supports the Fernald Site by providing technical assistance on an as needed basis. Although Fernald does not now have science and technology needs requiring TFA action, the TFA continues to build its relationship with Fernald to expand the TFA's ability to capitalize on successful technical solutions throughout the DOE complex.

To accomplish its mission, the TFA:

- brings together users and technical experts to define and execute the mission
- integrates the work across the sites and other funding organizations
- builds teams of users and providers to deliver and deploy technical solutions.

The TFA uses a systematic process for developing its annual program that draws from the tanks science and technology development needs expressed by the five DOE tank waste sites. TFA's annual program development process is iterative and involves the following steps:

- collection of site needs
- needs analysis
- development of technical responses and initial prioritization
- refinement of the program for the next fiscal year
- formulation of the Corporate Review Budget (CRB)
- preparation of Program Execution Guidance for the next fiscal year (FY)
- revision of the Multiyear Program Plan.

This document describes the outcomes of the first phase of this process, from collection of site needs to the initial prioritization of technical activities.

Table ES.1. Summary of Site Needs Submitted to the Tanks Focus Area

	Hanford	INEEL	ORR	SRS	WVDP	Total
Safety	8	7	1	5	1	22
Characterization	6	15	1	2	2	26
Pretreatment	9	11	2	6	1	29
Immobilization	8	33	1	4	1	47
Retrieval	11	4	1	5	3	24
Closure	8	8	1	3	2	22
Total	50	78	7	25	10	170

Each site's Site Technology Coordination Group was responsible for developing and delivering priority tank waste needs. The TFA received site needs between October and December 2000. A total of 170 site needs were received, an increase of 30 over the previous year. The needs were analyzed and integrated, where appropriate. Sixty-six distinct technical responses were drafted and prioritized. In addition, seven strategic tasks were approved to compete for available funding in FY 2002 and FY 2003. The TFA matched each need to one or more of six functions: safety, characterization, pretreatment, immobilization, retrieval, and closure. A summary of the TFA's functional assignment of the needs is shown in Table ES.1.

To prioritize the technical responses, the TFA used four rating criteria:

- **Broad-based benefit** – This criterion rated whether the technical responses could satisfy needs at multiple sites (complex-wide impact).

- **User commitment** – The TFA assessed the user's commitment based on interest expressed in the needs description and present or future co-funding of development and/or deployment.

- **Technical risk** - This criterion considered the site needs priorities related to a technical response. The waste stream risks element of this criterion could not be considered, as this information was not available in Integrated Planning, Accounting, and Budgeting System (IPABS) at the time of the evaluation.

- **Other technical impact** – The TFA considered a technical response's impacts on schedule, cost avoidance, and link to regulatory requirements.

Draft technical responses were prepared and provided to the TFA Site Representatives and the TFA User Steering Group for their review and comment. These responses were discussed at a March 15, 2001, meeting where the TFA Management Team established the priority listing in preparation for input to the DOE Office of Science and Technology (OST) budget process. At the time of publication of this document, the TFA continues to finalize technical responses as directed by the TFA Management Team and clarify the intended work scopes for FY 2002 and FY 2003. Presently, the FY 2003 CRB is under development, reflecting the priorities established by the TFA Management Team.

Each year the TFA takes a critical look at its needs assessment process to determine where to direct self-improvement efforts for the next year. Revisions to the Prioritization Criteria were made to strengthen the criteria, based on feedback from the TFA Management Team.

Coordinating site needs analyses and technical response development with and between the TFA's partner programs continues to be a sizeable task. To increase the efficiency of the coordination and integration, the TFA is establishing operating agreements between it and the TFA's three main crosscutting program partners (Characterization, Monitoring, and Sensor Technology Program, Efficient Separations and Processing Program, and Robotics). Agreements of Cooperation between the TFA and each of these three programs are being finalized.

The requirement exists to better synchronize, at the DOE Office of Environmental Management (EM) and OST level, the scheduling of program development activities that culminate in the TFA's preparation and submission of draft budget documents in the March-April timeframe of each year.

Sites continue to struggle with the magnitude of the needs documentation process resulting in incomplete needs submittals, needs not being updated to reflect changing site issues and accomplishments, and umbrella, broad-scope needs that are difficult to manage and reflect progress in resolving and closing needs.

Development and use of IPABS continues to be a serious impediment to program development. IPABS is difficult for sites and Focus Areas to use and update, leading to challenges in keeping information current. More work is still needed to make the system less cumbersome, more reliable, and better integrated. Data quality issues remain, especially in waste stream linkages to site needs and technical risks existing in those waste streams. The TFA has taken on an added burden of helping identify to the sites where data issues exist. In addition, there continues to be great uncertainty about data quality, rating criteria, and system scheduling requirements leading up to work package prioritization.

The TFA continues to refine its operations within the context of the Focus Area-centered environment, particularly in the basic science portion of its investment portfolio. Progress was made during the last year in strengthening relationships with the Environmental Science Management Program (EMSP) staff to make the program more relevant and of impact to EM high-level waste (HLW) issues. Key efforts undertaken this year include the following:

- TFA provided assistance in the selection of EMSP projects relevant to site needs and programs. TFA worked directly with the site users to identify and develop the needs for the FY 2001 HLW EMSP proposal call.

- TFA continues to suggest methods to strengthen the EMSP proposal relevancy review, so that EMSP projects clearly relevant to HLW needs and programs are initiated and renewed.

- TFA assisted in increasing communications/interactions between the EMSP Principal Investigators (PIs) and the site users by involving 12 recently renewed EMSP projects in TFA's FY 2001 Midyear Review. The EMSP PIs presented the plans and progress of their projects to site users and technical experts, and had an opportunity to interact with these staff offline.

- TFA is spearheading an effort to better communicate EMSP project information. The effort involves screening and selecting publications from relevant EMSP projects for distribution to site users.

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Acronyms

CMST	Characterization, Monitoring, and Sensor Technology Program
CPES	Chemical Process Evaluation System
CRB	Corporate Review Budget
CSSF	Calcine Solids Storage Facility
CST	crystalline silicotitanate
DOE	U.S. Department of Energy
DOE-ID	U.S. Department of Energy's Idaho Operations Office
DST	double-shell tank
DWPF	Defense Waste Processing Facility
ECR	effective cleaning radius
EIS	Environmental Impact Statement
EM	Office of Environmental Management
EMSP	Environmental Management Science Program
EN	electrochemical noise
EPA	U.S. Environmental Protection Agency
ESP	Efficient Separations and Processing Program
FY	fiscal year
HAW	high activity waste
HEPA	high-efficiency particulate air
HIP	hot isostatic pressing
HLW	high-level waste
ILAW	immobilized low activity waste
INEEL	Idaho National Engineering and Environmental Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
IPABS	Integrated Planning, Accounting, and Budgeting System
ITP	In-Tank Precipitation
LAW	low-activity waste
LDUA	Light Duty Utility Arm
LDR	land disposal restriction
LET&D	Liquid Effluent Treatment and Disposal
LLW	low-level waste
MACT	Maximum Achievable Control Technology

MOU	Memorandum of Understanding
MYPP	Multiyear Program Plan
MYTR	Multiyear Technical Response
NDE	non-destructive examination
NETL	National Energy Technology Laboratory
NGLW	newly-generated liquid waste
NPH	normal paraffin hydrocarbon
NTS	Nevada Test Site
ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
ORP	DOE's Office of River Protection
OST	DOE's Office of Science and Technology
PBS	project baseline summary
PE	problem element
PEG	Program Execution Guidance
PEWE	Process Evaporative Waste Evaporator
PI	Principal Investigator
PIC	products of incomplete combustion
PNNL	Pacific Northwest National Laboratory
RBX	Robotics Crosscutting Program
RCRA	Resource Conservation and Recovery Act
RL	DOE's Richland Operations Office
RPP	River Protection Project
SBW	sodium-bearing waste
SCFA	Subsurface Contaminants Focus Area
SREX	strontium extraction
SRS	Savannah River Site
SST	single-shell tank
STCG	Site Technology Coordination Group
TAG	(TFA's) Technical Advisory Group
TBP	tributyl phosphate
Tc	technetium
TFA	Tanks Focus Area
TIM	(TFA's) Technology Integration Manager
TRUEX	transuranic extraction
TSD	treatment, storage, and disposal
TTP	Technical Task Plan
UDS	undissolved solids

UNEX	universal solvent extraction
USG	(TFA's) User Steering Group
VCO	Voluntary Consent Order
WAPS	Waste Acceptance Product Specifications
WASRD	Waste Acceptance System Requirements Document
WIPP	Waste Isolation Pilot Plant
WTP	Waste Treatment and Immobilization Plant
WVDP	West Valley Demonstration Project

Section 1 - Introduction

This report documents the process used by the Tanks Focus Area (TFA) to analyze and develop responses to science and technology needs submitted by five major U.S. Department of Energy (DOE) sites that have radioactive tank waste problems, and the initial results of the analysis. These five sites are Hanford, Idaho National Engineering and Environmental Laboratory (INEEL), Oak Ridge Reservation (ORR), Savannah River Site (SRS), and West Valley Demonstration Project (WVDP). The TFA also supports Fernald by providing technical assistance as needed.

This is the seventh edition of the TFA site needs assessment. As with previous editions, this edition serves to provide the basis for accurately defining the TFA program for the upcoming fiscal year (FY), and adds definition to the program for up to four additional out-years. Therefore, this edition distinctly defines the FY 2002 program and further defines the FY 2003 - FY 2006 program. Each year, the TFA reviews and amends its program in response to site users' science and technology needs.

Overall, the TFA's annual program development cycle involves the

- collection of site needs
- needs analysis
- development of technical responses and initial prioritization
- refinement of the program for the next FY
- formulation of the Corporate Review Budget (CRB)
- preparation of Program Execution Guidance (PEG) for the next FY
- revision of the Multiyear Program Plan (MYPP).

This document describes the TFA's process of collecting site needs, analyzing them, and developing technical responses to the needs. It also summarizes the information captured within the TFA needs database, including information provided by the five major DOE sites that have tank waste problems. The technical scope of the TFA's 5-year program will be defined in detail with the publication of the companion to this document, the MYPP, in September 2001.

The TFA mission remains unchanged – to deliver, develop, and implement technical solutions – through an integrated approach – to safely and efficiently accomplish tank waste remediation at the five major DOE tank waste sites. The TFA focuses on the 282 tanks[1] that

[1] In 1997, two of these tanks were closed.

contain approximately 380,000 m^3 of HLW, low-level waste (LLW), and transuranic waste. There are a number of smaller tanks at these sites that are outside of the TFA's purview at this time. The varying tank structure, construction, and capacity, as well as the different waste types themselves, provide an extraordinary challenge to the formation of an integrated tanks science and technology program. Multiple programmatic, institutional, and regulatory issues across the five sites add to the complex-wide challenge of remediation.

The overall objective of the TFA program is to deliver a tank science and technology program that reduces the current cost and the technical, operational, and safety risks of tank remediation. The TFA continues to enjoy close, cooperative relationships with each site, and, while not one of the "official" TFA tank sites, the TFA also supports Fernald by providing technical assistance, as needed.

The TFA continues to emphasize technical assistance and integration activities. These activities are essential, especially considering the dynamic environment at several sites. New or amended site needs frequently arise, requiring the TFA to be prepared not only to amend its program in response, but also to help the sites arrive at the best technical approach to solve revised site needs. Additionally, as the results of technology development are not 100% guaranteed, the TFA must work with the sites to find appropriate alternative solutions if technology development and deployment results do not meet expectations.

Since its inception, the TFA cited four tanks technology program attributes essential for TFA success. These attributes guide the TFA's service to the user, such that the program is

- **applicable** - addresses users' needs and can be implemented within budget, schedule, and regulatory constraints. The TFA uses a consensus-driven site needs collection and technical response process that enhances a deeper understanding of the interrelationships of the needs. Through this process, the TFA developed a priority listing of FY 2002 and FY 2003 proposed activities in accordance with representatives from all five major tank waste sites.

- **integrated** - leverages relevant activities across the DOE EM system, across the DOE complex, and beyond. The TFA is part of a science and technology network formed within DOE's Office of Science and Technology (OST) and DOE Office of Environmental Management (EM) at each site. The awareness of related work between sites and Focus Areas continues to grow. The TFA fosters this awareness through leveraging opportunities. Under the "Focus Area-centered" concept, the TFA is making a concerted effort to more fully integrate resources available from all other OST activities; thus, the TFA is establishing operating agreements with three OST crosscutting programs (Efficient Separations and Processing Program [ESP]; Characterization, Monitoring, and Sensor Technology Program [CMST]; and Robotics Program [RBX]).

- **acceptable** - broadly involves 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 including the Site Technology Coordination Groups (STCGs) and the TFA User Steering Group (USG).

- **accountable** - performs within budget, on schedule, and produces a clear benefit. The TFA continues to execute its mission with a high degree of accuracy, both fiscally and within milestone schedules. As a result, the TFA maintains the confidence of site users.

The TFA accomplishes its mission by executing an iterative approach to program development that involves site users and stakeholders through the STCGs at each site. The needs assessment forms the basis for defining the TFA program. As previously noted, the TFA's program development cycle begins with the collection of site needs and ends with the publication of the MYPP. This site needs assessment describes the TFA's efforts through the first part of this cycle, from site needs collection through the development of technical responses and their initial prioritization. The TFA uses six steps to accomplish the first part of this cycle, which are listed below and depicted in Figure 1.1:

- STCG needs submission
- Needs analysis and screen
- Strategic investment identification
- Technical response development
- Technical response rating
- TFA Management Team prioritization.

On March 15, 2001, the TFA Management Team approved the TFA task prioritization for FY 2002 and FY 2003. Work is underway to finalize the technical responses developed earlier and to prepare the FY 2003 CRB. The final technical responses will form the basis for PEG development required for execution of the FY 2002 program.

Section 2 of this site needs assessment describes the TFA's process in reaching this point, from needs collection and analysis to task prioritization. Section 3 describes follow-on program development activities the TFA will use to complete this year's program development process cycle. Appendix A contains a summary of the needs submitted by the sites and the TFA's initial disposition of them through technical responses and prioritization.

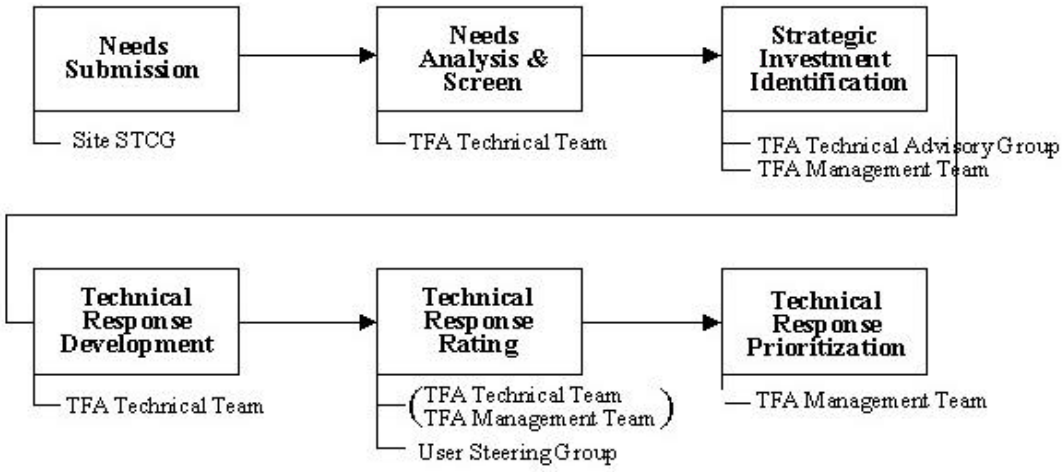

Figure 1.1. FY 2001 Tanks Focus Area Technical Response Development Process

Section 2 – Site Needs Assessment and Technical Response Development Process

The TFA continues to enjoy a general endorsement of its program development process from its site user community. Minor changes were made this year to fine-tune the TFA's proven process of program development. Specifically, following changes were made to strengthen TFA's prioritization criteria:

- **Broad-based benefit** – clarifying the identification of potential benefit to a single site.

- **User commitment** – updating the requirements for Memoranda of Understanding (MOU) to validate user co-funding.

- **Technical risk** – incorporating an additional technical risk element to be more consistent with OST work package prioritization criteria.

- **Other technology impact** – identifying the type of documentation to support cost avoidance.

As previously stated in Section 1, the program development process steps are as follows:

- STCG needs submission
- Needs analysis and screen
- Strategic investment identification
- Technical response development
- Technical response rating
- TFA Management Team prioritization.

2.1 STCG Needs Submission

The five tank waste sites submitted their science and technology development needs between October and December 2000. Each site uses its own internal process to determine and prioritize site needs. The standardized site needs template again proved helpful this year in communicating and understanding the needs. The TFA's Site Representatives were essential in communicating the needs from the sites to the TFA. (See Figure 2.1, Tanks Focus Area Organization, for a graphical depiction of the TFA organization.)

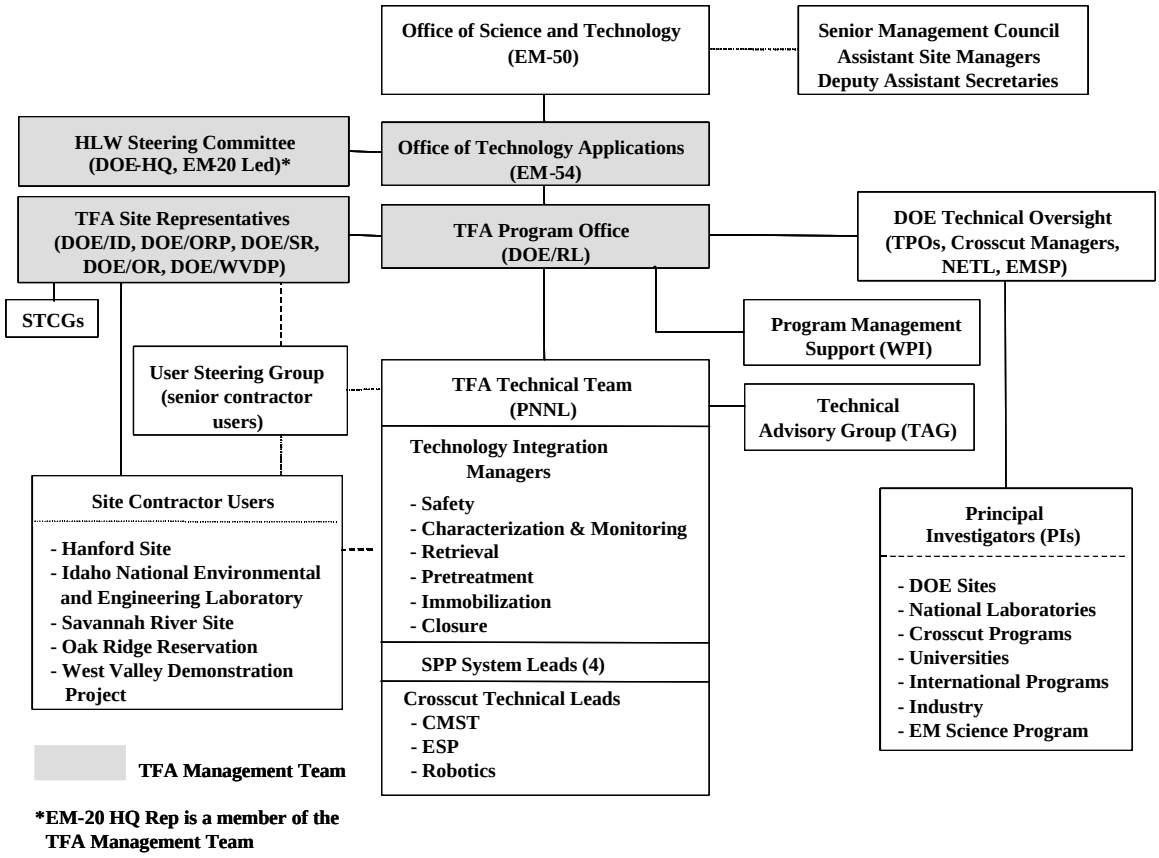

Figure 2.1. Tanks Focus Area Organization

2.2 Needs Analysis and Screen

Each science and technology need identified by the sites was subjected to an initial needs screening, which assessed whether or not the need and possible technical response

- was within the TFA mission area
- required a technology development component
  - Development, first-time hot demonstration or deployment, re-engineering, etc., was required
  - Technology was available, and no technology development was required
- was technically feasible (schedule or cost).

Those needs screened out were coordinated with the submitting site for further disposition. Some needs were screened out as potentially outside of the TFA mission area. These needs may best be addressed within a different OST program, such as another Focus Area. In such cases, the TFA interacts with the other programs and informs the submitting site STCG of any need identified as such in this process.

The TFA then analyzed each site need that passed through the screening criteria. This analysis served to familiarize the TFA with the general scope of site needs. The TFA worked interactively with the sites to better understand the problem to be solved, required performance specifications, timing of the technical solution, integration of functional interfaces (e.g., between pretreatment and immobilization), and interfaces with other OST programs.

2.3 Strategic Investment Identification

Focusing predominately on the analysis of site-submitted needs, the TFA identified needs whose solutions would be strategic in nature to the TFA and addressed these through strategic investments comprising strategic tasks and EMSP and Applied Research projects.

Strategic investments primarily address needs that would be critical over a longer-term, but aren't necessarily a current priority. Long-term strategic investments focus in two area: 1) technology "gaps" in the longer-term baseline plans, or 2) breakthrough opportunities that could produce significant savings by investment in alternatives to current baseline plans. A third type of strategic investment focuses on short-term tasks that could address urgent issues that needed rapid resolution. This type of strategic investment gives the TFA the ability to respond to urgent issues more rapidly than possible through the yearly needs identification, response, prioritization, and budgeting process. This flexibility is an important strategic advantage for the TFA. The following points illustrate a TFA strategic investment:

- Pursues a longer-term problem identified within a site baseline, but not currently being addressed. This problem may otherwise go unsatisfied due to budget limitations and priority. An official need may or may not have been submitted by the STCG of a specific site. Successful TFA response to the need may result in

    - accelerated schedule
    - risk reduction (programmatic or technical)
    - establishment of a technical or programmatic basis that drives near-term related baseline efforts.

- Pursues a technical change to a baseline (alternative) and may require that the TFA leverage other programs. An official need may or may not have been submitted by a site. Successful response to the need may result in

    - significant (e.g., > $250M) mortgage reduction
    - risk reduction (programmatic or technical).

- Resolves an urgent technical roadblock or problem that has recently been identified. This problem may be identified by the TFA or external reviewers, rather than officially submitted as a need by a specific site. Satisfaction of this need may result in

    - prevention of recently identified problems
    - technical contingency through identification of another viable technical approach
    - risk reduction (programmatic or technical).

In addition to analysis of site submitted needs, other sources are used to identify strategic investments. These sources include reviews and recommendations from expert panels (e.g., National Academy of Science/National Research Council, Strategic Laboratory Council, etc.), site long-term planning and road mapping, and detailed site knowledge developed by the TFA through site visits, response development, and project execution.

EMSP projects primarily address needs requiring the highest degree of creativity and carrying the highest risk that the investment will not solve the need. Needs determined by the TFA to be best addressed by EMSP become the basis for EMSP calls for proposals. Resulting projects are then funded by EMSP.

Applied Research projects primarily address needs requiring development of emerging technology for a specific DOE application. Needs determined by TFA to be best addressed by Applied Research become the basis for Applied Research calls for proposals. Resulting projects are then funded through the National Energy Technology Laboratory (NETL).

Strategic tasks are projects managed directly by TFA and/or its crosscut program partners and are heavily focused on evaluation of feasibility and preliminary investigation of technologies that could fulfill any of the three drivers for strategic investments. The TFA has secured wide user support for the concept of selective identification and funding of strategic tasks, and has identified seven strategic tasks for FY 2002 – five for continuation and two new tasks for initiation. The TFA submitted these tasks for consideration and review by its Management Team on March 15, 2001.

2.4 Technical Response Development

The TFA uses an established standard framework to begin its annual program planning process. This framework groups similar or related site needs and the TFA's technical responses, allowing 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. The results of the program development process will be addressed in the upcoming revision to the MYPP scheduled for publication in September 2001.

To establish and maintain this program planning framework, the TFA uses its problem element structure. The problem element structure

- provides an updated method to logically group site needs and TFA technical responses
- assists in sequencing and scheduling integrated technical solutions
- identifies the problem elements and the needs within them as baseline, enhancements, or alternatives.

The problem element structure was amended by TFA this year to simplify and increase its ease of application. The structure includes seven categories or types of problems in which the needs being addressed are “binned” or assigned

- Safe Waste Storage
- Waste and Process Characterization
- Waste Retrieval
- Remote Systems Operation
- Waste Pretreatment
- Waste Immobilization
- Tank Closure/Waste Disposal.

The TFA then developed Multi-year Technical Responses (MYTRs) to all needs passing through the screening criteria. The MYTRs summarize the site science and technology needs based on the needs analysis and describe the technology and/or technical approach to be pursued to address the needs. Work scope details are provided in attachments and include schedules, budgets, and interfaces among the site users, TFA, and other OST programs. To the maximum extent possible, the TFA integrated responses to similar needs. As necessary, the TFA contacted the specific need technical point of contact for further clarification. Also, the TFA was careful to take advantage of other OST funding sources to maximize leveraging opportunities. The MYTRs were prepared by the Technical Team (see Figure 2.1 for the Technical Team organization) and submitted to the USG and Management Team for review and comment.

2.5 Technical Response Rating

The TFA rated each technical response for use in funding decisions based on approved task selection criteria. Technical responses rated above the anticipated funding line generally form the basis for estimated "target" budget funding levels.

The composite set of technical responses was rated against the prioritization criteria intended to rank them for further program development activities. As noted at the beginning of this section, the criteria included the following:

- Broad-based benefit
- User commitment
- Technical risk
- Other technical impact.

Broad-Based Benefit - This criterion addressed the potential complex-wide benefit of a technical response.

High: *Two* or more different site STCG-submitted needs with strong interest in a single, integrated response. Note: "Strong interest" means site interest is confirmed with the TFA Site Representative and USG member.

High to Medium:

- High/Medium: One STCG-submitted need; two or more sites with strong interest where resulting hardware or data would *directly* benefit.

- Medium/High: One STCG-submitted need; one site with strong interest where resulting hardware or data would *directly* benefit.

- Medium: One STCG-submitted need; one site with strong interest where resulting hardware or data would *indirectly* benefit; or one STCG-submitted need that may be satisfied through deployment of a technology already developed elsewhere, but still requiring technology development work.

Low: One STCG-submitted need and one other potential benefiting site based on collective Technology Integration Manager (TIM) judgment.

User Commitment - The TFA values user commitment to the development and deployment of technical solutions. This criterion assesses the strength of user commitment to share the burden of a technology's development and deployment. Note: For responses with OST investments greater than $1M in the year of prioritization or $3M for the life of the response benefiting a single site, a signed MOU, other signed document, or approved budget plan validating user co-funding will be provided prior to release of TFA funds.

High:

- Site co-funds development and demonstration (or deployment).

- High commitment to deploy through out-year baseline, project baseline summary (PBS), and budget request.

- Currently in site baseline operational plan with MOU or other signed document committing to funding and plan for deployment in subject FY.

- Deployment within 1 to 2 years.

- Greater than or equal to 50/50 co-funding of development and demonstration for the year of prioritization or duration of the response.

High/Medium: Response results in data delivery for key DOE decisions, e.g., Environmental Impact Statement or technical selection decisions.

- Site co-funds data development and delivery.

- Data will be used within 1 to 2 years.

- High commitment to deploy through out-year baseline, PBS, and budget request.

- Greater than or equal to 50/50 co-funding of development and delivery for the year of prioritization or duration of the technical response.

Medium/High: Approximately equal co-funding to develop and demonstrate during time of the technical response. High commitment to deploy through out-year baseline, PBS, and budget request.

Medium: Approximately one-quarter co-funding; high commitment to deploy through out-year baseline, PBS, and budget request.

Low: Site co-funding exists, but no clearly defined date to deploy or use data (e.g., not in sites' out-year planning documents).

Co-funding is to be focused on support to the overall project that the TFA is funding. This may include direct support to PIs, support to on-site operations staff to facilitate testing, sample collection/analysis/shipping, and design and review.

Technical Risk - This criterion considers technical risks related to site baselines.

Needs Priority

- High: Technical response addresses at least two needs with a priority of 1, or three needs with a priority of 2.
- Medium: Technical response addresses at least one need with a priority of 1, or two needs with a priority of 2.
- Low: Technical response addresses at least one need with a priority of 2. (Note: No value is assigned to a technical response addressing needs with a priority of 3.)

Technical Risk

- High: Related waste stream technical risk is high (risk rating of 4 or 5), related critical path milestone technical risk is high (risk rating of 4 or 5), or related TSD technical risk is high (risk rating of 4 or 5)
- Medium: Related waste stream technical risk is medium with a risk rating of 3, related critical path milestone technical risk is medium (risk rating of 3), or related TSD technical risk is medium (risk rating of 3)
- Low: Related waste stream technology risk is medium or low with a risk rating of 2 or 1, related critical path milestone technical risk is medium or low (risk rating of 2 or 1), or related TSD technical risk is medium or low (risk rating of 2 or 1).

Other Technology Impact - The objective of this criterion is to broadly assess the overall potential technology impact of a technical response. The TFA considers a response's impact on schedule, cost avoidance, and link to regulatory requirements to determine impact. The ratings include the following:

High: (one or more of the following apply)

- Technology required to meet baseline assumptions.

- Documented high cost avoidance (over $250M) to EM (information must be provided to TFA as shown in an approved needs statement or other supplemental information available at or prior to prioritization).

- Possesses high-cost reduction potential (over $250M).

- Required to meet firm regulatory requirements that could delay tank waste remediation schedules.

Medium: (one or more of the following apply)

- Required to meet enhancements or alternatives to baselines.

- Documented moderate cost avoidance (between $250M and $50M) (information must be provided to TFA as shown in an approved needs statement or other supplemental information available at or prior to prioritization) or general consensus on high-cost avoidance (over $250M) that cannot be documented due to lack of data, which will be developed if the task goes forward.

- Possesses moderate cost reduction potential.

- Adds assurance that regulatory requirements are met, or supports a regulatory requirement that the site may renegotiate.

Low: (one or more of the following)

- Appears that technology could meet baseline or enhancement assumptions, but more data are needed and will be provided explicitly if the task proceeds.

- General consensus that moderate cost avoidance (between $250M and $50M) could be achieved but cannot yet be documented.

- The technical response's link to regulatory requirements is not fully determined.

On March 8-9, 2001, the TFA rated each technical response using the approved criteria. This initial assessment was accomplished in a group consensus of TIMs and monitored by the TFA Management Team. The TFA's intent was to ensure that technical responses would

- be provided for each need received
- contain an explanation of the priority of the response according to either
  - Screening criteria

  - Prioritization criteria
- describe multiyear intent based on
  - 4-year budget estimate (current + 3 years)
  - Basis of estimate
- describe the intended scope
- identify the relationship or benefit to other site needs.

2.6 TFA Management Team Prioritization

The TFA technical response prioritization took place on March 15, 2001, in conjunction with TFA Midyear Review activities. During prioritization, the TFA Management Team assigned final scores to each technical response against the approved criteria. The Management Team discussed the merits of the responses, focusing closely on aspects of site benefits, user commitment, and continuity of ongoing technology development. Additionally, the Management Team reviewed and approved five strategic tasks for continuation and two new tasks for initiation for the FY 2002-2003 program. At the conclusion of the prioritization session, the Management Team affirmed the results, thereby creating the official TFA FY 2002-2003 Integrated Priority Listing.

As of the publication date of this document, the TFA is finalizing the technical responses to incorporate actions directed by the Management Team during prioritization. The final version of the technical responses will be posted on the Technical Team home page (http://www.pnl.gov/tfa/program) in the near future.

2.7 Data Summary

In all, the TFA received 170 science and technology needs this year. The TFA assigned each need to one of the TFA's six functional areas based on the major subject area of the need. Some needs statements were broad enough that they required action in more than one technical response. In all, sixty-six technical responses were prepared by the TFA. A summary of the TFA's functional assignment of needs and technical responses by site is shown in Table 2.1.

Table 2.1. Summary of Site Needs Submitted to the Tanks Focus Area

	Hanford	INEEL	ORR	SRS	WVDP	Total
Safety	8	7	1	5	1	22
Characterization	6	15	1	2	2	26
Pretreatment	9	11	2	6	1	29
Immobilization	8	33	1	4	1	47
Retrieval	11	4	1	5	3	24
Closure	8	8	1	3	2	22
Total	50	78	7	25	10	170

The needs across the complex reflect requirements to

- inspect tank integrity, monitor tank corrosion, and detect and mitigate leaks
- reduce waste volumes and minimize the generation of additional wastes, including secondary wastes
- sample and characterize the chemical and physical properties of the wastes
- retrieve salt and sludge wastes and tank heels
- pump and transfer wastes efficiently without plugging pipelines
- separate radionuclides from non-radioactive waste components
- provide grout and glass waste forms for LLW immobilization and disposal
- optimize waste loadings in HLW glass waste forms
- enhance design of HLW glass melters
- improve efficiency of existing waste storage and treatment facility operations and maintenance
- access waste residuals as precursors to additional retrieval and tank closure decisions
- immobilize waste residuals and stabilize tanks as part of closure.

Hanford and SRS require continued emphasis on determining the impacts of waste chemistry on waste retrieval and transport. These sites require additional mixing technologies to suspend sludges and saltcake for waste removal. SRS also requires technical data to support the selection, design, and implementation of an alternative to the in-tank precipitation process for radionuclide removal. As waste storage and processing facilities mature, technologies are needed for remote maintenance and repair and to optimize equipment design for improved operations. INEEL requires technologies and technical assistance to support vitrification of their liquid and calcine wastes. WVDP and SRS require improved technologies for HLW canister decontamination. Hanford needs additional data and tools to support waste disposal system performance assessments. Hanford also needs vitrification technology enhancements and technical assistance in support of their Phase I Waste Treatment and Immobilization Plant (WTP), and technologies in support of the longer-term balance of mission.

During its analysis of the site needs, the TFA found that many of the requirements from any one site have multi-site benefits. The TFA will exploit the resolution of these requirements to leverage these multi-site benefits. Multi-site, or broad-based, benefit is one of the four criteria the TFA used this year in prioritizing future work. The tentative program for FY 2002 - 2003 reflects the importance that TFA places on multi-site benefit.

2.8 Lessons Learned

Every year, the TFA learns new lessons in executing the initial stages of the program development process. Coordinating site needs analyses and technical response development with and among the TFA's partner programs continues to be a sizeable task, and the TFA appreciates the efforts of its partner programs to help meet the challenge. To increase the efficiency of the coordination and integration, the TFA has established operating agreements among it and the TFA's three main crosscutting program partners (CMST, ESP, and RBX). Agreements of Cooperation among the TFA and each of these three programs are being finalized.

The requirement exists to better synchronize, at the EM and OST level, the scheduling of program development activities that culminate in the TFA's preparation and submission of draft budget documents in the March-April timeframe of each year.

Sites continue to struggle with the magnitude of the needs documentation process resulting in incomplete needs submittals, needs not being updated to reflect changing site issues and accomplishments, and umbrella, broad-scope needs that are difficult to manage and reflect progress in resolving and closing needs.

Development and use of IPABS continues to be a serious impediment to program development. IPABS is difficult for sites and Focus Areas to use and update, leading to challenges in keeping information current. More work is still needed to make IPABS less cumbersome, more reliable, and better integrated. Data quality issues remain, especially in waste stream linkages to site needs and technical risks existing in those waste streams. The TFA has taken on an added burden of helping identify to the sites where data inconsistencies exist. In addition, there continues to be great uncertainty about data quality, rating criteria, and system scheduling requirements leading up to work package prioritization.

The TFA continues to grow into its perceived Focus Area-centered responsibilities in the basic science portion of its investment portfolio. Progress was made during the last year in strengthening relationships with the EMSP staff to make the program more relevant and of impact to EM HLW issues. Key efforts undertaken this year include the following –

- TFA provided assistance in the selection of EMSP projects relevant to site needs and programs. TFA worked directly with the site users to identify and develop the needs for the FY 2001 HLW EMSP proposal call.

- TFA continues to suggest methods to strengthen the EMSP proposal relevancy review, so that EMSP projects clearly relevant to HLW needs and programs are initiated and renewed.

- TFA assisted in increasing communications/interactions between the EMSP PIs and the site users by involving 12 recently renewed EMSP projects in TFA’s FY 2001 Midyear Review. The EMSP PIs presented the plans and progress of their projects to

site users and technical experts and had an opportunity to interact with these staff offline.

- TFA is spearheading an effort to better communicate EMSP project information. The effort involves screening and selecting publications from relevant EMSP projects for distribution to site users.

Section 3 – The Next Process Steps

As noted earlier, this document reports only on the initial program development steps. Formulation of the final detailed technical response for each submitted need is in progress. The first phase of the FY 2003 CRB development is completed. The purpose of this section is to describe how the activities covered in this site needs assessment fit into the overall program development process and to provide a short description of the remaining program development activities. Within the overall program development process, the following major tasks and schedule remain for this year's program development cycle:

- Finalize FY 2003 CRB submittal (May 2001)
- OST work package prioritization for the FY 2003 CRB (May 2001)
- Prepare and submit FY 2002 program execution documents (June-August 2001)
- Prepare MYPP (September 2001)
- Obtain High-Level Waste Steering Committee approval of MYPP (October 2001).

3.1 Finalize FY 2003 CRB Submittal

The TFA is completing preparation of its FY 2003 CRB input based on the prioritized technical responses to site needs. The TFA groups technical responses by functional subject area and TFA priority into "work packages." Work packages are the main components of the TFA's CRB.

3.2 OST Work Package Prioritization for the FY 2003 CRB

OST rates each Focus Area work package according to pre-established criteria. Presently, these criteria value

- PBSs – the number of them represented, their life cycle costs, and significant milestones
- likelihood of technology deployments
- priority of site needs addressed
- technical risk
- potential cost savings.

The result of the rating is a prioritized list of work packages for DOE management consideration within expected available funding. The TFA supports the prioritization activity by ensuring, through coordination with its user sites, the most accurate data are available.

3.3 Prepare and Submit FY 2002 Program Execution Documents

Each year, the TFA uses two documents to provide for program execution. The first, the PEG, is the TFA's guidance to the selected work performers and is tied to the users' commitment and priority. This guidance states the mandatory technical and programmatic requirements needed for each task. The PEG is simply an expansion of the final technical responses that have been reviewed and approved by the TFA Management Team.

Upon receipt of the PEG, the performer develops the second document, the Technical Task Plan (TTP). The TTP is the performer's response to the PEG. An approved TTP constitutes a contractual arrangement among the TFA, the performing DOE Field Office, and the performing organization. Both documents are generally required before work initiation and funding authorization.

During the transition from PEG to TTP, the TFA coordinates with sites and performers to assure site commitment to each technical response, that all performer selection issues have been resolved, and that the proposed scope and budget are understood fully by all.

3.4 Prepare the MYPP

The companion document to this one is the TFA MYPP. The MYPP documents the results of the preceding planning steps and is the basis for complementary planning between OST and the Offices of Environmental Restoration and Waste Management in future years, which is reflected in the OST budget process. This approach is consistent with the TFA goal of defining and implementing an integrated technical program. The MYPP describes the TFA's technical strategies and the actions being taken to address the site needs within the strategies. The FY 2002 – FY 2006 MYPP is expected to be published during September 2001.

Each year, the MYPP is updated to reflect the changing emphasis of the sites and the subsequent changes in the TFA's technical focus. Based on the FY 2002 site needs submittal and the resulting technical responses, the FY 2002 - FY 2006 MYPP should show the TFA's continuing emphasis to

- provide technologies that support waste retrieval and tank closure at SRS, Hanford, INEEL, WVDP, and ORR
- provide technical answers to vitrification requirements from around the complex
- support development and implementation of the alternative to in-tank precipitation at SRS
- support INEEL in the vitrification of their liquid and calcine wastes
- provide technologies for monitoring tank integrity and corrosion
- provide technology enhancements to support Hanford’s Phase I WTP
- provide technologies to support Balance of Mission of Hanford’s tank waste remediation project.

Section 4 - References

Tanks Focus Area (TFA). 2000a. *Tanks Focus Area Site Needs Assessment FY 2000*, PNNL-13186. Pacific Northwest National Laboratory, Richland, Washington.

Tanks Focus Area (TFA). 2000b. *Tanks Focus Area Multiyear Program Plan FY01-FY05*, PNNL-13339. Pacific Northwest National Laboratory, Richland, Washington.

Appendix A – Site Needs Database

This appendix summarizes the 170 science and technology needs submitted by the sites and the Tanks Focus Area's (TFA's) intended technical disposition of them. Table A.1 is a list of the needs received from each site and identification of the technical response or responses linked to that need. Table A.2 takes those same needs and aligns them within the TFA problem element structure. Additionally, Table A.2 lists the need priority assigned by the site to the need, and the functional area the TFA assigned to the need. Note that a need may occur more than once in the problem element structure. This is because a need may be broad enough that it is described best in more than one problem element, and therefore will likely appear in more than one technical response.

Table A.3 portrays the TFA's interpretation of the benefiting sites for each technical response. The technical responses are listed in the priority order established by the TFA Management Team.

The remainder of the appendix is devoted to the individual site needs. This document only provides a summary of each need. Interested readers may find full versions of the site high-level tank waste needs at the following web sites:

- Hanford: http://www.pnl.gov/stcg/needs.stm
- Idaho National Engineering and Environmental Laboratory (INEEL): http://stcgneeds.inel.gov/wt_select.asp?id=HLW
- Oak Ridge Reservation (ORR): http://www.em.doe.gov/usr-bin/techneed/qu/sg?stcg=TANKS&site=OAK+RIDGE+NATIONAL+LABORATORY&category=Any&contam=Any
- Savannah River Site (SRS): http://www.srs.gov/general/srtech/stcg/needstmt.htm
- West Valley Demonstration Project (WVDP): http://www.ohio.doe.gov/oh-stcg/needs.asp

This appendix provides a brief summary of each site needs statement. The summaries were largely extracted from the actual needs statements found in the above web sites. Following the summary for each need is the number, title, and FY 2002 - FY 2003 TFA priority number for the technical response to that need. In several cases, the TFA responded to individual needs in more than one technical response.

Table A.1. Tanks Focus Area Needs Submitted by Sites

Site Need ID	Need Title	TFA Response ID
Hanford		
RL-DD082	Retrieval of Waste Heel from Vault Tanks at 340 Facility	B382
RL-WT01	Technetium-99 Analysis in Hanford Tank Waste and Contaminated Tank Farm Areas	B264
RL-WT04	Double-Shell Tank Corrosion Monitoring	B143
RL-WT05	Remote Inspection of High-Level Waste Single-Shell Tanks (SSTs)	B175
RL-WT09	Representative Sampling and Associated Analysis to Support Operations and Disposal	B246
RL-WT015	Standard Method for Determining Waste Form Release Rate	B748
RL-WT016	Glass Monolith Surface Area	B749
RL-WT017	Long-Life Waste Isolation Surface Barrier	B950
RL-WT021	Cleaning, Decontaminating and Upgrading Hanford Pits	B352
RL-WT022	Adapting Tandem Synthetic Aperture Focusing Technique (TSAFT) for Flaw Characterization in the Inaccessible Portion of the Knuckle Region of the Double-Shell Tanks (DSTs)	B175
RL-WT026	Tank Leak Detection Systems for Underground Single-Shell Waste Storage Tanks (SSTs)	B156
RL-WT027	Tank Leak Mitigation Systems	B157
RL-WT060	Better Waste Mixing Mobilization	B359, B387
RL-WT061	Reactive Barriers to Contaminant Migration	B960
RL-WT062	Variable Suction Level Transfer Pump	B365
RL-WT063	Hanford SST Saltcake Dissolution Retrieval	B362
RL-WT064	Hanford Past Practice Sluicing Improvements	B367
RL-WT066	Compositional Dependence of the Long Term Performance of Glass as a Low-Activity Waste Form	B748
RL-WT067	Improved Double Shell Tank (DST) Integrity NDE Measurement Tools	B175
RL-WT068	Radionuclide Source Term from Tank Residuals	B588
RL-WT069	Value of Information Decision Analysis for Tank Farm Closure	B924
RL-WT072	Use Of Handheld Technology To Automate Operator Data Sheets For Tank Farm Operations	B101
RL-WT077	Improvements to Salt Well Pumping	B362
RL-WT080	Advanced/Improved Vitrification	B748, B773, B7S2
RL-WT084	Extension of Glass Properties Model to LAW and Phase II HLW Glass Composition Ranges	B773
RL-WT086	Anti-foaming Agents for Evaporation of Alkaline Wastes	B542
RL-WT087	Assessment of Effects to HLW Glass Production from Using Crystalline Silicotitanate (CST) to Separate Cesium from Alkaline Waste Solutions	B773
RL-WT088	Advanced Approaches for Reducing Waste Volume Stored in DSTs	B511, B566
RL-WT089	Alternate Retrieval Methods from Potentially Leaking Single-Shell Tanks (SSTs)	B157, B338, B362, B367, B376, B3S2
RL-WT090	Chemical and Physical Behavior of Sludge Wastes	B376, B554, B555
RL-WT091	Chemical and Physical Behavior of Saltcake Wastes	B554
RL-WT092	Improved Separation Agents and Processes to Remove Cesium from Supernatant Solutions	B570, B579, B581
RL-WT093	Filtration Optimization and Process Enhancement	B584
RL-WT094	Understanding and Controlling Post-filtration Precipitation	B554
RL-WT096	Cold Test/Mockup Facility	B359, B367
RL-WT098	Erosion Testing	B339

Table A.1. Tanks Focus Area Needs Submitted by Sites

Site Need ID	Need Title	TFA Response ID
Hanford		
RL-WT100	HLW/LAW Melter Operation	B722, B768, B769
RL-WT101	Sulfate Mitigation for Hanford Tank Low Activity Waste (LAW) Vitrification	B205, B279, B768, B773
RL-WT102	Advanced Characterization Tools for Contaminants of Concern	B292
RL-WT103	Separable Organic Phase Destruction, Removal, and Monitoring In Tank Waste	B279, B517
RL-WT032-S	Monitoring of Key Waste Physical Properties During Retrieval and Transport	B278
RL-WT035-S	Moisture Flow and Contaminant Transport in Arid Conditions	B958
RL-WT044-S	Distribution of Recharge Rates	B958
RL-WT046-S	Getter Materials	B960
RL-WT053-S	Contaminant Mobility Beneath Tank Farms	B958
RL-WT054-S	Solids Yield During Mixer Pump Mobilization	B359
RL-WT076-S	Plutonium Interaction with Silicates	B960
RL-WT078-S	Plutonium Segregation and Association in HLW	B554
RL-WT079-S	Double Shell Tanks (DST) Corrosion Chemistry	B143
RL-WT099-S	Rapid Analysis of Vitrification Feeds	B264
INEEL		
ID-2.1.06a	TRU and Sr Removal from High Activity Waste	B501
ID-2.1.06b	Cs Removal from High Level Waste Calcine and Off-gas Scrubber Solutions	B501
ID-2.1.16	Decontamination Facility/Analytical Facility Waste Reduction	B264, B508
ID-2.1.17	Develop New Filter Leach Process	B508
ID-2.1.18	Continuous Emissions Monitor for Offgas Analysis	B205
ID-2.1.19	Modified EPA Offgas Sample Collection and Analysis Methods	B206
ID-2.1.20	Tank Annulus/Vault Inspection	B175, B203
ID-2.1.23	Low-Activity Wasteform Qualification	B719, B924
ID-2.1.24	Integration/Optimization of High Activity Waste/Low Activity Waste Process Flowsheet	B709
ID-2.1.27	Cleanable Off Gas Filters	B171
ID-2.1.28	Cs and Sr Removal from Newly Generated Liquid Waste	B521
ID-2.1.29	Evaluate Corrosion Potential	B514, B709
ID-2.1.30	Remove/Treat Corrosive Off-gas Components	B514
ID-2.1.31	Characterization of Entrainable Solids in Tank Waste	B216
ID-2.1.35	Direct Immobilization of INTEC Newly Generated Liquid Wastes	B719
ID-2.1.38	Conditioning of Low Activity Waste for Treatment	B719
ID-2.1.39	Acceptance Criteria for LAW Disposal in Underground Storage Tanks	B924
ID-2.1.40	Low Activity Waste Grout Sorbent Addition to Reduce Leachability	B719
ID-2.1.41	HLW Process Offgas Treatment	B722
ID-2.1.42	Acceptance Criteria for Tank Closure	B924
ID-2.1.44	Certify LDUA Sampler as EPA-Approved Method of Sampling Tank Heel Solids	B203
ID-2.1.45	Acceptance Criteria for Grouting Tank Heels	B924
ID-2.1.46	Management of Tank Heel Liquids	B923
ID-2.1.47	Management of Tank Heel Solids	B363, B923
ID-2.1.48	Wasteform Qualification for Low-Activity Waste in Underground Storage Tanks	B924
ID-2.1.49	Acceptance Criteria for High Activity Waste/Low Activity Waste	B730, B924
ID-2.1.50	Solids Waste (Calcine) Retrieval	B232, B331
ID-2.1.51	Develop Calcine Dissolution Kinetics for Solid/Liquid Equilibria	B532

Table A.1. Tanks Focus Area Needs Submitted by Sites

Site Need ID	Need Title	TFA Response ID
Hanford		
ID-2.1.52	Characterization of Solids from Calcine Dissolution	B532
ID-2.1.57	Conditioning of HAW for Treatment	B769
ID-2.1.58	HAW Immobilization	B730, B768, B773
ID-2.1.62	Acceptance Criteria for Bin Set Closure	B924
ID-2.1.64	Solid-Liquid Separation Equipment Development and Application	B521, B584
ID-2.1.65	Treatment Selection for Removed Tank Solids	B709
ID-2.1.66	Treatment/Disposition of Spent Ion Exchange Resins	B338, B719
ID-2.1.67	High Level Waste Slurry Handling	B246, B335, B361, B365, B376, B554, B769
ID-2.1.68	Technetium Removal from INEEL High Level Waste	B501
ID-2.1.69	Solids Waste (Calcine) Retrieval from CSSF1	B331
ID-2.1.72	Simplified Tank Solids and Vault Sampling and Sludge Volume Determination Systems	B201, B203
ID-2.1.74	Alternative Melters to Joule Heated Design for Applications to INEEL Calcine	B7S2
ID-2.1.75	Glass and Alternative Glass-Ceramic Waste Forms	B751, B773
ID-2.1.76	Selection of Refractory Materials Based Upon Glass Chemistry	B768
ID-2.1.77	Dry Feed Handling - Pumpability, Homogeneity, Uniform Mixing, and Pre-Process Sampling	B232, B333
ID-2.1.78	Fate and Impacts of Sulfates in Vitrification Processes	B773
ID-2.1.79	Upgrade INEEL HLW Tanks Corrosion Monitoring Capability	B143
ID-2.1.80	Low-Activity Waste Gas Generation	B719
ID-2.1.81	Materials Development Needs for Vitrification of INEEL Acidic, Sodium Bearing High Level Waste	B722
ID-2.1.82	Melter Components - Electrodes, Heaters, Top Head, Drain System Erosion/Corrosion Rates	B768
ID-2.1.83	Decommissioning a High Level Waste Melter System and Change Out of its Components	B777
ID-2.1.84	Removal of Mercury from SBW Vitrification Off-Gas	B521, B722
ID-2.1.85	Offgas Control System and Technologies	B722
ID-2.1.86	HLW Melter Offgas Monitoring and Control	B205
ID-2.1.87	Development of Real Time NDE Technology for Quality Verification of Canister Closure Seal Welds	B753
ID-2.1.88	Evaporation or Pretreatment of Liquid Sodium Bearing Waste (SBW) Prior to Feeding Melter	B769
ID-2.1.89	SBW Vitrification Offgas System Components Optimization	B709, B722
ID-2.1.90	SBW Vitrification Offgas NOx Abatement and PIC/HAP Destruction	B722
ID-2.1.91	Vitrification Secondary Waste Characterization & Disposition Path Regulatory Development	B719, B722, B730
ID-2.1.92	Structural Integrity Program for Interim Storage of INEEL HLW Glass Canisters	B753
ID-2.2.1	Post-Closure Monitoring Techniques for HLW Tank Farm	B292
ID-9.1.01	Underground Instrumentation Placement for Buried Tanks	B292
ID-9.1.02	Pipe Explorer for Pipes Less Than Three Inches in Diameter	B203
ID-9.1.03	Access To Tanks Below Liquid Level	B203
ID-9.1.04	Certifiable In-field Chemical Characterization of Tank Contents	B202
ID-9.1.05	Non-intrusive Characterization of Waste Material	B202
ID-9.1.06	Internal Obstructions Navigation/Avoidance for Waste Tanks	B203

Table A.1. Tanks Focus Area Needs Submitted by Sites

Site Need ID	Need Title	TFA Response ID
Hanford		
ID-9.1.07	Waste Tank Resealing Technology	B157
ID-9.1.08	Tanks/Piping Information Base for Configuration Control and Statusing	B190
ID-S.1.02	Continuous Emissions Monitors for Offgas Analysis	B205
ID-S.1.29	Glass and Alternative Glass-Ceramic Waste Forms	B751, B773
ID-S.1.30	Selection of Refractory Materials Based Upon Glass Chemistry	B768
ID-S.1.31	Dry Feed Handling-Pumpability, Homogeneity, Uniform Mixing, and Pre-Process Sampling	B232, B333
ID-S.1.32	Fate and Impacts of Sulfates in Vitrification Processes	B773
ID-S.1.33	Upgrade INEEL HLW Tanks Corrosion Monitoring Capability	B143
ID-S.1.34	Materials Development Needs for Vitrification of INEEL Acidic, Sodium Bearing High Level Waste	B722
ID-S.1.35	Melter Components - Electrodes, Heaters, Top Head, Drain System Erosion/Corrosion Rates	B768
ID-S.1.36	Offgas Control System and Technologies	B521, B722
ID-S.1.37	SBW Vitrification Offgas Compositional Data and Predictive Models	B709
ID-S.1.38	Update DOE Order 435.1 Guidance Document # BNL-52527	B175, B1S1
ORR		
ORTK-01	Tank Waste Characterization	B175, B201
ORTK-02	Tank Solid Waste Retieval	B367
ORTK-04	Sludge Mixing and Slurry Transport	
ORTK-05	Tank Sludge and Supernatant Separations	B586
ORTK-06	Tank Sludge Supernatant Immobilization	B719
ORTK-09	Tank Closure	B292, B923, B985
ORTK-11	Tank Supernatant Pretreatment	B555, B586
SRS		
SR01-2027	Demonstrate Alternative Filtration Technologies to Replace Conventional HEPA Filters	B171
SR01-2028	Alternative Waste Removal Technology	B359, B362
SR01-2029	Alternate DWPF Canister Decon Technology	B972
SR01-2031	Develop Remote Technology to Improve DWPF Operations	B374, B777
SR01-2032	Optimize Melter Glass Chemistry and Increase Waste Loading	B768, B773
SR01-2033	Provide Alternative Processing and/or Concentration Methods for DWPF Recycle Aqueous Streams	B554, B566, B584
SR01-2034	Second Generation Salt Feed Preparation	B570, B579, B580, B581
SR01-2035	Develop Advanced Techniques for Life Extension of High Level Waste Tanks and Piping	B144, B157, B175, B176
SR01-2036	Develop Improved HLW Melter	B768
SR01-2037	Tank Heel Removal/Closure Technology	B157, B175, B202, B278, B303, B311, B352, B359, B363, B365, B367, B382, B387, B554, B555
SR01-2039	Methods to Unplug Waste Transfer Lines	B376, B554, B555
SR01-2040	Demonstrate Remote Decommissioning/Disassembly of High Level Waste Processing Equipment	B777

Table A.1. Tanks Focus Area Needs Submitted by Sites

Site Need ID	Need Title	TFA Response ID
Hanford		
SR01-2041	Develop Advanced Mixing Technology	B359
SR01-2044	In-Situ Technology for Waste Characterization and Level Monitoring	B201, B202, B278, B292
SR01-2045	In-Situ Waste Tank Corrosion Probe	B143
SR01-2051	Technology to Mitigate Effects of Technetium Under Tank Closure Conditions	B588, B923
SR01-2052	Aluminum Dissolution from HAW Sludge and Its Impact on Downstream Salt Processing	B554, B555, B773, B7S2
SR01-2055	Increase in Applicability/Efficiency of High-Level Waste Planning Tool	B709
SR01-2056	Development of an Improved Understanding of the Causes of Foam Formation During Radioactive Waste Processing and Identification or Development of More Effective Antifoam Agents	B542, B570, B579
SR01-2057	Technology to Determine The Wind Flow Patterns Around Windbreaks	B191
SR01-2049-S	Technetium Chemistry Under Waste Removal Conditions	B588
SR01-2050-S	Fracture Toughness Properties for Carbon Steel Utilized for Nuclear Waste Containment Vessels	B144
SR01-2053-S	Develop an Alternative Sorbent to Replace Monosodium Titanate for Sr and Actinide Removal	B570, B580
SR01-2054-S	Develop Improved Radiochemical Analysis for High Ionic Strength Samples	B264
SR01-2058-S	Develop Solvent Extractant System for Co-Removal of Cesium, Strontium, and Other Actinides	B570, B581
WVDP		
OH-WV-902	Decontamination of High-Level Waste (HLW) Canisters (WVDP-2-99)	B204, B972
OH-WV-903	Vitrification Expended Material Processing (WVDP-3-99)	B777
OH-WV-904	High Level Waste Tank Closure	B310, B985
OH-WV-905	Removal of Tank Residuals	B361
OH-WV-906	Radioactivity Measurement of High-Level Waste Residuals in Tanks and Ancillary Equipment	B202
OH-WV-907	High-Level Waste Tank Interim Maintenance	B175
OH-WV-908	Decontamination of High-Level Waste Contaminated Equipment	B311
OH-WV-914	Development of Grout for In-Situ Closure	B923
OH-WV-915	Processing of High Activity Waste with High Sodium Content	B511
OH-WV-916	Hazardous Waste Measurement of Residuals in Tanks Piping and Ancillary Equipment	B202

Table A.2. Tanks Focus Area Site Needs Distributed Within the Problem Element Structure

PE#	Problem Element Title	Site	Need Pri	Function
1	**Safe Waste Storage**			
1.1.0	**Maintain Tanks**			
ID-S.1.38	Update DOE Order 435.1 Guidance Document # BNL-52527	INEEL	2	Safety
1.1.1	**Monitor Corrosion**			
RL-WT04	Double-Shell Tank Corrosion Monitoring	Hanford	1	Safety
RL-WT079-S	Double Shell Tanks (DST) Corrosion Chemistry	Hanford	1	Safety
SR01-2045	In-Situ Waste Tank Corrosion Probe	SRS	2	Safety
ID-2.1.79	Upgrade INEEL HLW Tanks Corrosion Monitoring Capability	INEEL	1	Safety
ID-S.1.33	Upgrade INEEL HLW Tanks Corrosion Monitoring Capability	INEEL	1	Safety
1.1.2	**Monitor Integrity**			
RL-WT05	Remote Inspection of High-Level Waste Single-Shell Tanks (SSTs)	Hanford	1	Safety
RL-WT022	Adapting Tandem Synthetic Aperture Focusing Technique (TSAFT) for Flaw Characterization in the Inaccessible Portion of the Knuckle Region of the Double-Shell Tanks (DSTs)	Hanford	1	Safety
RL-WT067	Improved Double Shell Tank (DST) Integrity NDE Measurement Tools	Hanford	1	Safety
SR01-2035	Develop Advanced Techniques for Life Extension of High Level Waste Tanks and Piping	SRS	3	Safety
SR01-2037	Tank Heel Removal/Closure Technology	SRS	1	Safety
SR01-2050-S	Fracture Toughness Properties for Carbon Steel Utilized for Nuclear Waste Containment Vessels	SRS	1	Safety
ID-2.1.20	Tank Annulus/Vault Inspection	INEEL	1	Safety
ID-S.1.38	Update DOE Order 435.1 Guidance Document # BNL-52527	INEEL	2	Safety
OH-WV-907	High-Level Waste Tank Interim Maintenance	WVDP	2	Safety
ORTK-01	Tank Waste Characterization	ORR	2	Safety
1.1.3	**Detect Leaks**			
RL-WT026	Tank Leak Detection Systems for Underground Single-Shell Waste Storage Tanks (SSTs)	Hanford	1	Safety
1.1.4	**Repair Tanks**			
RL-WT027	Tank Leak Mitigation Systems	Hanford	2	Safety
RL-WT089	Alternate Retrieval Methods from Potentially Leaking Single-Shell Tanks (SSTs)	Hanford	1	Safety
SR01-2035	Develop Advanced Techniques for Life Extension of High Level Waste Tanks and Piping	SRS	3	Safety
SR01-2037	Tank Heel Removal/Closure Technology	SRS	1	Safety
ID-9.1.07	Waste Tank Resealing Technology	INEEL	2	Safety
1.2.0	**Resolve Safety Issues**			
SR01-2057	Technology to Determine The Wind Flow Patterns Around Windbreaks	SRS	2	Safety
2	**Characterize Waste and Process**			
2.1.0	**Sample Waste**			
RL-WT09	Representative Sampling and Associated Analysis to Support Operations and Disposal	Hanford	2	Characterization
ID-2.1.19	Modified EPA Offgas Sample Collection and Analysis Methods	INEEL	2	Characterization

Table A.2. Tanks Focus Area Site Needs Distributed Within the Problem Element Structure

PE#	Problem Element Title	Site	Need Pri	Function
ID-2.1.20	Tank Annulus/Vault Inspection	INEEL	1	Characterization
ID-2.1.44	Certify LDUA Sampler as EPA-Approved Method of Sampling Tank Heel Solids	INEEL	1	Characterization
ID-2.1.50	Solids Waste (Calcine) Retrieval	INEEL	1	Characterization
ID-2.1.67	High Level Waste Slurry Handling	INEEL	1	Characterization
ID-2.1.72	Simplified Tank Solids and Vault Sampling and Sludge Volume Determination Systems	INEEL	1	Characterization
ID-2.1.77	Dry Feed Handling - Pumpability, Homogeneity, Uniform Mixing, and Pre-Process Sampling	INEEL	1	Characterization
ID-9.1.02	Pipe Explorer for Pipes Less Than Three Inches in Diameter	INEEL	2	Characterization
ID-9.1.03	Access To Tanks Below Liquid Level	INEEL	2	Characterization
ID-9.1.06	Internal Obstructions Navigation/Avoidance for Waste Tanks	INEEL	2	Characterization
ID-S.1.31	Dry Feed Handling-Pumpability, Homogeneity, Uniform Mixing, and Pre-Process Sampling	INEEL	1	Characterization
2.2.0	**Characterize Waste**			
RL-WT01	Technetium-99 Analysis in Hanford Tank Waste and Contaminated Tank Farm Areas	Hanford	2	Characterization
RL-WT099-S	Rapid Analysis of Vitrification Feeds	Hanford	2	Characterization
SR01-2054-S	Develop Improved Radiochemical Analysis for High Ionic Strength Samples	SRS	3	Characterization
ID-2.1.16	Decontamination Facility/Analytical Facility Waste Reduction	INEEL	1	Characterization
ID-2.1.31	Characterization of Entrainable Solids in Tank Waste	INEEL	1	Characterization
2.2.1	**Characterize Chemical Composition**			
2.2.2	**Characterize Radionuclide Compsition**			
2.2.3	**Characterize Physical Properties**			
2.2.4	**Characterize Waste In-Situ**			
SR01-2037	Tank Heel Removal/Closure Technology	SRS	1	Characterization
SR01-2044	In-Situ Technology for Waste Characterization and Level Monitoring	SRS	2	Characterization
ID-2.1.72	Simplified Tank Solids and Vault Sampling and Sludge Volume Determination Systems	INEEL	1	Characterization
ID-9.1.04	Certifiable In-field Chemical Characterization of Tank Contents	INEEL	2	Characterization
ID-9.1.05	Non-intrusive Characterization of Waste Material	INEEL	2	Characterization
OH-WV-902	Decontamination of High-Level Waste (HLW) Canisters (WVDP-2-99)	WVDP	1	Characterization
OH-WV-906	Radioactivity Measurement of High-Level Waste Residuals in Tanks and Ancillary Equipment	WVDP	2	Characterization
OH-WV-916	Hazardous Waste Measurement of Residuals in Tanks Piping and Ancillary Equipment	WVDP	1	Characterization
ORTK-01	Tank Waste Characterization	ORR	2	Characterization
2.3.0	**Monitor and Control Processes**			
RL-WT101	Sulfate Mitigation for Hanford Tank Low Activity Waste (LAW) Vitrification	Hanford	2	Characterization
RL-WT103	Separable Organic Phase Destruction, Removal, and Monitoring In Tank Waste	Hanford	1	Characterization
RL-WT032-S	Monitoring of Key Waste Physical Properties During Retrieval and Transport	Hanford	3	Characterization

Table A.2. Tanks Focus Area Site Needs Distributed Within the Problem Element Structure

PE#	Problem Element Title	Site	Need Pri	Function
SR01-2037	Tank Heel Removal/Closure Technology	SRS	1	Characterization
SR01-2044	In-Situ Technology for Waste Characterization and Level Monitoring	SRS	2	Characterization
ID-2.1.18	Continuous Emissions Monitor for Offgas Analysis	INEEL	1	Characterization
ID-2.1.86	HLW Melter Offgas Monitoring and Control	INEEL	1	Characterization
ID-S.1.02	Continuous Emissions Monitors for Offgas Analysis	INEEL	1	Characterization
ORTK-04	Sludge Mixing and Slurry Transport	ORR	3	Characterization
3	**Waste Retrieval**			
3.1.0	**Mobilize Waste**			
3.1.1	**Mobilize Liquids**			
RL-WT060	Better Waste Mixing Mobilization	Hanford	2	Retrieval
SR01-2037	Tank Heel Removal/Closure Technology	SRS	1	Retrieval
3.1.2	Mobilize Sludges and Slurries			
RL-DD082	Retrieval of Waste Heel from Vault Tanks at 340 Facility	Hanford	2	Retrieval
RL-WT060	Better Waste Mixing Mobilization	Hanford	2	Retrieval
RL-WT063	Hanford SST Saltcake Dissolution Retrieval	Hanford	1	Retrieval
RL-WT077	Improvements to Salt Well Pumping	Hanford	2	Retrieval
RL-WT089	Alternate Retrieval Methods from Potentially Leaking Single-Shell Tanks (SSTs)	Hanford	1	Retrieval
RL-WT096	Cold Test/Mockup Facility	Hanford	1	Retrieval
RL-WT054-S	Solids Yield During Mixer Pump Mobilization	Hanford	2	Retrieval
SR01-2028	Alternative Waste Removal Technology	SRS	1	Retrieval
SR01-2037	Tank Heel Removal/Closure Technology	SRS	1	Retrieval
SR01-2041	Develop Advanced Mixing Technology	SRS	3	Retrieval
3.1.3	**Mobilize Dry Solids**			
ID-2.1.50	Solids Waste (Calcine) Retrieval	INEEL	1	Retrieval
ID-2.1.69	Solids Waste (Calcine) Retrieval from CSSF1	INEEL	1	Retrieval
3.1.4	**Mobilize Residual Wastes**			
RL-WT064	Hanford Past Practice Sluicing Improvements	Hanford	1	Retrieval
RL-WT089	Alternate Retrieval Methods from Potentially Leaking Single-Shell Tanks (SSTs)	Hanford	1	Retrieval
RL-WT096	Cold Test/Mockup Facility	Hanford	1	Retrieval
SR01-2037	Tank Heel Removal/Closure Technology	SRS	1	Retrieval
ID-2.1.67	High Level Waste Slurry Handling	INEEL	1	Retrieval
OH-WV-905	Removal of Tank Residuals	WVDP	1	Retrieval
ORTK-02	Tank Solid Waste Retieval	ORR	2	Retrieval
3.1.5	**Clean Tanks**			
SR01-2037	Tank Heel Removal/Closure Technology	SRS	1	Retrieval
ID-2.1.47	Management of Tank Heel Solids	INEEL	1	Retrieval
3.2.0	**Remove Waste**			
3.2.1	**Remove Liquids**			
3.2.2	**Remove Sludges and Slurries**			
RL-WT062	Variable Suction Level Transfer Pump	Hanford	1	Retrieval
SR01-2037	Tank Heel Removal/Closure Technology	SRS	1	Retrieval

Table A.2. Tanks Focus Area Site Needs Distributed Within the Problem Element Structure

PE#	Problem Element Title	Site	Need Pri	Function
ID-2.1.67	High Level Waste Slurry Handling	INEEL	1	Retrieval
3.2.3	**Remove Dry Solids**			
3.3.0	**Transfer Waste**			
ID-2.1.67	High Level Waste Slurry Handling	INEEL	1	Retrieval
3.3.1	**Transfer Liquids**			
3.3.2	**Transfer Sludges and Slurries**			
RL-WT089	Alternate Retrieval Methods from Potentially Leaking Single-Shell Tanks (SSTs)	Hanford	1	Retrieval
RL-WT090	Chemical and Physical Behavior of Sludge Wastes	Hanford	1	Retrieval
RL-WT098	Erosion Testing	Hanford	3	Retrieval
SR01-2039	Methods to Unplug Waste Transfer Lines	SRS	2	Retrieval
ID-2.1.67	High Level Waste Slurry Handling	INEEL	1	Retrieval
3.3.3	**Transfer Dry Solids**			
ID-2.1.77	Dry Feed Handling - Pumpability, Homogeneity, Uniform Mixing, and Pre-Process Sampling	INEEL	1	Retrieval
ID-S.1.31	Dry Feed Handling-Pumpability, Homogeneity, Uniform Mixing, and Pre-Process Sampling	INEEL	1	Retrieval
3.3.4	**Transport Waste**			
RL-WT089	Alternate Retrieval Methods from Potentially Leaking Single-Shell Tanks (SSTs)	Hanford	1	Retrieval
ID-2.1.66	Treatment/Disposition of Spent Ion Exchange Resins	INEEL	1	Retrieval
4	**Operate Remote Systems**			
4.1.0	**Deploy Equipment**			
4.2.0	**Maintain Equipment and Facilities**			
RL-WT021	Cleaning, Decontaminating and Upgrading Hanford Pits	Hanford	2	Retrieval
RL-WT072	Use Of Handheld Technology To Automate Operator Data Sheets For Tank Farm Operations	Hanford	2	Safety
SR01-2031	Develop Remote Technology to Improve DWPF Operations	SRS	3	Retrieval
SR01-2037	Tank Heel Removal/Closure Technology	SRS	1	Retrieval
ID-9.1.08	Tanks/Piping Information Base for Configuration Control and Statusing	INEEL	2	Safety
4.3.0	**Disposition Equipment**			
SR01-2031	Develop Remote Technology to Improve DWPF Operations	SRS	3	Immobilization
SR01-2037	Tank Heel Removal/Closure Technology	SRS	1	Retrieval
SR01-2040	Demonstrate Remote Decommissioning and Disassembly of High Level Waste Processing Equipment	SRS	3	Immobilization
ID-2.1.83	Decommissioning a High Level Waste Melter System and Change Out of its Components	INEEL	1	Immobilization
OH-WV-903	Vitrification Expended Material Processing (WVDP-3-99)	WVDP	1	Immobilization
OH-WV-904	High Level Waste Tank Closure	WVDP	1	Retrieval
OH-WV-908	Decontamination of High-Level Waste Contaminated Equipment	WVDP	3	Retrieval
5	**Waste Pretreatment**			

Table A.2. Tanks Focus Area Site Needs Distributed Within the Problem Element Structure

PE#	Problem Element Title	Site	Need Pri	Function
ORTK-05	Tank Sludge and Supernatant Separations	ORR	2	Pretreatment
ORTK-11	Tank Supernatant Pretreatment	ORR	2	Pretreatment
5.1.0	**Dissolve Wastes**			
RL-WT068	Radionuclide Source Term from Tank Residuals	Hanford	1	Pretreatment
RL-WT090	Chemical and Physical Behavior of Sludge Wastes	Hanford	1	Pretreatment
RL-WT091	Chemical and Physical Behavior of Saltcake Wastes	Hanford	1	Pretreatment
RL-WT094	Understanding and Controlling Post-filtration Precipitation	Hanford	2	Pretreatment
RL-WT078-S	Plutonium Segregation and Association in HLW	Hanford	2	Pretreatment
SR01-2033	Provide Alternative Processing and/or Concentration Methods for DWPF Recycle Aqueous Streams	SRS	2	Pretreatment
SR01-2037	Tank Heel Removal/Closure Technology	SRS	1	Pretreatment
SR01-2039	Methods to Unplug Waste Transfer Lines	SRS	2	Pretreatment
SR01-2051	Technology to Mitigate Effects of Technetium Under Tank Closure Conditions	SRS	2	Pretreatment
SR01-2052	Aluminum Dissolution from HAW Sludge and Its Impact on Downstream Salt Processing	SRS	2	Pretreatment
SR01-2049-S	Technetium Chemistry Under Waste Removal Conditions	SRS	1	Pretreatment
ID-2.1.51	Develop Calcine Dissolution Kinetics for Solid/Liquid Equilibria	INEEL	1	Pretreatment
ID-2.1.52	Characterization of Solids from Calcine Dissolution	INEEL	1	Pretreatment
ID-2.1.67	High Level Waste Slurry Handling	INEEL	1	Pretreatment
ORTK-11	Tank Supernatant Pretreatment	ORR	2	Pretreatment
5.2.0	**Separate Solids**			
RL-WT093	Filtration Optimization and Process Enhancement	Hanford	2	Pretreatment
SR01-2033	Provide Alternative Processing and/or Concentration Methods for DWPF Recycle Aqueous Streams	SRS	2	Pretreatment
ID-2.1.64	Solid-Liquid Separation Equipment Development and Application	INEEL	1	Pretreatment
5.3.0	**Separate Chemicals**			
RL-WT092	Improved Separation Agents and Processes to Remove Cesium from Supernatant Solutions	Hanford	2	Pretreatment
SR01-2034	Second Generation Salt Feed Preparation	SRS	1	Pretreatment
SR01-2056	Development of an Improved Understanding of the Causes of Foam Formation During Radioactive Waste Processing and Identification or Development of More Effective Antifoam Agents	SRS	3	Pretreatment
SR01-2053-S	Develop an Alternative Sorbent to Replace Monosodium Titanate for Sr and Actinide Removal	SRS	3	Pretreatment
SR01-2058-S	Develop Solvent Extractant System for Co-Removal of Cesium, Strontium, and Other Actinides	SRS	3	Pretreatment
ID-2.1.06a	TRU and Sr Removal from High Activity Waste	INEEL	1	Pretreatment
ID-2.1.06b	Cs Removal from High Level Waste Calcine and Off-gas Scrubber Solutions	INEEL	1	Pretreatment
ID-2.1.68	Technetium Removal from INEEL High Level Waste	INEEL	1	Pretreatment
5.3.1	**Separate Cesium**			
5.3.2	**Separate Strontium**			
5.3.3	**Separate Actinides**			

Table A.2. Tanks Focus Area Site Needs Distributed Within the Problem Element Structure

PE#	Problem Element Title	Site	Need Pri	Function
5.3.4	**Separate Technetium**			
5.3.5	**Separate Non-Radioactive Chemicals**			
RL-WT088	Advanced Approaches for Reducing Waste Volume Stored in DSTs	Hanford	1	Pretreatment
ID-2.1.29	Evaluate Corrosion Potential (LET&D/PEWE/HLW Vitrification Process and Off-gas system/Other Future Processes)	INEEL	1	Pretreatment
ID-2.1.30	Remove/Treat Corrosive Off-gas Components (LET&D/PEWE/Vitrification Melter/Other Future Processes)	INEEL	1	Pretreatment
OH-WV-915	Processing of High Activity Waste with High Sodium Content	WVDP	1	Pretreatment
5.4.0	**Transform Compounds**			
RL-WT103	Separable Organic Phase Destruction, Removal, and Monitoring In Tank Waste	Hanford	1	Pretreatment
5.5.0	**Evaporate Water**			
RL-WT086	Anti-foaming Agents for Evaporation of Alkaline Wastes	Hanford	3	Pretreatment
RL-WT088	Advanced Approaches for Reducing Waste Volume Stored in DSTs	Hanford	1	Pretreatment
SR01-2033	Provide Alternative Processing and/or Concentration Methods for DWPF Recycle Aqueous Streams	SRS	2	Pretreatment
SR01-2056	Development of an Improved Understanding of the Causes of Foam Formation During Radioactive Waste Processing and Identification or Development of More Effective Antifoam Agents	SRS	3	Pretreatment
5.6.0	**Treat Liquid Effluents**			
ID-2.1.16	Decontamination Facility/Analytical Facility Waste Reduction	INEEL	1	Pretreatment
ID-2.1.17	Develop New Filter Leach Process	INEEL	1	Pretreatment
ID-2.1.28	Cs and Sr Removal from Newly Generated Liquid Waste	INEEL	1	Pretreatment
ID-2.1.64	Solid-Liquid Separation Equipment Development and Application	INEEL	1	Pretreatment
ID-2.1.84	Removal of Mercury from SBW Vitrification Off-Gas	INEEL	1	Pretreatment
ID-S.1.36	Offgas Control System and Technologies	INEEL	1	Pretreatment
6	**Reserved**			
7	**Waste Immobilization**			
SR01-2055	Increase in Applicability/Efficiency of High-Level Waste Planning Tool	SRS	3	Immobilization
ID-2.1.24	Integration/Optimization of High Activity Waste/Low Activity Waste Process Flowsheet	INEEL	1	Immobilization
ID-2.1.29	Evaluate Corrosion Potential (LET&D/PEWE/HLW Vitrification Process and Off-gas system/Other Future Processes)	INEEL	1	Immobilization
ID-2.1.65	Treatment Selection for Removed Tank Solids	INEEL	1	Immobilization
ID-2.1.89	SBW Vitrification Offgas System Components Optimization	INEEL	1	Immobilization
ID-S.1.37	SBW Vitrification Offgas Compositional Data and Predictive Models	INEEL	1	Immobilization
7.1.0	**Define Waste Form**			
7.1.1	**Formulate Glass**			
RL-WT080	Advanced/Improved Vitrification	Hanford	2	Immobilization

Table A.2. Tanks Focus Area Site Needs Distributed Within the Problem Element Structure

PE#	Problem Element Title	Site	Need Pri	Function
RL-WT084	Extension of Glass Properties Model to LAW and Phase II HLW Glass Composition Ranges	Hanford	1	Immobilization
RL-WT087	Assessment of Effects to HLW Glass Production from Using Crystalline Silicotitanate (CST) to Separate Cesium from Alkaline Waste Solutions	Hanford	3	Immobilization
RL-WT101	Sulfate Mitigation for Hanford Tank Low Activity Waste (LAW) Vitrification	Hanford	2	Immobilization
SR01-2052	Aluminum Dissolution from HAW Sludge and Its Impact on Downstream Salt Processing	SRS	2	Immobilization
ID-2.1.58	HAW Immobilization	INEEL	1	Immobilization
ID-2.1.75	Glass and Alternative Glass-Ceramic Waste Forms	INEEL	1	Immobilization
ID-2.1.78	Fate and Impacts of Sulfates in Vitrification Processes	INEEL	1	Immobilization
ID-S.1.29	Glass and Alternative Glass-Ceramic Waste Forms	INEEL	1	Immobilization
ID-S.1.32	Fate and Impacts of Sulfates in Vitrification Processes	INEEL	1	Immobilization
7.1.2	**Formulate Grout**			
7.1.3	**Define Alternative Forms**			
ID-2.1.75	Glass and Alternative Glass-Ceramic Waste Forms	INEEL	1	Immobilization
ID-S.1.29	Glass and Alternative Glass-Ceramic Waste Forms	INEEL	1	Immobilization
7.2.0	**Condition Waste**			
RL-WT100	HLW/LAW Melter Operation	Hanford	2	Immobilization
ID-2.1.57	Conditioning of HAW for Treatment	INEEL	1	Immobilization
ID-2.1.67	High Level Waste Slurry Handling	INEEL	1	Immobilization
ID-2.1.88	Evaporation or Pretreatment of Liquid Sodium Bearing Waste (SBW) Prior to Feeding Melter	INEEL	1	Immobilization
7.2.1	**Adjust Composition**			
7.2.2	**Remove Water**			
7.3.0	**Immobilize Waste**			
7.3.1	**Vitrify Waste**			
RL-WT080	Advanced/Improved Vitrification	Hanford	2	Immobilization
RL-WT100	HLW/LAW Melter Operation	Hanford	2	Immobilization
RL-WT101	Sulfate Mitigation for Hanford Tank Low Activity Waste (LAW) Vitrification	Hanford	2	Immobilization
SR01-2032	Optimize Melter Glass Chemistry and Increase Waste Loading	SRS	2	Immobilization
SR01-2036	Develop Improved HLW Melter	SRS	3	Immobilization
SR01-2052	Aluminum Dissolution from HAW Sludge and Its Impact on Downstream Salt Processing	SRS	2	Immobilization
ID-2.1.58	HAW Immobilization	INEEL	1	Immobilization
ID-2.1.74	Alternative Melters to Joule Heated Design for Applications to INEEL Calcine	INEEL	1	Immobilization
ID-2.1.76	Selection of Refractory Materials Based Upon Glass Chemistry	INEEL	1	Immobilization
ID-2.1.82	Melter Components - Electrodes, Heaters, Top Head, Drain System Erosion/Corrosion Rates	INEEL	1	Immobilization
ID-S.1.30	Selection of Refractory Materials Based Upon Glass Chemistry	INEEL	1	Immobilization
ID-S.1.35	Melter Components - Electrodes, Heaters, Top Head, Drain System Erosion/Corrosion Rates	INEEL	1	Immobilization

Table A.2. Tanks Focus Area Site Needs Distributed Within the Problem Element Structure

PE#	Problem Element Title	Site	Need Pri	Function
7.3.2	**Grout Waste**			
ID-2.1.23	Low-Activity Wasteform Qualification	INEEL	1	Immobilization
ID-2.1.35	Direct Immobilization of INTEC Newly Generated Liquid Wastes	INEEL	1	Immobilization
ID-2.1.38	Conditioning of Low Activity Waste for Treatment	INEEL	1	Immobilization
ID-2.1.40	Low Activity Waste Grout Sorbent Addition to Reduce Leachability	INEEL	1	Immobilization
ID-2.1.66	Treatment/Disposition of Spent Ion Exchange Resins	INEEL	1	Immobilization
ID-2.1.80	Low-Activity Waste Gas Generation	INEEL	1	Immobilization
ID-2.1.91	Vitrification Secondary Waste Characterization & Disposition Path Regulatory Development	INEEL	1	Immobilization
ORTK-06	Tank Sludge Supernatant Immobilization	ORR	1	Immobilization
7.4.0	**Treat Gaseous Effluents**			
RL-WT100	HLW/LAW Melter Operation	Hanford	2	Immobilization
SR01-2027	Demonstrate Alternative Filtration Technologies to Replace Conventional HEPA Filters	SRS	3	Safety
ID-2.1.27	Cleanable Off Gas Filters	INEEL	1	Safety
ID-2.1.41	HLW Process Offgas Treatment	INEEL	1	Immobilization
ID-2.1.81	Materials Development Needs for Vitrification of INEEL Acidic, Sodium Bearing High Level Waste	INEEL	1	Immobilization
ID-2.1.84	Removal of Mercury from SBW Vitrification Off-Gas	INEEL	1	Immobilization
ID-2.1.85	Offgas Control System and Technologies	INEEL	1	Immobilization
ID-2.1.89	SBW Vitrification Offgas System Components Optimization	INEEL	1	Immobilization
ID-2.1.90	SBW Vitrification Offgas NOx Abatement and PIC/HAP Destruction	INEEL	1	Immobilization
ID-2.1.91	Vitrification Secondary Waste Characterization & Disposition Path Regulatory Development	INEEL	1	Immobilization
ID-S.1.34	Materials Development Needs for Vitrification of INEEL Acidic, Sodium Bearing High Level Waste	INEEL	1	Immobilization
ID-S.1.36	Offgas Control System and Technologies	INEEL	1	Immobilization
7.5.0	**Package Waste Form**			
SR01-2029	Alternate DWPF Canister Decon Technology	SRS	3	Closure
ID-2.1.87	Development of Real Time NDE Technology for Quality Verification of Canister Closure Seal Welds	INEEL	1	Immobilization
ID-2.1.92	Structural Integrity Program for Interim Storage of INEEL HLW Glass Canisters	INEEL	1	Immobilization
OH-WV-902	Decontamination of High-Level Waste (HLW) Canisters (WVDP-2-99)	WVDP	1	Closure
7.6.0	**Qualify Waste Form**			
ID-2.1.49	Acceptance Criteria for High Activity Waste/Low Activity Waste	INEEL	1	Immobilization
ID-2.1.58	HAW Immobilization	INEEL	1	Immobilization
ID-2.1.91	Vitrification Secondary Waste Characterization & Disposition Path Regulatory Development	INEEL	1	Immobilization
7.7.0	**Store Immobilized Waste**			
9	**Tank Closure/Waste Disposal**			
9.1.0	**Define Criteria**			
RL-WT069	Value of Information Decision Analysis for Tank Farm Closure	Hanford	1	Closure
ID-2.1.23	Low-Activity Wasteform Qualification	INEEL	1	Closure

Table A.2. Tanks Focus Area Site Needs Distributed Within the Problem Element Structure

PE#	Problem Element Title	Site	Need Pri	Function
ID-2.1.39	Acceptance Criteria for LAW Disposal in Underground Storage Tanks	INEEL	1	Closure
ID-2.1.42	Acceptance Criteria for Tank Closure	INEEL	1	Closure
ID-2.1.45	Acceptance Criteria for Grouting Tank Heels	INEEL	1	Closure
ID-2.1.48	Wasteform Qualification for Low-Activity Waste in Underground Storage Tanks	INEEL	1	Closure
ID-2.1.49	Acceptance Criteria for High Activity Waste/Low Activity Waste	INEEL	1	Closure
ID-2.1.62	Acceptance Criteria for Bin Set Closure	INEEL	1	Closure
9.2.0	**Provide Disposal Facilities**			
9.3.0	**Stabilize Tanks**			
SR01-2051	Technology to Mitigate Effects of Technetium Under Tank Closure Conditions	SRS	2	Closure
ID-2.1.46	Management of Tank Heel Liquids	INEEL	1	Closure
ID-2.1.47	Management of Tank Heel Solids	INEEL	1	Closure
OH-WV-904	High Level Waste Tank Closure	WVDP	1	Closure
OH-WV-914	Development of Grout for In-Situ Closure	WVDP	1	Closure
ORTK-09	Tank Closure	ORR	1	Closure
9.4.0	**Minimize Migration**			
RL-WT017	Long-Life Waste Isolation Surface Barrier	Hanford	1	Closure
9.4.1	**Minimize Infiltration**			
9.4.2	**Retard Migration**			
9.5.0	**Assess Performance**			
RL-WT061	Reactive Barriers to Contaminant Migration	Hanford	1	Closure
RL-WT046-S	Getter Materials	Hanford	2	Closure
RL-WT076-S	Plutonium Interaction with Silicates	Hanford	2	Closure
9.5.1	**Define Source Term**			
RL-WT015	Standard Method for Determining Waste Form Release Rate	Hanford	2	Immobilization
RL-WT016	Glass Monolith Surface Area	Hanford	2	Immobilization
RL-WT066	Compositional Dependence of the Long Term Performance of Glass as a Low-Activity Waste Form	Hanford	1	Immobilization
RL-WT080	Advanced/Improved Vitrification	Hanford	2	Immobilization
9.5.2	**Assess Transport**			
RL-WT035-S	Moisture Flow and Contaminant Transport in Arid Conditions	Hanford	1	Closure
RL-WT044-S	Distribution of Recharge Rates	Hanford	1	Closure
RL-WT053-S	Contaminant Mobility Beneath Tank Farms	Hanford	2	Closure
9.5.3	**Assess Impacts**			
9.6.0	**Monitor Long-Term Performance**			
RL-WT102	Advanced Characterization Tools for Contaminants of Concern	Hanford	1	Characterization
SR01-2044	In-Situ Technology for Waste Characterization and Level Monitoring	SRS	2	Characterization
ID-2.2.1	Post-Closure Monitoring Techniques for HLW Tank Farm	INEEL	2	Characterization
ID-9.1.01	Underground Instrumentation Placement for Buried Tanks	INEEL	2	Characterization
ORTK-09	Tank Closure	ORR	1	Characterization

Table A.3. Tanks Focus Area FY 2002 – FY 2003 Integrated Priority Listing

Pri	MYTR#	Technical Response Title	Han	INEEL	ORR	SRS	WVDP	Site Needs Included
0	B1S1	Pre-Closure Interim Tank Maintenance					■	ID-S.1.38
0	B3S2	SST Retrieval from Potential Leaking Tanks	■					RL-WT089
0	B5S1	Removal of Key Non-Radioactive Elements from Tank Waste						
0	B5S2	Selective Chemical Dissolution of Tank Heels to Improve Retrieval				■		
0	B7S2	New Melter Technology						RL-WT080, SR01-2052, ID-2.1.74
0	B9S1	Controlling Radionuclide Source Terms Important to Tank Closure						
0	B9S2	Closure of Ancillary Piping and Equipment						
0	B570	Salt Processing Project				■		RL-WT092, SR01-2034, SR01-2056, SR01-2053-S, SR01-2058-S
1	B143	HLW Tank Corrosion Control and Monitoring	■	■	■	■		RL-WT04, RLWT079-S, SR01-2045, ID-2.1.79, ID-S.1.33
2	B175	Tank Integrity Inspection Techniques	■	▒		▒		RL-WT05, RL-WT022, RL-WT067, SR01-2035, SR01-2037, ID-2.1.20, ID-S.1.38, OH-WV-907, ORTK-01
3	B361	Heel Retrieval from Obstructed Tanks		▒			■	ID-2.1.67, OH-WV-905
4	B362	Low Liquid Volume Saltcake Retrieval	■			▒		RL-WT063, RL-WT077, RL-WT089, SR01-2028
5	B554	Tank Waste Chemistry	■			▒		RL-WT090, RL-WT091, RL-WT094, RL-WT078-S, SR01-2033, SR01-2037, SR01-2039, SR01-2052, ID-2.1.67
6	B768	Specify and Enhance Design of HLW Glass Melters	▒	■		▒		RL-WT100, RL-WT101, SR01-2032, SR01-2036, ID-2.1.58, ID-2.1.76, ID-2.1.82, ID-S.1.30, ID-S.1.88
7	B773	Improve Waste Loading in HLW and LLW Glasses	▒	■		▒		RL-WT080, RL-WT084, RL-WT087, RL-WT101, SR01-2032, SR01-2052, ID-2.1.58, ID-2.1.75, ID-2.1.78, ID-S.1.29, ID-S.1.32
8	B157	Tank Leak Mitigation	▒	▒		■		RL-WT027, RL-WT089, SR01-2035, SR01-2037, ID-9.1.07
9	B363	Chemical Cleaning of Tanks		■		■		SR01-2037, ID-2.1.47
10	B367	Unobstructed Tank Heel Retrieval	■			▒		RL-WT064, RL-WT089, RL-WT096, SR01-2037, ORTK-02
11	B555	Sludge Washing and Dissolution	■		■	■		RL-WT090, SR01-2037, SR01-2052, ORTK-11
12	B709	Waste Treatment Process Flowsheet Model		■		▒		SR01-2055, ID-2.1.24, ID-2.1.29, ID-2.1.65, ID-2.1.89, ID-S.1.37
13	B769	Conditioning of HLW for Immobilization	▒	■				RL-WT100, ID-2.1.57, ID-2.1.67, ID-2.1.88
14	B777	Remote Disassembly of HLW Melters and Other Processing Equipment				■	■	SR01-2031, SR01-2040, ID-2.1.83, OH-WV-903

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15	B566	Waste Chemistry During Evaporation						RL-WT088, SR01-2033
16	B584	Cross-Flow Filtration						RL-WT093, SR01-2033, ID-2.1.64
17	B359	Waste Mobilization and Mixing						RL-WT060, RL-WT096, RL-WT054-S, SR01-2028, SR01-2037, SR01-2041
18	B923	Enhanced Grout Formulations for Tank Closure						SR01-2051, ID-2.1.46, ID-2.1.47, OH-WV-914, ORTK-09
19	B382	Horizontal and Small Tank Sludge Mixing and Retrieval						RL-DD082, SR01-2037
20	B719	Conditioning and Immobilization of Low-Activity Waste						ID-2.1.23, ID-2.1.35, ID-2.1.38, ID-2.1.40, ID-2.1.66, ID-2.1.80, ID-2.1.91, ORTK-06
21	B203	Residual Waste Sampling						ID-2.1.20, ID-2.1.44, ID-2.1.72, ID-9.1.02, ID-9.1.03, ID-9.1.06
22	B508	Decon and Filter Leach Processes Waste Volume Reduction						ID-2.1.16, ID-2.1.17
23	B171	Alternative Air Filtration Technology						SR01-2027, ID-2.1.27
24	B376	Pipeline Plugging Prevention, Unplugging, and Cleaning						RL-WT089, RL-WT090, SR01-2039, ID-2.1.67
25	B311	Long-Length Equipment Handling						SR01-2037, OH-WV-908
26	B352	Remote Systems for Pit Operations and Maintenance						RL-WT021, SR01-2037
27	B722	HLW Process Offgas Treatment						RL-WT100, ID-2.1.41, ID-2.1.81, ID-2.1.84, ID-2.1.85, ID-2.1.89, ID-2.1.90, ID-2.1.91, ID-S.1.34, ID-S.1.36
28	B521	Acid-Side Radionuclide Separations						ID-2.1.28, ID-2.1.64, ID-2.1.84, ID-S.1.36
29	B156	Tank Leak Detection						RL-WT026
30	B588	Leaching and Treatment of Technetium for Tank Closure						RL-WT068, SR01-2051, SR01-2049-S
31	B232	Dry Materials Sampling						ID-2.1.50, ID-2.1.77, ID-S.1.31
32	B201	Sludge Mapping and Volume Estimates						SR01-2044, ID-2.1.72, ORTK-01
33	B202	In-Situ Waste Characterization						SR01-2037, SR01-2044, ID-9.1.04, ID-9.1.05, OH-WV-906, OH-WV-916
34	B365	Waste Transfer Pumping						RL-WT062, SR01-2037, ID-2.1.67
35	B748	Testing and Prediction of Long-Term Waste Glass Performance						RL-WT015, RL-WT066, RL-WT080
36	B532	Calcine Dissolution Solubility and Kinetics						ID-2.1.51, ID-2.1.52
37	B246	Tank Waste Sampling						RL-WT09, ID-2.1.67
38	B278	Slurry Transfer and Tank Waste Mixing Monitors						RL-WT032-S, SR01-2037, SR01-2044
39	B279	Two-Phase Liquid Detection						RL-WT101, RL-WT103

Table A.3. Tanks Focus Area FY 2002 – FY 2003 Integrated Priority Listing

40	B972	Alternative HLW Canister Decontamination Techniques						SR01-2029, OH-WV-902
41	B374	Remote Technologies for Process Cell Operations and Maintenance						SR01-2031
42	B501	INEEL Integrated Radionuclide Separations Process						ID-2.1.06a, ID-2.1.06b, ID-2.1.68
43	B176	Piping Integrity Inspection Techniques						SR01-2035
44	B542	Antifoam Agents for Waste Evaporation						RL-WT086, SR01-2056
45	B303	Waste Retrieval from Confined Spaces						SR01-2037
46	B205	Continuous Emissions Monitor for Offgas Analysis						RL-WT101, ID-2.1.18, ID-2.1.86, ID-S.1.31
47	B514	Removal of Chloride from Waste Solutions						ID-2.1.29, ID-2.1.30
48	B511	Sodium Salt Removal for Waste Volume Reduction						RL-WT088, OH-WV-915
49	B335	Transfer Line and Piping Improvements						ID-2.1.67
50	B338	Containers for Waste Slurry Transport						RL-WT089, ID-2.1.66
51	B191	Aerodynamic Greenhouses						SR01-2057
52	B387	Improved Mixing Methods						RL-WT060, SR01-2037
53	B310	Tank Decontamination and Dismantling						OH-WV-904
54	B144	Tank Materials Properties						SR01-2035, SR01-2050-S
55	B264	Improve Waste Analytical Methods						RL-WT01, RL-WT099-S, SR01-2054-S, ID-2.1.16
56	B924	Tank Closure Criteria/Decision Support						RL-WT069, ID-2.1.23, ID-2.1.39, ID-2.1.42, ID-2.1.45, ID-2.1.48, ID-2.1.49, ID-2.1.62
57	B331	Dry Solid Waste Retrieval						ID-2.1.50, ID-2.1.69
58	B960	Reduced Radionuclide Mobility						RL-WT061, RL-WT046-S, RL-WT076-S
59	B339	Feed Slurry Erosion Testing						RL-WT098
60	B749	Glass Monolith Surface Area						RL-WT016
61	B333	Dry Materials Transfer and Blending						ID-2.1.77, ID-S.1.31
62	B751	Alternative HLW Waste Forms						ID-2.1.75, ID-S.1.29
63	B517	Organic Phase Removal						RL-WT103
64	B204	Characterization Methods for Contaminated Large Equipment						OH-WV-902
65	B730	Acceptance Criteria for High Activity Waste						ID-2.1.49, ID-2.1.58, ID-2.1.91
66	B958	Data and Tools for Performance Assessments						RL-WT035-S, RL-WT044-S, RL-WT053-S

Site: Hanford

Site Need ID: RL-DD082
Site Need Title: Retrieval of Waste Heel from Vault Tanks at 340 Facility
Need Summary: A method is needed for removing residual waste from two 15,000 gallon tanks. The tanks are situated below grade in a concrete vault. Waste remaining in each tank is comprised of about 1,500 gallons of liquids, sludge, solids and dispersible materials. A similar need is documented in Technology Need RL-DD09.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B382, Horizontal and Small Tank Sludge Mixing and Retrieval, TFA priority #19.

Site Need ID: RL-WT01
Site Need Title: Technetium-99 Analysis in Hanford Tank Waste and Contaminated Tank Farm Areas
Need Summary: An accurate, robust production laboratory method for the measurement of technetium-99 (^{99}Tc) concentration in Hanford Site waste tank matrices and in soils from the vadose zone surrounding the tanks is needed. The method must provide a high level of confidence in the ^{99}Tc concentrations because data are important in risk-based assessments. To obtain this level of confidence, verification of method performance needs to be done by the use of independent methods and/or by interlaboratory comparisons on actual waste samples between U.S. Department of Energy (DOE) Sites.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B264, Improve Waste Analytical Methods, TFA priority #55.

Site Need ID: RL-WT04
Site Need Title: Double-Shell Tank Corrosion Monitoring
Need Summary: Corrosion monitoring of double-shell tanks (DSTs) is currently provided by process knowledge and tank sampling. Tanks found to be within chemistry specification limits are considered to be not at risk for excessive corrosion damage. There have been no direct corrosion monitoring systems for DSTs in use at the Hanford Site. As many as four low hydroxide (out of corrosion specification) tanks continue to be operated. In fiscal year 1999, DST 241-AN-105 was discovered to have wall thinning that cannot be explained by existing corrosion chemistry models. This indicates that this system is inadequate to support corrosion control. Tank samples are infrequent and their analysis difficult and expensive. Waste streams that are exempt from the corrosion control specifications complicate process knowledge. In-tank, real-time measurement of the corrosive characteristics of the tank wastes is needed to improve control of corrosion processes.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B143, HLW Tank Corrosion Control and Monitoring, TFA priority #1.

Site Need ID: RL-WT05
Site Need Title: Remote Inspection of High-Level Waste Single-Shell Tanks (SSTs)
Need Summary: The Hanford Federal Facility Agreement and Consent Order (Tri Party Agreement) schedule requires completion of a saltcake dissolution retrieval demonstration in SST S-112 during FY 2005. A crawler based retrieval demonstration in SST C-104 will occur during FY 2007 with completion of retrieval system construction during FY 2006. The first full-scale waste retrieval will occur in SST S-102 during FY 2006. To meet this schedule, a retrieval method needs to be selected to retrieve the waste for processing. A non-destructive evaluation (NDE) of the tank needs to be performed prior to the selection of a retrieval method to assure successful retrieval of the waste from the tank without causing leakage. Methods for reducing the corrosive nature of the in-tank environment need to also be examined; including addition of corrosion inhibitors and high-viscosity caustics for pulling moisture out of the air to reduce the introduction of moisture through ventilation system flow.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B175, Tank Integrity Inspection Techniques, TFA priority #2.

Site Need ID: RL-WT09
Site Need Title: Representative Sampling and Associated Analysis to Support Operations and Disposal
Need Summary: A concept for taking representative samples and associated rapid analysis of feeds that are to be staged for cross site transfer or are to be staged as feed for the waste treatment and immobilization plant (WTP) needs to be developed and demonstrated. Feed for immobilization demonstrations must be sampled prior to transfer to WTP. The samples must be representative of the tank contents. To accomplish this, the intermediate waste feed staging tank contents must be sampled while being mixed for transfer to the WTP feed staging tank. A variable depth or multiple depth sampling system is needed that can be operated in conjunction with the active mixing system to take representative samples and certify the tank contents. The certified tank contents will be needed either for acceptance of the waste feed batch or as a means to determine the changes in processing required before the waste can be immobilized.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B246, Tank Waste Sampling, TFA priority #37.

Site Need ID: RL-WT015
Site Need Title: Standard Method for Determining Waste Form Release Rate
Need Summary: The release of radionuclides from a waste form and package to the environment results from the interactions between the waste form and water in the disposal system. For the disposal of immobilized low-activity tank waste (ILAW), the waste form and package are expected to be in an extremely dry environment. In such an environment, the release rate is a sensitive function of physical (temperature, water content) and chemical environment (pH and amount and type of mineral and non-mineral species). Waste forms are typically developed to minimize the rate of release as measured by a variety of test methods. Current ILAW product specifications require

Product Consistency Test testing and ANS 16.1 testing of the waste forms, which involve testing the waste form in an environment where water is abundant and where chemical effects are minimized. These test methods will not be representative of the expected disposal system environment at the Hanford Site. A release rate test method yielding results that can be related to the waste form release rate under expected service conditions is needed as a basis for Phase II ILAW product specifications.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B748, Testing and Prediction of Long-Term Waste Glass Performance, TFA priority #35.

Site Need ID: RL-WT016
Site Need Title: Glass Monolith Surface Area
Need Summary: A method is needed to estimate the surface area of vitrified low-activity waste (LAW). The contaminant release rate from glasses is proportional to the surface area reachable by moving moisture. As glass cools it experiences internal stresses and strains, which may cause the glass to crack and hence increase the surface area on the glass. External stresses (for example, those caused by earthquakes) could also increase surface area. In addition, cracks may expose imperfections in waste form (internal gas pockets, nucleation sites, and devitrification regions) which may cause increased contaminant release rates. Relatively little is known about the long-term behavior of such cracks. Yet the total contaminant release must be known (or at least estimated) for thousands of years.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B749, Glass Monolith Surface Area, TFA priority #60.

Site Need ID: RL-WT017
Site Need Title: Long-Life Waste Isolation Surface Barrier
Need Summary: Surface barriers are being used over many Hanford Site waste sites contaminated with low-level radionuclides and/or chemical contaminants. Many more waste sites are expected to use such barriers in the future. Such barriers are used to reduce moisture infiltration and plant and animal intrusion. Short-term testing of barriers has occurred under project-sponsored activities, but long-term studies remain a funding orphan. Since the design life of the barrier is 500 to 1,000 years, data will be needed on degradation to better understand the validity of the design life estimate. Concern exists regarding the integrity of barrier designs and the definition of adequate testing to verify barrier performance. This technology need relates to the generation and subsequent regulatory acceptance of adequate design, selection, validation, and monitoring results. Acceptance of these results will allow an environmentally sound, cost-effective, graded design approach for barrier implementation at the Hanford Site.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B950, Barriers for Tank/Disposal Facility Closure. TFA elected not to fund this effort because the Subsurface Contaminants Focus Area (SCFA) infiltration barrier effort is satisfying site needs for a guidance document. The TFA will not

develop a separate FY02-06 multiyear response for the Hanford needs. The TFA will revisit whether it should develop a multiyear response for tank infiltration barriers after the sites have had an opportunity to review the SCFA effort and submit revised needs to the TFA.

Site Need ID: RL-WT021
Site Need Title: Cleaning, Decontaminating and Upgrading Hanford Pits
Need Summary: Waste retrieved from Hanford Site tanks must pass through a number of pits associated with single-shell and double shell tanks before it is received by the privatization contractor for treatment and disposal. Many of these pits will have to be modified before the waste can be transferred. Current methods for modifying, operating, cleaning and decontaminating these pits are labor intensive and costly, and they result in a high dose to workers. Currently, work associated with pits is the single largest contribution to RPP operations dose levels. For example, the dose in the 241-C-106 pits was 40 R/hr. After investing $2 million and 5 months, the dose had been reduced to only 20 R/hr. During the pit operations, 25 personrems were accumulated.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B352, Remote Systems for Pit Operations and Maintenance, TFA priority #26.

Site Need ID: RL-WT022
Site Need Title: Adapting Tandem Synthetic Aperture Focusing Technique (TSAFT) for Flaw Characterization in the Inaccessible Portion of the Knuckle Region of the Double-Shell Tanks (DSTs)
Need Summary: Compliance to Washington Administrative Code 173-303-640 requires life cycle integrity assessments, including NDE of six DSTs on a portion of the tank wall, bottom knuckle, and bottom. Washington Administrative Order 00NWPKW-1250/1251 provides additional examination requirements for knuckle examinations. Additional DSTs will be selected for NDE based upon examination results. NDE equipment must be deployed to fulfill this requirement. Fracture mechanics analysis indicates that the knuckle region of the DST that rests on the concrete foundation is the highest-stressed region of the tanks. This high-stressed region is not accessible using current ultrasonic technology. A promising alternative for accessing this region is by propagating ultrasonic energy around a plate with a one-foot radius bend. Current inspection studies demonstrate that defects in this region can be detected. However, characterizing the length and through-wall extent of defects is not possible using current technology.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B175, Tank Integrity Inspection Techniques, TFA priority #2.

Site Need ID: RL-WT026
Site Need Title: Tank Leak Detection Systems for Underground Single-Shell Waste Storage Tanks (SSTs)
Need Summary: The use of past-practice sluicing for SST waste removal involves the addition of liquid to tanks and therefore increases the potential for waste leakage to the environment. Leak detection applies to all SST retrieval operations and would be

deployed in conjunction with in-tank methods (i.e., level measurements, spectral gamma measurements, and other material balance techniques). An improvement is needed over the current method of mass balance calculations during transfer because of its limited accuracy. Leak detection methods are also needed that can detect tank waste leakage in the vadose zone immediately surrounding the SST's and have the capability to quantify the volume of a leak from a tank. The technique needs to have the capability of interrogating all vadose zone soils surrounding the SST's; even those directly beneath the tank.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B156, Tank Leak Detection, TFA priority #29.

Site Need ID: RL-WT027
Site Need Title: Tank Leak Mitigation Systems
Need Summary: The use of liquid based retrieval methods for SST waste removal involves the addition of liquid to tanks and therefore increases the potential for waste leakage to the environment. Leakage mitigation applies to all SST retrievals, including retrieval during Phase I and preparation of the Phase II specification. Leakage mitigation efforts and tools, that can be shown to provide cost-benefit and significant risk reduction over baseline methods, should be incorporated into retrieval system design and operating procedures. Existing mitigation techniques (i.e., the current baseline approach) must continue to be evaluated against potential/candidate mitigating technologies to ensure that the most cost-effective, risk reducing approach is applied. Periodic identification and evaluation of potential leakage mitigation tools for possible application during SST retrieval operations is required on a continuing basis.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B157, Tank Leak Mitigation, TFA priority #8.

Site Need ID: RL-WT060
Site Need Title: Better Waste Mixing Mobilization
Need Summary: Hanford needs enhanced sludge mobilization methods to retrieve sludge that is beyond the Effective Cleaning Radius (ECR) of the baseline pair of long-shaft mixer pumps. The objective is a small system that can be installed in the tanks along with the mixers when needed to mobilize the remaining sludge. Both Hanford and SRS are also interested in identifying replacements for baseline mixer pumps with more cost-effective alternates with respect to life-cycle/operations costs for bulk sludge, sludge heel, and salt cake retrieval both in large HLW storage tanks and in smaller process tanks such as SRS transfer system Pump Tanks. Safety impacts to Authorization Bases also needs to be evaluated. The TFA is evaluating the use of Flygt mixers for SRS this year as part of this goal. In addition, Hanford needs mixer pumps which can start at very low RPM in very viscous (one million + centipoise) waste to de-gas tanks, and mixer pumps which can remove the pumping energy (i.e. cooling) added to the tank to avoid waste heating.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B359, Waste Mobilization and Mixing, TFA priority #17.
- B387, Improved Mixing Methods, TFA priority #52.

Site Need ID: RL-WT061
Site Need Title: Reactive Barriers to Contaminant Migration
Need Summary: Sixty-seven of the 149 SSTs at the Hanford Site are known or suspected leakers. Retrieval of waste from these tanks will incur risk from additional leakage. In addition, waste that has been retrieved will be processed, vitrified and disposed in solid form. Based on past analyses, this waste may add radionuclides to the soil column. For example, the performance assessment activities supporting the disposal of vitrified low-activity waste identified technetium-99 and selenium-79 as the radionuclides that contributed most significantly to long-term risk. If these key radioactive elements could be trapped or immobilized in the waste matrix, disposal facility, closed tanks, and/or the soil column, the risk to human health and the environment could be significantly reduced. Deployment of sequestering agents as a permeable flow-through (reactive) barrier to attenuate the migration of these contaminants and reduce the risk is needed. In the case of contaminated soil, the reactive barrier will be deployed using conventional emplacement technology, e.g., slant drilling, etc. For the vitrified waste and for tank closure, the getter could be placed inside the facility. For existing waste sites, the material may need to be injected into the soil underlying the facility.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B960, Reduced Radionuclide Mobility, TFA priority #58.

Site Need ID: RL-WT062
Site Need Title: Variable Suction Level Transfer Pump
Need Summary: A transfer pump that can draw waste from pre-selected levels that range from the surface to within 10” or less of the tank bottom, and can be operated simultaneously with mixer pumps, is needed. The current baseline transfer pump achieves variable suction levels by using a flexible hose controlled by a tether cable. This design can’t be operated simultaneously with mixer pumps because of hose instability and may be difficult to lower in viscous waste. Baseline transfer pumps that can be operated simultaneously with mixer pumps do not have variable suction level. The current baseline equips sludge tanks (HLW feed to the treatment plant) with fixed suction level transfer pumps, in order to allow solids suspension by mixer pump during transfers. However, some HLW tanks will need decanting capabilities for both the baseline process, and risk mitigation-type activities, such as contingency staging space for LAW feed. The current design equips the salt tanks (LAW feed to the treatment plant) with variable suction level transfer pumps, in order to enable decanting of the supernate and delivery of solid free LAW to the treatment plant, as required by the feed specification. The current design for these pumps (flexible hose) does not allow simultaneous mixer pump operation. However, these tanks may also require simultaneous mixer pump and transfer pump operation for specific situations, such as solids accumulation mitigation, or contingency space for HLW staging.

Technical Disposition: The TFA responded to this need within the following technical response(s):

- B365, Waste Transfer Pumping, TFA priority #34.

Site Need ID: RL-WT063
Site Need Title: Hanford SST Saltcake Dissolution Retrieval
Need Summary: Performance data and retrieval efficiency data are required for a simplified sprinkler-applied (low volume) water dissolution of saltcake system for use in Hanford's SSTs. Effects of in-tank hardware and tank walls shall also be determined. This system is also known as the Low Volume Density Gradient retrieval method. Application of this method to a representative stimulant of waste shall provide the necessary data to select this method for baseline implementation.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B362, Low Liquid Volume Saltcake Retrieval, TFA priority #4.

Site Need ID: RL-WT064
Site Need Title: Hanford Past Practice Sluicing Improvements
Need Summary: Improvements in sluicing technology have been made since past practice sluicing was performed at Hanford for tank waste retrieval. A better understanding of these improvements and how they compare to past practice sluicing is needed to optimize waste retrieval operations. A direct comparison between the past practice sluice nozzles and current industrial nozzles capabilities needs to be performed to provide the most effective design requirements to support HLW feed delivery. A comparison between past practice pumping systems and current improved pumping systems capabilities should also be completed. The comparisons must provide a clear quantitative analysis of the ability of each nozzle and pump type and configuration and its ability to move different waste types.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B367, Unobstructed Tank Heel Retrieval, TFA priority #10.

Site Need ID: RL-WT066
Site Need Title: Compositional Dependence of the Long Term Performance of Glass as a Low-Activity Waste Form
Need Summary: The present plan for the 54 million gallons of Hanford tank waste is to retrieve the waste from the underground tanks, separate the waste into a high-level fraction (containing most of the radionuclides and hazardous materials) and into a low-activity fraction (containing most of the waste). Both fractions will be immobilized, with the immobilized high-level fraction stored until shipped to a federal geologic repository and the immobilized low-activity fraction disposed of on the Hanford Site. Because of the relatively large amount of contaminants in the ILAW form, the rate of release must be slow and the rate limited for hundreds of thousands of years. Estimating such a long-term release rate from short-term experiments (even those lasting many years) requires a strong database, an understanding of the degradation process, and numerical simulation tools that combine the database and a mathematical model of the glass corrosion process.

In particular, the current database must be expanded so the affect of different glass compositions on long-term performance can be determined. An important subset of this need is to understand how glass composition impacts the rate of sodium ion-exchange in LAW glasses, which has been found to significantly affect the calculated pH in the disposal system and thus the long-term radionuclide release rate.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B748, Testing and Prediction of Long-Term Waste Glass Performance, TFA priority #35.

Site Need ID: RL-WT067
Site Need Title: Improved Double Shell Tank (DST) Integrity NDE Measurement Tools
Need Summary: Compliance to Washington Administrative Code 173-303-640 requires life cycle integrity assessments, including NDE of six DSTs on a portion of the tank wall, bottom knuckle, and bottom. Washington Administrative Order 00NWPKW-1250/1251 provides additional examination requirements for examinations. Additional DSTs will likely be selected for NDE based upon examination results. Size of the NDE equipment currently used restricts its deployment access to two 24 inch risers, diametrically opposed, per DST. NDE of the DSTs is currently limited to 20 to 25% of the tank circumference, in the regions closest to the 24 inch risers. NDE equipment that could be deployed through smaller diameter risers is needed to provide access to a larger percentage, potentially all, of the tank circumference.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B175, Tank Integrity Inspection Techniques, TFA priority #2.

Site Need ID: RL-WT068
Site Need Title: Radionuclide Source Term from Tank Residuals
Need Summary: Remediation and closure of high-level waste tanks at Hanford will leave residual solids and liquids that are estimated to be one of the major long-term radionuclide sources into underlying vadose zone sediments. However, the actual release rate of technetium, selenium, iodine, carbon, uranium, chromium, nitrate, and nitrite (the major predicted dose contributors) from the residuals is essentially unknown. A fundamental understanding of the true radionuclide source-term from the residuals is needed to base sound cost/benefit/risk decisions regarding the extent of waste removal actually required from the tanks to meet site-wide groundwater protection standards. A better understanding of the presence and impact of complexants on contaminant mobility is also required. Finally, an understanding of post-saltwell pumped tank wastes is needed to determine possible changes in waste characteristics over time and effects on eventual retrieval.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B588, Leaching and Treatment of Technetium for Tank Closure, TFA priority #30.

Site Need ID: RL-WT069
Site Need Title: Value of Information Decision Analysis for Tank Farm Closure
Need Summary: Presently, criteria for making closure decisions (e.g., quantitative measure(s) of compliance, points of compliance, period of compliance, exposure scenarios) have not been established, although criteria are required to be established under the recently adopted Hanford Site Tri-Party Agreement milestones as a basis for determining what subsurface data should be collected. Also, no criteria have been established to guide the decision due in FY 2004 on whether additional subsurface data may be needed in a second phase of subsurface investigations in the SST waste management areas under Resource Conservation and Recovery Act (RCRA) assessment. Because subsurface investigations in contaminated tank farm soils are expensive, an approach is needed for determining when enough information has been gathered to support decisions on closure.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B924, Tank Closure Criteria/Decision Support, TFA priority #56.

Site Need ID: RL-WT072
Site Need Title: Use Of Handheld Technology To Automate Operator Data Sheets For Tank Farm Operations
Need Summary: Hanford Tank Farm Operations desires the ability to improve the operator rounds function. Operations badly needs to automate data collection from the field in order to optimize the Shift Manager's ability to analyze plant conditions to enable him to make informed decisions based on real time data, trends, alarms, etc. Conduct of Operations improvements.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- TFA-RL-WT072, Automated Data Collection System for Tank Operations. TFA elected not to fund this effort, since the technology proposed for adoption and incorporation into this site's data management system (Passport) is available, with minimal modifications, from commercial vendors.

Site Need ID: RL-WT077
Site Need Title: Improvements to Salt Well Pumping
Need Summary: Improvements in the speed and completeness of salt well pumping are required to enhance the stabilization of SSTs. Methods to enhance liquid removal from the moist tank waste solids must be developed to aid in ongoing salt well pumping and to improve planned waste retrieval operations. Methods to enhance liquid removal from moist solids exist in geological technical regimes such as petroleum recovery, groundwater drainage, and solution (in-situ and heap) mining. Rapid investigation and qualification of such methods must be performed to be applicable to tanks in the FY 2004 time frame. Investigation and qualification of enhanced drainage methods for waste retrieval operations also is required for future waste retrieval.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B362, Low Liquid Volume Saltcake Retrieval, TFA priority #4.

Site Need ID: RL-WT080
Site Need Title: Advanced/Improved Vitrification
Need Summary: Current baseline HLW vitrification technology imposes limitations to glass waste loading resulting in increased glass volumes and resultant number of HLW canisters. The current, baseline LAW vitrification technology requires very large melters with key components, that require frequent replacement. Both the HLW and LAW melters also create significant solid waste disposal issues due to their size and disposal requirements. Alternative or advanced technologies have not been evaluated to determine their ability to significantly reduce life-cycle production and disposal costs. Concurrent evaluation and demonstration of HLW and LAW glasses that can achieve higher waste loadings or durable crystalline phases also need to be performed. This need includes higher temperature joule heated melters, cold wall or cold crucible melters, and higher waste loading techniques; i.e., dealing with problem constituents.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B748, Testing and Prediction of Long-Term Waste Glass Performance, TFA priority #35.
- B773, Improve Waste Loading in HLW and LLW Glasses, TFA priority #7.
- B7S2, New Melter Technology, TFA priority #0.

Site Need ID: RL-WT084
Site Need Title: Extension of Glass Properties Model to LAW and Phase II HLW Glass Composition Ranges
Need Summary: The glass properties model, developed by the Pacific Northwest National Laboratory (PNNL) to describe the liquidus temperature, viscosity, and durability of glasses as a function of their compositions, should be extended to include projected LAW compositions and lower silica compositions recently projected for HLW.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B773, Improve Waste Loading in HLW and LLW Glasses, TFA priority #7.

Site Need ID: RL-WT086
Site Need Title: Anti-foaming Agents for Evaporation of Alkaline Wastes
Need Summary: **A**dditives that inhibit / reduce foaming of alkaline wastes during evaporation are needed. The alkaline liquid fraction of the tank wastes contains varying quantities of aqueous soluble organic compounds such as oxalate, formate, citrate, ethylenediaminetetraacetic acid, and N-(2-hydroxyethyl) ethylenediaminetetraacetic acid. Evaporation of these waste solutions can lead to foaming and increased entrainment of radionuclides and hazardous waste constituents into the evaporator overheads, causing the overheads to exceed waste acceptance criteria at effluent treatment facilities.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B542, Antifoam Agents for Waste Evaporation, TFA priority #44.

Site Need ID: RL-WT087
Site Need Title: Assessment of Effects to HLW Glass Production from Using Crystalline Silicotitanate (CST) to Separate Cesium from Alkaline Waste Solutions
Need Summary: The effects to HLW glass composition and production quantity from using CST in place of SuperLig 644 resin to separate cesium from alkaline waste solutions is needed. In order to ensure that CST is a viable alternative cesium adsorption material, the effects of using CST in the WTP flowsheet on the estimated volume of HLW glass and the HLW glass composition need to be evaluated.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B773, Improve Waste Loading in HLW and LLW Glasses, TFA priority #7.

Site Need ID: RL-WT088
Site Need Title: Advanced Approaches for Reducing Waste Volume Stored in DSTs
Need Summary: The volume of DST space is limited and may restrict the volume of SST waste retrieved for storage in DSTs. Given the current SST retrieval schedule at Hanford, it is projected that additional DST space will be needed in the FY 2010 time frame. The Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement) calls for evaluation of options and actions to increase available DST space in support of SST retrieval. The current process is to remove water through the 242-A Evaporator within administrative controls limiting waste concentration. Advanced approaches for reducing waste volumes sent to and contained within DSTs are needed to minimize the need for additional DST space and reduce the associated costs. Possible options include removal of LAW from stored waste for storage outside the DST System and developing a better understanding of waste concentration to relax administrative control on evaporator operations.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B511, Sodium Salt Removal for Waste Volume Reduction, TFA priority #48.
- B566, Waste Chemistry During Evaporation, TFA priority #15.

Site Need ID: RL-WT089
Site Need Title: Alternate Retrieval Methods from Potentially Leaking Single-Shell Tanks (SSTs)
Need Summary: Sixty-seven of Hanford's 149 SSTs are confirmed or assumed leakers that have leaked an estimated 750,000 to 1,050,000 gallons to the surrounding vadose zone (HNF-EP-0182-148, "Waste Tank Summary Report for Month Ending July 31, 2000). The SSTs currently contain approximately 35 million gallons of waste. Although no waste has been added to the SSTs since November 1980, all of the SSTs have exceeded their original design life of roughly 20 years and continue to deteriorate over time. The baseline method for SST waste retrieval is "past practice" hydraulic sluicing. While this technique has proven to be effective in tanks believed to be sound, hydraulic sluicing raises concerns in tanks that are known or suspected to be leaking. These concerns are due, in part, to the reliance on the use of liquids to mobilize and retrieve the wastes. A need exists for alternate waste retrieval technologies that use little or no liquids to mobilize and retrieve SST wastes from potentially leaking tanks.

Technical Disposition: The TFA responded to this need within the following technical response(s):

- B157, Tank Leak Mitigation, TFA priority #8.
- B338, Containers for Waste Slurry Transport, TFA priority #50.
- B362, Low Liquid Volume Saltcake Retrieval, TFA priority #4.
- B367, Unobstructed Tank Heel Retrieval, TFA priority #10.
- B376, Pipeline Plugging Prevention, Unplugging, and Cleaning, TFA priority #24.
- B3S2, SST Retrieval from Potential Leaking Tanks, TFA priority #0.

Site Need ID: RL-WT090
Site Need Title: Chemical and Physical Behavior of Sludge Wastes
Need Summary: Additional chemical, physical, and hydrodynamic information is needed to guide the retrieval, delivery, and caustic leaching of Hanford tank sludge wastes. Wastes must be transported and treated with minimum cost and delay. To this end, the transfer and treatment equipment must be designed correctly, and the operating plans must be accurate. Successful design and operation both rely on accurate knowledge of the chemistry and physical properties of the wastes to be treated. Although a good deal of information has been obtained about the elemental composition of the waste, we do not yet have complete knowledge of the chemical compounds formed by these elements. Knowledge of the chemical compounds present in sludge wastes is important to predict the degree of completeness of caustic leaching and the manner in which leach rate and completeness are affected by variations in process parameters.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B376, Pipeline Plugging Prevention, Unplugging, and Cleaning, TFA priority #24.
- B554, Tank Waste Chemistry, TFA priority #5.
- B555, Sludge Washing and Dissolution, TFA priority #11.

Site Need ID: RL-WT091
Site Need Title: Chemical and Physical Behavior of Saltcake Wastes
Need Summary: Additional equilibrium and kinetic solubility data is needed to guide the retrieval, delivery, and treatment of Hanford tank saltcake wastes. Wastes must be transported and treated with minimum cost and delay. To this end, the transfer and treatment equipment must be designed correctly, and the operating plans must be accurate. Successful planning, equipment design, and plant operation all rely on accurate knowledge of the chemistry and physical properties of the wastes to be treated. In particular, detailed knowledge of waste component solubilities permits planning to take place to ensure that production expectations are achieved. Although a good deal of information has been obtained about the elemental composition of the waste, we do not yet have complete knowledge of the chemical compounds formed by these elements. Accurate knowledge of the chemical compounds present in saltcake wastes is important to predict how much of the waste will dissolve as a function of the amount of dilution water added, temperature, and other process parameters.

Technical Disposition: The TFA responded to this need within the following technical response(s):

- B554, Tank Waste Chemistry, TFA priority #5.

Site Need ID: RL-WT092
Site Need Title: Improved Separation Agents and Processes to Remove Cesium from Supernatant Solutions
Need Summary: By separating the radioactive and long-lived compounds from the HLW-tank supernatants, the solutions could be disposed of as LAW after treatment. Such separation technology would reduce the disposal cost. Current technologies include ion exchange and precipitation. Several ion exchange media are of interest at Oak Ridge, Savannah River and Hanford for the removal of cesium. Despite advances in separation technology, improvements to processing rates, separation system capacity, and system stability are needed to minimize capital, operating and disposal costs. In particular, scientific and applied research is needed to increase the loading of separating agents, speed up the kinetics, improve materials stability under realistic process conditions, improve processing rates, and optimize disposal of spent agents.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B570, Salt Processing Project, TFA priority #0.

Site Need ID: RL-WT093
Site Need Title: Filtration Optimization and Process Enhancement
Need Summary: A filtration step is currently designed to protect the ion exchange beds from loading with particles and is used to concentrate solids during leaching steps. Several possibilities for improving the process and to optimize the filtration step need to be investigated. Process enhancement will benefit from an increased understanding of the parameters that are important for dewatering. The areas that have the potential for improving the process include changing processing parameters such as flow rates, cross membrane pressure, backflow pulses, filter elements, etc., and understanding waste chemistry effects. For example, there appears to be a point that too much leaching leaves the remaining solids very difficult to filter. Other constituents such as dissolved organics also appear to influence filtration. Adding filter aids can frequently enhance filtration. These are typically organics that change the charge on solid particle and aid in agglomeration.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B584, Cross-Flow Filtration, TFA priority #16.

Site Need ID: RL-WT094
Site Need Title: Understanding and Controlling Post-filtration Precipitation
Need Summary: Filtration is done to remove solids which may bind an ion exchange column. It is not uncommon for the filtrate from test apparatus to form solids upon sitting for a period of time in the laboratory environment. If similar phenomena occur in the plant, then the filtrate would either need to be refiltered or there is a potential of impacting the ion exchange beds. An understanding of what materials are precipitating,

how fast the precipitate forms, and how the precipitation can be controlled is needed. The precipitate may be formed by a number of ways such as changing of pH due to CO_2 absorption, organic aging forming solids such as sodium oxalate, organics oxidizing to less soluble species, slow concentration of the waste due to evaporation, etc. The study will explore parameters such as radiation, light, heat, oxygen, crystal formation disruption additives, or other oxidative agents, so that a method for controlling the precipitate can be found.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B554, Tank Waste Chemistry, TFA priority #5.

Site Need ID: RL-WT096
Site Need Title: Cold Test/Mockup Facility
Need Summary: Equipment is needed at the Hanford complex tank farm facility to evaluate transfer and mixer pump and alternative sampling (ability to sample while mixing) systems capabilities, performance, and effects to support final tank-waste retrieval operations. These facilities are also needed to perform initial run-in of new transfer and mixer pumps. There are no identified facilities that currently can be used for full-scale, full power pump deployment and operation and full-scale sampling systems testing.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B359, Waste Mobilization and Mixing, TFA priority #17.
- B367, Unobstructed Tank Heel Retrieval, TFA priority #10.

Site Need ID: RL-WT098
Site Need Title: Erosion Testing
Need Summary: The Hanford Site vitrification plant and waste treatment plant will move large volumes of liquid waste during a projected 40-year work life. Many of the liquid wastes will have suspended particles. Not only particles from waste but also glass formers that are recycled inside the plant will be moved. Very little is known about the abrasion of these particles on the various metal parts (pump impellers, piping, protruding instrument wells, etc.). Certain tests are being planned to measure the Miller Number (a measure of abrasiveness of a slurry) for some simulated wastes this fiscal year. These will include some glass formers. There have been limited measurements of Miller number in the past on actual waste and additional measurements will be needed. The waste abrasiveness as measured by the Miller and SAR numbers needs to be correlated with simulants to assure the simulants are adequate. Other parts of the plant will transfer waste at slower velocities (~ 7 ft/sec). Extrapolating erosion rates to these lower velocities accurately needs to be considered. These tests need to be correlated to actual plant experience at West Valley and at Savannah River.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B339, Feed Slurry Erosion Testing, TFA priority #59.

Site Need ID: RL-WT100
Site Need Title: HLW/LAW Melter Operation
Need Summary: Operational issues with the HLW and LAW melters are opportunities for risk reduction and cost savings for the River Protection Project (RPP)-WTP Project. Many of them relate to the use of bubblers in the melters and the required frequency of replacement. Frequent bubbler replacement will result in added downtime and additional contamination to the melter cells. This facility contamination, if extreme, could severely impact the ability to do equipment (e.g., crane and manipulator) maintenance. Information relating to melter operation are needed in the following areas: long-term consequences of cell contamination due to replacement of spent melter; pressure fluctuations in the melter and submerged bed scrubber, noble metals accumulation measurement and mitigation, processing rate, and advanced, corrosion-resistant materials.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B722, HLW Process Offgas Treatment, TFA priority #27.
- B768, Specify and Enhance Design of HLW Glass Melters, TFA priority #6.
- B769, Conditioning of HLW for Immobilization, TFA priority #13.

Site Need ID: RL-WT101
Site Need Title: Sulfate Mitigation for Hanford Tank Low Activity Waste (LAW) Vitrification
Need Summary: Sulfate, which is a significant component in the supernate fractions of many tank wastes at Hanford, poses serious economic impacts and risks for the LAW vitrification process. Sulfate tends to phase separate in the melter forming a corrosive molten sulfate salt layer on top of the glass melt that will damage the melter if allowed to accumulate. Mitigation approaches that 1) detect and measure sulfate layer formation in the melter when it occurs, 2) remove or destroy sulfate salt phases in the melter, 3) improve glass and feed formulations for sulfate incorporation, and 4) improve materials and design to increase the melter tolerance to sulfate are needed.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B205, Continuous Emissions Monitor for Offgas Analysis, TFA priority #46.
- B279, Two-Phase Liquid Detection, TFA priority #39.
- B768, Specify and Enhance Design of HLW Glass Melters, TFA priority #6.
- B773, Improve Waste Loading in HLW and LLW Glasses, TFA priority #7.

Site Need ID: RL-WT102
Site Need Title: Advanced Characterization Tools for Contaminants of Concern
Need Summary: The extent of contamination in soil, burial ground, and tank farm sites is often poorly defined. A cost-effective technology that provides real-time, in situ measurement of radioactive (technetium, uranium, plutonium, strontium-90, iodine, and selenium) and hazardous (chromium, mercury, lead, nitrate, sodium) contaminants of concern in soils at depth is required to better define the contaminant plume boundaries prior to remediation and also to support long-term monitoring for performance validation of the completed remediation activity.

Technical Disposition: The TFA responded to this need within the following technical response(s):

- B292, Contaminant Migration Monitors. TFA elected not to fund this effort because the need has been assigned to the SCFA for appropriate new technology development and technical assistance to the sites. The CMST Liaison to TFA will monitor developments that may be of interest to TFA via periodic consultation with the CMST Liaison to SCFA. This MYTR will be updated on an annual basis to reflect the relevant work being conducted by SCFA.

Site Need ID: RL-WT103
Site Need Title: Separable Organic Phase Destruction, Removal, and Monitoring In Tank Waste
Need Summary: As of December 2000, one SST, C-103, is known to contain about 4,500 gallons of floating separable phase organic liquid comprised of tributyl phosphate (TBP) and normal paraffin hydrocarbon (NPH). Four other SSTs have been identified as containing lesser volumes of TBP and/or NPH entrained in the waste solids. In the past, there was evidence that some DSTs likely contained separable organic material, however, there is no current evidence of a separate organic phase in any of Hanford's twenty-eight DSTs. The RPP mission includes removal of the pumpable liquids from SSTs (interim stabilization) by FY 2004 and processing of tank waste at a WTP by FY 2007. Currently, a 25 ppm separable organic material limit has been imposed on WTP waste feed. It has been suggested that trace concentrations of separable organic material entrained in waste solids can be processed in the WTP with minimal impacts. The baseline plan for interim stabilization of C-103 has the floating separable organic layer and the aqueous liquid being pumped together to a designated DST. An alternative process for separately removing the organic layer prior to waste transfer from C-103 to the receiver DST has been evaluated and found to be viable but not cost effective. Technology development can aid the handling of the C-103 organic layer and any other separable organic material that may be discovered during waste retrieval in support of WTP processing. Specifically, technology that could remove the C-103 organic layer down to the 25 ppm level, without entrainment of the radiologically-contaminated aqueous liquid could make that alternative cost effective.

Technical Disposition: The TFA responded to this need within the following technical response(s):

- B279, Two-Phase Liquid Detection, TFA priority #39.
- B517, Organic Phase Removal, TFA priority #63.

Site Need ID: RL-WT032-S
Site Need Title: Monitoring of Key Waste Physical Properties During Retrieval and Transport
Need Summary: Monitoring of key waste physical properties during retrieval and transport of the material between tanks and to the waste treatment plant is needed to meet the minimum physical property requirements for low-activity waste feed and high-level waste feed specified. Control of insoluble solids is necessary for low-activity waste transferred to the plant to limit the solid material transferred to less than 2 weight percent

(dry basis) to meet contractual requirements. For high-level waste transferred, it is desirous to transfer the solid material to the plant, and it is contractually required to transfer waste with at least 10 grams of unwashed solids per liter of solution and up to 200g/L.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B278, Slurry Transfer and Tank Waste Mixing Monitors, TFA priority #38.

Site Need ID: RL-WT035-S
Site Need Title: Moisture Flow and Contaminant Transport in Arid Conditions
Need Summary: Understanding of the movement of contaminants through zones of low moisture (region-wide saturation less than 10%) is needed for use in risk assessments. Most of the work concerning moisture flow and contaminant transport has been done at sites important for agriculture, i.e., sites having moisture contents near saturation. Thus, the theories and equations for moisture flow and contaminant transport are modifications of theories and equations for fully saturated environments. In such an environment, it is movement through the pore spaces between soil particles that is dominant. Under very dry conditions, the interactions with the soil particles will become more important. Tested theories and equations are needed for use in performance assessment in order to predict moisture movement and contaminant transport.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B958, Data and Tools for Performance Assessments, TFA priority #66.

Site Need ID: RL-WT044-S
Site Need Title: Distribution of Recharge Rates
Need Summary: Fundamental data to improve confidence in the estimation of recharge rates as a function of time and space is needed for use in impact assessments under realistic conditions. The rate at which moisture exits the surface root zone of soil and enters into the subsurface (often called the recharge rate) is often the major parameter (along with inventory) determining the rate at which contaminants enter groundwater. This is particularly true in dry climates. The recharge rate is known to depend upon many parameters (for example, type and condition of surface soil, type and extent of vegetation, climate). However, this dependence is usually determined for idealized conditions and for small spatial and temporal extents. For large sites, such as Hanford where waste disposal covers many acres and where impact calculations must extent beyond thousands of years, such simple descriptions are inadequate to convince the technical community, the regulators, and the stakeholders that impacts can be adequately estimated.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B958, Data and Tools for Performance Assessments, TFA priority #66.

Site Need ID: RL-WT046-S
Site Need Title: Getter Materials
Need Summary: Negatively charged elements and compounds (e.g. TcO4-, Se-) are poorly sorbed on most materials under basic (pH > 7) conditions. However, some negatively charged materials (e.g. I-) do sorb on Hanford soils under basic conditions. An understanding of how important contaminants interact with the soil is needed to aid the development of appropriate materials to retard the transport of those contaminants. If low-cost getter materials can be developed for use in waste disposal, then requirements on waste forms can be reduced, potentially saving hundreds of millions of dollars in the Hanford Immobilized Waste Disposal Program.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B960, Reduced Radionuclide Mobility, TFA priority #58.

Site Need ID: RL-WT053-S
Site Need Title: Contaminant Mobility Beneath Tank Farms
Need Summary: Quantification and understanding of the evolution of the present distribution of contaminants, both radioactive and nonradioactive (particularly cesium-137, but also Pu, Tc-99, Sr-90, Cr, and nitrate), beneath the tank farms is needed to evaluate their potential mobility under all "leave or retrieve" options. The current understanding of the mobility of contaminants from single-shell tank leaks and major soil column transuranic disposal sites is inadequate to fully support cleanup, closure, or performance assessment-related decisions. Notably, borehole logging in SX Tank Farm revealed cesium-137 at depths of 130 ft, significantly deeper than predicted by current models. Further investigations, including the drilling of two additional wells, confirmed the presence of migrated cesium in the formation. The report issued by the River Protection Project Vadose Zone Expert Panel concluded that cesium migration was poorly understood and that insufficient data were available to validate migration models.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B958, Data and Tools for Performance Assessments, TFA priority #66.

Site Need ID: RL-WT054-S
Site Need Title: Solids Yield During Mixer Pump Mobilization
Need Summary: Validated mixer pump performance correlations, i.e., ECR as a function of definable properties is needed to predict full-scale performance. PNNL's mixer pump test data were recently correlated with three dimensionless parameters (Letter Report by Shekarriz et al. April 1998) with the following result: ECR is much more sensitive to nozzle velocity (Uo0.75) than to shear strength (1/ts0.17). Shear strength appears to be less important than the characteristics of the jet. In full-scale mixer pumps, pumped slurry exits through a very short nozzle that may not create a well-developed jet, while PNNL's small-scale mobilization tests used a nozzle that created a well-developed jet. It isn't clear if the current mixer pump design produces jets that are analogous to the small-scale tests, and consequently, the validity of using the correlations to predict full-scale performance is in question.

Technical Disposition: The TFA responded to this need within the following technical response(s):

- B359, Waste Mobilization and Mixing, TFA priority #17.

Site Need ID: RL-WT076-S
Site Need Title: Plutonium Interaction with Silicates
Need Summary: Plutonium leaking with HLW from RPP tanks will first encounter silicate-rich concrete and Hanford soils. The chemical interaction of plutonium, under alkaline condition, with silicates needs to be understood to evaluate the potential for plutonium migration from HLW tank leak plumes. Plutonium present in the HLW resides primarily in the low solubility sludges but radiochemical analyses also show that significant solution concentrations can be found under certain conditions. Plutonium in either phase is capable of migration from tank leaks; that is, plutonium can travel as dissolved species or as microscopic colloids from sludges. The major barrier to further plutonium migration is the Hanford sedimentary minerals surrounding the waste tanks and even the structural concrete of the tanks themselves. Interactions of plutonium in waste with the sedimentary minerals, and with the structural concrete of the storage tanks, can provide the primary retardation mechanism to plutonium movement. Studies of the chemistry of the interaction of plutonium with concrete and soil mineral phases are required, as arethe potential for formation of colloids. All valence states and solution forms of plutonium should be investigated.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B960, Reduced Radionuclide Mobility, TFA priority #58.

Site Need ID: RL-WT078-S
Site Need Title: Plutonium Segregation and Association in HLW
Need Summary: Determination of the distribution of plutonium to neutron-poisoning sludge elements as functions of solution composition and sedimentation is required to firmly establish nuclear criticality safety requirements for RPP operations. Tests with genuine waste sludges and solutions are required to determine the disposition of plutonium to sludge solid phases according to solids particle size, composition, and sedimentation rate and to determine if plutonium can segregate from neutron poisons present in HLW solid phases by physical or chemical mechanisms envisioned in RPP operations. Such mechanisms include sluicing, settling, and chemical leaching by organic complexants, carbonate, aluminate, and hydroxide by envisioned waste blending and sludge washing operations. The analytical results must be interpreted to identify correlations of plutonium concentration to solids settling velocity and the concentrations of the major chemical elements in light of their neutron poisoning capacity. There may also be a significant effect from chemical segregation of transplutonics in some phases.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B554, Tank Waste Chemistry, TFA priority #5.

Site Need ID: RL-WT079-S
Site Need Title: Double Shell Tanks (DST) Corrosion Chemistry
Need Summary: A laboratory corrosion testing effort is needed to determine the cause of tank wall thinning Hanford. In fiscal year 1999 DST 241-AN-105 was discovered to have wall thinning significantly in excess of predictions from uniform corrosion rate estimations. Although some theories have been put forward to explain the wall thinning, the exact cause of this wall thinning is still unknown. One possibility is that the waste chemistry, although within the Hanford Site's operating limits for corrosion control, may not be providing the expected protection. However, plans are to ultrasonically reexamine the tank within the next five years to assure the corroded regions are not thinning at a rate inconsistent with the waste specifications. Previous studies by PNNL have identified dilute waste chemistries promoting excessive corrosion attack, and more concentrated wastes producing high corrosion rates at temperatures above the normal DST operating temperature range.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B143, HLW Tank Corrosion Control and Monitoring, TFA priority #1.

Site Need ID: RL-WT099-S
Site Need Title: Rapid Analysis of Vitrification Feeds
Need Summary: HLW stored in underground tanks at a number of DOE facilities is or is being planned to be vitrified to generate a glass product for disposal in the geologic repository currently proposed at Yucca Mountain. The glass is required to satisfy the specifications delineated in the Waste Acceptance Product Specifications (WAPS) for it to be accepted at the repository. The process is typically controlled by analyzing a sample of the HLW feed to the melter to determine the required glass formers and additives with reference to a property – composition model such that the expected glass will satisfy the WAPS. In addition, analysis must be undertaken to show the products compliance with the WAPS according to the quality assurance provisions delineated in the Quality Assurance Requirements Document (QARD or RW-0333P). There are a number of approaches available for showing compliance including glass sampling and analysis (as performed at West Valley) and melter feed sampling and analysis (as performed at the Defense Waste Processing Facility [DWPF]).
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B264, Improve Waste Analytical Methods, TFA priority #55.

Site: INEEL

Site Need ID: ID-2.1.06a
Site Need Title: TRU and Sr Removal from High Activity Waste
Need Summary: Information is needed on the chemical separations of transuranic and strontium radionuclides from liquid waste derived from dissolution of calcine. This would include transuranic extraction (TRUEX) and strontium extraction (SREX) testing, as well as continued evaluation of the universal solvent extraction (UNEX) process.

Technical Disposition: The TFA responded to this need within the following technical response(s):

- B501, INEEL Integrated Radionuclide Separations Process, TFA priority #42.

Site Need ID: ID-2.1.06b
Site Need Title: Cs Removal from High Level Waste Calcine and Off-gas Scrubber Solutions
Need Summary: Information is needed on cesium removal from liquid waste derived from dissolution of calcine or from thermal process off-gas scrubber streams using ion exchange sorbents or chemical separations. Ongoing evaluations of the CST and ammonium molybdophosphate-polycrylonitrile (AMP-PAN) sorbents and the impacts of their use on pretreatment, post treatment, and general flow sheet implications would be supported. As part of this effort, comparative evaluations of the UNEX process as an alternative cesium removal technology would be continued through the Efficient Separations and Processing Program and Russian collaborations, as warranted.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B501, INEEL Integrated Radionuclide Separations Process, TFA priority #42.

Site Need ID: ID-2.1.16
Site Need Title: Decontamination Facility/Analytical Facility Waste Reduction
Need Summary: Processes operating at the Idaho Nuclear Technology and Engineering Center (INTEC) generate hazardous radioactive liquid waste that is stored in the Tank Farm. Based on the current operating assumptions, all of this waste cannot be treated by the end of 2012 (if waste volumes are not minimized), as required by the Idaho Settlement Agreement. Therefore, DOE is requiring INTEC to minimize the volume of wastes going to the HLW tanks as a precursor to closing out the tanks. Aggressive reductions in waste generation rates will be required to meet this 2012 Settlement Agreement. More efficient decontamination technologies and alternative operating techniques are currently being investigated as part of the EM-30 funded HLW Development Program. In addition, reduction of waste (radioactive and mixed) from decontamination activities, optimization of analytical processes and techniques, and development/implementation of alternative waste stream treatments are needed.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B264, Improve Waste Analytical Methods, TFA priority #55.
- B508, Decon and Filter Leach Processes Waste Volume Reduction, TFA priority #22.

Site Need ID: ID-2.1.17
Site Need Title: Develop New Filter Leach Process
Need Summary: The high-efficiency particulate air (HEPA) filter leach system generates hazardous radioactive liquid waste that is stored in the Tank Farm. Based on the current operating assumptions, all of the Tank Farm waste cannot be calcined by the end of 2012, as required by the Idaho Settlement Agreement. Aggressive reductions in waste generation rates are needed to meet the 2012 Settlement Agreement requirement.

The current process, which leaches the used mixed waste HEPA filters with nitric acid to remove the RCRA components is one of the larger waste streams still being sent to the Tank Farm.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B508, Decon and Filter Leach Processes Waste Volume Reduction, TFA priority #22.

Site Need ID: ID-2.1.18
Site Need Title: Continuous Emissions Monitor for Offgas Analysis
Need Summary: Offgas monitoring development is required for permitting and operation of existing and future INTEC high-level waste treatment processes; namely, the New Waste Calcining Facility, the High-Level Liquid Waste Evaporators, the Process Equipment Waste evaporator (PEWE), the Liquid Effluent Treatment & Disposal (LET&D) acid fractionator, future waste denitration and waste melter processes. Continuous emissions monitoring will be required by the State and U.S. Environmental Protection Agency (EPA) in accordance with the Maximum Achievable Control Technology (MACT) rule for incinerators, the Clean Air Act,and RCRA. Discrete offgas monitoring will be required to establish an emission inventory for INTEC processes during EPA trial burns. The monitor will also be required for process control feedback as required by MACT. To this end a versatile, multi-component monitor, consisting of an array of individual instruments, is needed. The monitor needs to be put into service on pilot plant facilities to test and verify the monitor prior to installation on actual plant processes. This will provide data which are needed to design suitable offgas treatment systems for each process. The data will also help develop environmental permitting plans.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B205, Continuous Emissions Monitor for Offgas Analysis, TFA priority #46.

Site Need ID: ID-2.1.19
Site Need Title: Modified EPA Offgas Sample Collection and Analysis Methods
Need Summary: Develop and demonstrate modifications to EPA offgas sample collection and analysis methods for use on offgas streams containing elevated nitrogen oxides and nitric acid concentrations known to damage sampling media and analytical instrumentation. Offgas samples may originate from thermal treatment processes including evaporators, denitration units, and glass melters. Special consideration must also be given to the radioactive nature of the offgas streams and resulting samples. EPA concurrence with the method modifications must ultimately obtained prior to performance of an emissions inventory to support RCRA permitting of the unit or required trial or risk burns
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B206, EPA Methods Sample Collection and Analysis. The role of the DOE Office of Science and Technology (OST) should be to monitor the evolution of sampling, analysis, and monitoring requirements for the other thermal processes. Discussions between INEEL site personnel, Mixed Waste Focus Area, and

Characterization, Monitoring, and Sensor Technology (CMST) Crosscutting Program personnel should continue as requirements become better defined. No FY02 funding of this technical approach is required, beyond the normal technical assistance activities of OST and operational activities of INEEL.

Site Need ID: ID-2.1.20
Site Need Title: Tank Annulus/Vault Inspection
Need Summary: Approximately 1.7 million gallons of radioactive liquid waste is currently stored in 11 tanks at INTEC. A closure plan must be submitted to the Idaho Department of Environmental Quality. Tank closure acceptance criteria need to be developed to meet the RCRA Landfill Closure Standards and State approval .in support of the closure plans. This requires not only development of criteria, but also development of the process to needed to ascertain compliance with those criteria.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B175, Tank Integrity Inspection Techniques, TFA priority #2.
- B203, Residual Waste Sampling, TFA priority #21.

Site Need ID: ID-2.1.23
Site Need Title: Low-Activity Wasteform Qualification
Need Summary: In-depth information, program costs, and lessons learned are needed from operating sites concerning how to perform and complete wasteform qualification for grouted mixed low-level waste. This includes qualification of the grouting process as well as the final wasteform.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B719, Conditioning and Immobilization of Low-Activity Waste, TFA priority #20.
- B924, Tank Closure Criteria/Decision Support, TFA priority #56.

Site Need ID: ID-2.1.24
Site Need Title: Integration/Optimization of High Activity Waste/Low Activity Waste Process Flowsheet
Need Summary: Many alternatives and options are being considered for the treatment and qualification of radioactive wastes located at INTEC for permanent disposal. Adequate evaluation of these options requires that each one have a process flow diagram and associated mass and energy balance. These are called flowsheets. The flowsheets provide the technical basis for performing cost estimates, safety evaluations, and estimates of impact to the environment. Later, they provide the technical basis for permit applications. Presently, the flowsheet calculations are performed manually, or with the assistance of several different software applications. They are being done, normally, just for one unit operation and do not link all of the required operations into a process flowsheet. These calculations must also be performed in the same manner again as new data is obtained which clarify assumptions that have been made. An integrated simulation tool(s) is needed to perform these calculations automatically, with minimal effort on the part of the engineer(s) who are tasked with doing this work. This tool(s) would consist of

both software and unit operation mathematical models. This provides for more accurate and timely data required for further evaluations.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B709, Waste Treatment Process Flowsheet Model, TFA priority #12.

Site Need ID: ID-2.1.27
Site Need Title: Cleanable Off Gas Filters
Need Summary: In the past, high level waste processes at INTEC have produced a large volume of mixed radioactive waste in the form of used HEPA filters. The spent filters are leached in nitric acid to eliminate the hazardous components, then they are disposed of as low level radioactive waste. The total cost including filter replacement, spent filter leaching, and disposal is over $800,000 per year. Consequently, future processes must minimize the need to for HEPA filter replacement. Efficient, cleanable air filters are needed to protect HEPA filters.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B171, Alternative Air Filtration Technology, TFA priority #23.

Site Need ID: ID-2.1.28
Site Need Title: Cs and Sr Removal from Newly Generated Liquid Waste
Need Summary: The sorption chemistry and large scale column designs need to be developed and demonstrated, as well as verified with actual waste feed streams. Cesium removal will be accomplished with an inorganic sorbents, primarily CST. Stronium removal must be developed either at the acid concentration of the evaporator bottoms or following partial neutralization. Sorption isotherms and column breakthrough tests must be performed to determine sorbent capacity and develop column design parameters.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B521, Acid-Side Radionuclide Separations, TFA priority #28.

Site Need ID: ID-2.1.29
Site Need Title: Evaluate Corrosion Potential (LET&D/PEWE/HLW Vitrification Process and Off-gas system/Other Future Processes)
Need Summary: The decision has been made to vitrify the remaining liquid wastes in the INTEC tank farm. Although chloride content is expected to be responsible for the majority of the corrosion problems in the evaporators, the high-temperature vitrification of the HLW wastes will require other corrosive components and conditions to be equally investigated. These additional corrosive components and conditions include: fluoride/other halides, sulfate, and reducing environments. Future waste processing operations must be modeled, and the effects of the corrosive components and conditions on equipment service life must be evaluated.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B514, Removal of Chloride from Waste Solutions, TFA priority #47.
- B709, Waste Treatment Process Flowsheet Model, TFA priority #12.

Site Need ID: ID-2.1.30
Site Need Title: Remove/Treat Corrosive Off-gas Components
Need Summary: Significant corrosion has already been experienced in the off-gas system for the LET&D acid fractionator, which processes the overheads from the PEWE. Similar corrosion problems can be expected within the future glass melter system (plemum, electrodes, heaters, top head, drain system, etc.), and its off-gas system. Although chloride content is expected to be responsible for the majority of the corrosion problems, the high-temperature vitrification of the HLW wastes will require other corrosive components and conditions to be equally investigated. These additional corrosive components and conditions include: fluoride/other halides, sulfate, and reducing environments. A literature evaluation and laboratory testing must be completed to support the HLW Program schedule.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B514, Removal of Chloride from Waste Solutions, TFA priority #47.

Site Need ID: ID-2.1.31
Site Need Title: Characterization of Entrainable Solids in Tank Waste
Need Summary: Little or no characterization of in-tank, entrainable solids has been performed. Analysis of these solids must be performed in order to select the proper solid-liquid separation technology. Various factors such as particle size and concentration greatly affect the separation process, and must be considered in the design stage. A solid-liquid separation technology cannot be chosen or implemented until these factors are determined.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B216, Characterization of Entrainable Solids. The TFA did not develop a technical response for this need based on discussions with INEEL. The TFA determined that there is little or no R&D component associated with the need. INEEL indicated that the tank waste undissolved solids would be dissolved and routine hot cell methods in the RAL would be used for analysis. The TFA recommends that INEEL reassess this need in the next site needs submission cycle.

Site Need ID: ID-2.1.35
Site Need Title: Direct Immobilization of INTEC Newly Generated Liquid Wastes
Need Summary: A method to directly immobilize and stabilize newly generated liquid waste (NGLW) is needed. NGLW is produced by decontamination operations and process equipment wastes. "Direct" means the liquid waste would be added to the solidifying agents, such as grout, with limited processing (evaporation, acid neutralization, and specific radionuclide separation). The waste product must meet applicable waste acceptance criteria for TRU waste or low-level waste. Two methods of direct grouting NGLW using portland cement, blast furnace slag, and fly ash have been tested at 40 weight percent waste. It is desired to find a method to improve waste loading and reduce total waste volume.

Technical Disposition: The TFA responded to this need within the following technical response(s):

- B719, Conditioning and Immobilization of Low-Activity Waste, TFA priority #20.

Site Need ID: ID-2.1.38
Site Need Title: Conditioning of Low Activity Waste for Treatment
Need Summary: Current expectations are that the LAW fraction will be immobilized on-site in a portland-cement based grout. However, an Environmental Impact Statement (EIS) alternative is to ship the conditioned LAW off-site for immobilization. Conditioning will be required to curb the ultimate volume of LAW grout and to ensure that the grout will properly cure and meet performance criteria. HLW calcine and sodium-bearing wastewater at the INTEC require conditioning and treatment prior to storage/disposal in an approved repository. To minimize the volume of remotely handled HLW that must be discarded, the waste steams will be separated into high-activity waste (HAW) and LAW fractions, using one or more chemical processes. Calcine will be retrieved from storage bins, dissolved in nitric acid, and processed to remove most of the non-radioactive constituents, which will constitute the LAW fraction. Current expectations are that the LAW fraction will be immobilized on-site in a portland-cement based grout. However, an EIS alternative is to ship the conditioned LAW off-site for immobilization.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B719, Conditioning and Immobilization of Low-Activity Waste, TFA priority #20.

Site Need ID: ID-2.1.39
Site Need Title: Acceptance Criteria for LAW Disposal in Underground Storage Tanks
Need Summary: Waste acceptance criteria must be developed and approved to use the underground storage tanks as low-level Class A waste disposal. Any operating experience or lessons learned from other sites on this subject is needed.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B924, Tank Closure Criteria/Decision Support, TFA priority #56.

Site Need ID: ID-2.1.40
Site Need Title: Low Activity Waste Grout Sorbent Addition to Reduce Leachability
Need Summary: Research information is needed concerning the addition of chemical sorbents to grouted waste to reduce the leachability of radionuclides and RCRA metals from the waste.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B719, Conditioning and Immobilization of Low-Activity Waste, TFA priority #20.

Site Need ID: ID-2.1.41
Site Need Title: HLW Process Offgas Treatment
Need Summary: Offgas treatment technology development is needed to support high-level wastes treatment technology development and feasibility design studies. The HLW wastes and their derivatives are considered RCRA wastes because they contain hazardous organic compounds and heavy metals. Offgas treatment processes need to be identified, tested, and designed to control emissions of any or all of these pollutants.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B722, HLW Process Offgas Treatment, TFA priority #27.

Site Need ID: ID-2.1.42
Site Need Title: Acceptance Criteria for Tank Closure
Need Summary: Approximately 1.3 million gallons of radioactive liquid waste is currently stored in 11 tanks at INTEC. A closure plan must be submitted to the Idaho Department of Environmental Quality. Tank Closure acceptance criteria need to be developed to meet the RCRA Standard Requirements and State approval in support of the closure plans. This requires not only development of criteria, but also development of the process needed to ascertain compliance with those criteria.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B924, Tank Closure Criteria/Decision Support, TFA priority #56.

Site Need ID: ID-2.1.44
Site Need Title: Certify LDUA Sampler as EPA-Approved Method of Sampling Tank Heel Solids
Need Summary: Approximately 1.7 million gallons of radioactive liquid waste is stored in 11 tanks at INTEC. A tank closure plan must be submitted, and the integrity of one of the tanks must be verified so it can be used as an emergency spare. Sampling the Tank Farm waste is required to support tank closure, delisting, an incidental waste determination, and Comprehensive Environmental Response, Compensation, and Liability Act source term definition.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B203, Residual Waste Sampling, TFA priority #21.

Site Need ID: ID-2.1.45
Site Need Title: Acceptance Criteria for Grouting Tank Heels
Need Summary: Upon tank closure, there will be some process residual waste, called a heel, left in the bottom of each tank. The closure acceptance criteria for the tank heels is needed to design tank closure and determine the method to immobilize and stabilize the heels. Savannah River and Oak Ridge sites have closed a few tanks. Any licensing and operating experience or lessons learned from these sites is needed.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B924, Tank Closure Criteria/Decision Support, TFA priority #56.

Site Need ID: ID-2.1.46
Site Need Title: Management of Tank Heel Liquids
Need Summary: Approximately 1.3 million gallons of radioactive liquid waste is currently stored in 11 tanks at INTEC. Currently, the tanks can only be emptied to the heel level, due to the level of the steam jets used to empty the tanks. Therefore, several thousand gallons of waste will still remain in the tanks when they are no longer being used. It is planned to close these tanks by grouting the heels in place. This poses some technical and regulatory challenges. The liquid heels are acidic and may not be conducive to direct grouting due to the chemistry and lack of mixing capabilities. In addition, acceptance criteria and waste form qualification for the solidified heels, and may prove difficult to meet for insitu grouting. In order to form a grouted waste and meet RCRA Closure Standards and State negotiated acceptance criteria, the liquid heels may have to be diluted, neutralized, reduced in volume, or totally removed. There is currently no mechanism to accomplish either neutralization or liquid heel removal, nor has it been proven that the liquid heel can be grouted in place. Therefore, development work is needed to first determine what must be done to manage these liquids to meet tank closure criteria (dilution, neutralization, reduced in volume, removed, etc.) and then how that can physically be accomplished.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B923, Enhanced Grout Formulations for Tank Closure, TFA priority #18.

Site Need ID: ID-2.1.47
Site Need Title: Management of Tank Heel Solids
Need Summary: Approximately 1.3 million gallons of radioactive liquid waste is currently stored in 11 tanks at INTEC. Currently, the tanks can only be emptied to the heel level, due to the level of the steam jets used to empty the tanks. Therefore, several thousand gallons of waste will still remain in the tanks when they are no longer being used. It is planned to close these tanks by grouting the heels in place. This poses some technical and regulatory challenges. The liquid heels are acidic and may not be conducive to direct grouting due to the chemistry and lack of mixing capabilities. In addition, acceptance criteria and waste form qualification for the solidified heels, and may prove difficult to meet for insitu grouting. In order to form a grouted waste and meet RCRA Closure Standards and State negotiated acceptance criteria, the liquid heels may have to be diluted, neutralized, reduced in volume, or totally removed. There is currently no mechanism to accomplish either neutralization or liquid heel removal, nor has it been proven that the liquid heel can be grouted in place. Therefore, development work is needed to first determine what must be done to manage these liquids to meet tank closure criteria (dilution, neutralization, reduced in volume, removed, etc.) and then how that can physically be accomplished.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B363, Chemical Cleaning of Tanks, TFA priority #9.
- B923, Enhanced Grout Formulations for Tank Closure, TFA priority #18.

Site Need ID: ID-2.1.48
Site Need Title: Wasteform Qualification for Low-Activity Waste in Underground Storage Tanks
Need Summary: In-depth grout development work will be required to determine formulation and operational constraints which will provide acceptable curing conditions and simultaneously assure optimized final grout performance requirements (leachability, strength, etc.). In-depth information, program costs, and lessons learned are needed from operating sites concerning how to perform and complete wasteform qualification for grouted mixed low-level waste. This includes qualification of the grouting process as well as the final wasteform. Completion of HLW Technology Needs ID # 2.1.39 (Acceptance Criteria for LAW Disposal in Tanks) will be required prior to full completion of this need.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B924, Tank Closure Criteria/Decision Support, TFA priority #56.

Site Need ID: ID-2.1.49
Site Need Title: Acceptance Criteria for High Activity Waste/Low Activity Waste
Need Summary: High level radioactive waste being stored at INTEC is not in a form suitable for repository storage. Vitrification, the best demonstrated available technology for converting HLW to a form suitable for storage in a federal geologic repository, has been reduced to practice at SRS's Defense Waste Processing Facility and at the West Valley Demonstration Plant. The DOE-RW Waste Acceptance System Requirements Document (WASRD) describes the system level requirements for emplacement of immobilized HLW in a federally licensed repository. The DOE-RM established WAPS defining technical and documentation requirements for vitrified waste forms to satisfy the higher level WASRD. Likewise, 10CFR61 establishes all requirements for the suitability of a grouted low activity waste forms such as INEEL/INTEC LAW to be disposed in shallow land burial. These precedents and requirements provide the drivers to convert INTEC HAW to a borosilicate glass and LAW to a grout suitable for storage in a federal geologic repository. The evaluation of the application of WASRD/WAPS and 10CFR61requirements at other DOE-complex sites for adapting past experience to INEEL/INTEC needs, and the establishment of an administrative system to collect information and data that proves the suitability vitrified and grouted products for respective disposal is needed.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B730, Acceptance Criteria for High Activity Waste, TFA priority #65.
- B924, Tank Closure Criteria/Decision Support, TFA priority #56.

Site Need ID: ID-2.1.50
Site Need Title: Solids Waste (Calcine) Retrieval
Need Summary: Highly radioactive waste material is being stored in bins in seven Calcined Solids Storage Facilities (CSSF). The material was in the form of granular solids and fines when it was sent to storage. Some of the material may have formed a relatively weak crust or cake in storage. Systems are needed to retrieve the calcined

solids out of storage bins and transfer them to a processing facility, so that they can be processed into an even more stable waste form.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B232, Dry Materials Sampling, TFA priority #31.
- B331, Dry Solid Waste Retrieval, TFA priority #57.

Site Need ID: ID-2.1.51
Site Need Title: Develop Calcine Dissolution Kinetics for Solid/Liquid Equilibria
Need Summary: Nitric acid dissolution of the calcine is one of the key head end operations in the separations option. This process requires investigation of the various rates occurring during dissolution, the extent of the dissolution, and the final solids/liquid equilibria associated with the dissolution process. Ideally, to scale-up and design calcine dissolution equipment, dissolution reaction rate expression is required for integration in an appropriate reactor performance equation. This dissolution rate expression will model heterogeneous reaction and accommodate the possebilities for the rate controlling phenomena. This will be accomplished by integrating the following parameters of: 1) the surface reaction rate constant, including temperature dependence; 2) the external film mass transfer coefficient, including dependence on agitation power input, and; 3) the internal effective diffusion coefficient. These parameters are required for scale-up and design of a calcine dissolution reactor. In addition, this model will predict the extent of the dissolution and the dissolver product solids/liquid equilibria. Calcine dissolution work may provide useful information for on going operations in which calcine dissolution is required for other processes or equipment.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B532, Calcine Dissolution Solubility and Kinetics, TFA priority #36.

Site Need ID: ID-2.1.52
Site Need Title: Characterization of Solids from Calcine Dissolution
Need Summary: The HLW calcine currently stored at the INTEC contain less than 1 wt. % of the actinides (Am, Pu, U, and Np) and fission products (predominately Cs-137 and Sr-90). The volume of HLW requiring permanent disposal can be substantially reduced by retrieval, dissolution, and subsequent treatment by specific separation processes to segregate actinides and fission products from the bulk material. Previous and continued experimental programs at the INTEC will establish the baseline conditions necessary to dissolve the calcine. Available data indicates 90 to 98 wt % of the calcine can be dissolved in several hours using nitric acid (necessary for compatibility with the downstream separation processes), elevated temperature, and continuous mixing. The residual or undissolved solids (UDS) from the dissolution process must be segregated from the liquid stream input to the downstream separation process since they cause problems in operational aspects of the separation process and can provide a source of significant contamination in the LLW fraction from separations. The data obtained to date indicates the UDS from the dissolution process will be intensely radioactive, thus requiring disposal with the HLW fraction and emphasizing the need for efficient removal from the liquid dissolver product. In order to efficiently remove or filter the solids from

the liquid stream, physical characteristics of the UDS, such as particle size distribution, must be determined. Physical characterization must be established prior to selecting a solids removal system. Due to the intense radioactivity of the solids, characterization must be performed in a remote environment. Finally, chemical characterization of the UDS is required to establish compatibility with the HLW final waste form.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B532, Calcine Dissolution Solubility and Kinetics, TFA priority #36.

Site Need ID: ID-2.1.57
Site Need Title: Conditioning of HAW for Treatment
Need Summary: Processing HLW calcine by separations processes results in HAW streams that will undergo further treatment into one or more final waste forms. Various alternative separations processes are currently envisioned. One treatment system, referred to as the "TRU Separations Option," results in a HAW waste stream that contains the actinide strip solution from the TRUEX process and undissolved solids separated from the feed. These wastes are to be concentrated by evaporation and, if feasible, dried to a granular solid prior to vitrification. Data are needed to determine the extent and method of evaporation and drying of this waste. If found infeasible to evaporate to dryness, data are needed to determine a method of stabilizing the waste into a solid form. In another treatment system referred to as "Full Separations," the TRUEX strip solution and the SREX strip solution are evaporated prior to being fed to a glass melter. Data are needed to determine the extent of evaporation achievable for these wastes, the point at which precipitates form, and the nature of the precipitated solids.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B769, Conditioning of HLW for Immobilization, TFA priority #13.

Site Need ID: ID-2.1.58
Site Need Title: HAW Immobilization
Need Summary: Direct vitrification has been selected as the method to be used to immobilize the INTEC liquid tank farm waste. Vitrification of this waste presents unique problems that require special attention. The high concentrations of nitrates in the wastes pose foaming problems in the glass melt, and add an additional restraint to melt rate. West Valley experience and preliminary testing indicate that the inclusion of chemical reductants in the melter feed will significantly aid in nitrate and NOx reduction. These reducing chemicals may also aid in reducing potentially troublesome sulfate salts, the presence of which could significantly decrease glass waste loading. Despite the significant benefits gained through the use of reductants, extreme care must be taken to not “over-reduce” the glass melt, as elemental metal precipitation can easily occur, compromising the integrity of the waste form. Thus, a means to control the oxidation potential of the glass melt to assure desired redox levels and prevent chemical separation in the glass melt needs to be developed.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B730, Acceptance Criteria for High Activity Waste, TFA priority #65.

- B768, Specify and Enhance Design of HLW Glass Melters, TFA priority #6.
- B773, Improve Waste Loading in HLW and LLW Glasses, TFA priority #7.

Site Need ID: ID-2.1.62
Site Need Title: Acceptance Criteria for Bin Set Closure
Need Summary: Highly radioactive liquid waste is being processed in the New Waste Calcining Facility, transforming it into a granular solid or powder called calcine. The calcine is being stored in seven CSSF. The Settlement Agreement requires a plan that provides for treatment of all calcined waste to produce a waste form which is suitable for transport to a permanent repository. This requires the material to be retrieved from the bins and transferred to a new processing facility. Bin set closure acceptance criteria are needed as soon as possible so that technologies needed to achieve final closure can be determined. Bin set closure must consider RCRA requirements, U.S. Nuclear Regulatory Commission requirements, and the Settlement Agreement. Although the Settlement Agreement implies that "all calcined waste" must be removed from the bins, it is likely that the risk to the environment from some residual amount of calcine in the bins will be less than the risk of removing it. The bin set closure acceptance criteria are needed as soon as possible to develop the required technology. Bin set closure is similar to any high level waste tank closure in the sense that the goal is to minimize the risk of releasing hazardous or radioactive material to the environment. Savannah River and Oak Ridge sites have experience with tank closure. Any licensing and operating experience or lessons learned from these sites are needed.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B924, Tank Closure Criteria/Decision Support, TFA priority #56.

Site Need ID: ID-2.1.64
Site Need Title: Solid-Liquid Separation Equipment Development and Application
Need Summary: The removal of solids from dissolved calcine and offgas scrubber solutions is required to avoid operational problems in the separation unit operations and/or avoid carryover of radioactivity into any LAW products. The removal of undissolved solids may be accomplished via crossflow filtration or other applicable solid/liquid separation technologies. Crossflow filtration has been tested at INTEC, and other sites around the Department of Energy complex, and proved to be a viable method for solids removal. However, due to the variations of UDS present in INTEC wastes and the lack of suitable solids characterization data, additional testing is required. Extensive testing is planned and necessary to envelope operating conditions and performance limitations. Amenable filtration technologies must ultimately be tested with simulated dissolved pilot plant calcine slurries.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B521, Acid-Side Radionuclide Separations, TFA priority #28.
- B584, Cross-Flow Filtration, TFA priority #16.

Site Need ID: ID-2.1.65
Site Need Title: Treatment Selection for Removed Tank Solids
Need Summary: Waste in the INEEL High Level Waste Tank Farm contains both settled and suspended solids. The solids are known to contain RCRA-hazardous components, transuranic radionuclides and fission products. However, it is not known at this time whether the tank solids will be ruled as high level waste. Once the waste classification is better determined, the disposal site can be identified and requirements for the disposal form determined. These waste form requirements will in turn set treatment requirements. Should the waste be ruled high level waste, the solids will need to be vitrified. Vitrification options include vitrification with tank liquids, separate vitrification, vitrification with calcine solids, or vitrification with high level waste effluents from a calcine separations treatment process. Should the waste be deemed an incidental waste, processing options include dewatering, drying, stabilization, or combinations of these technologies. Data is needed to provide a basis for the design of the treatment system.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B709, Waste Treatment Process Flowsheet Model, TFA priority #12.

Site Need ID: ID-2.1.66
Site Need Title: Treatment/Disposition of Spent Ion Exchange Resins
Need Summary: Ion exchange (IX) processes being considered for removal of Cs-137 (and possibly Tc-99) will involve disposal of spent IX resins. CST resin is inorganic and can likely be vitrified. However, other promising resins are organic-based and probably should not be vitrified directly. One such resin currently proposed for extraction of Cs from dissolved INEEL calcines is AMP-PAN. The current baseline process for handling spent AMP-PAN resin is to dissolve the AMP sorbent (containing the Cs) with caustic and vitrify the eluent. The organic PAN substrate which remains would then be sluiced out of the column and grouted with other LAW from separations processing. The impacts of the PAN on the quality and performance of the grout have not been evaluated. Test data is needed to determine whether the PAN will negatively impact the structural or leaching characteristec of performance grouts being considered for LDR-compliant disposal of LAW.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B338, Containers for Waste Slurry Transport, TFA priority #50.
- B719, Conditioning and Immobilization of Low-Activity Waste, TFA priority #20.

Site Need ID: ID-2.1.67
Site Need Title: High Level Waste Slurry Handling
Need Summary: A number of processes currently being considered for treatment of HLW involve handling of slurries. Three such processes under consideration at the INEEL are as follows: (1) Removal of sludges in tank farm heels, (2) Transport and storage of undissolved solids from filtration of radioactive liquids (including existing sodium bearing liquid wastes and solutions from dissolution of calcined waste prior to liquid/liquid extraction of TRU, Cs, and Sr), and (3) Sluicing of resin materials into and

out of ion exchange columns for extracting soluble species (e.g., Cs, Tc, etc.). Systems will be needed to pump, convey, store, and retrieve these radioactive slurries. Performance data for such systems is needed in order to select and size appropriate equipment to handle the slurries that are likely to be handled in the course of waste processing. In addition, rheological measurements on specific slurries to be handled will be needed to predict equipment performance during design activities.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B246, Tank Waste Sampling, TFA priority #37.
- B335, Transfer Line and Piping Improvements, TFA priority #49.
- B361, Heel Retrieval from Obstructed Tanks, TFA priority #3.
- B365, Waste Transfer Pumping, TFA priority #34.
- B376, Pipeline Plugging Prevention, Unplugging, and Cleaning, TFA priority #24.
- B554, Tank Waste Chemistry, TFA priority #5.
- B769, Conditioning of HLW for Immobilization, TFA priority #13.

Site Need ID: ID-2.1.68
Site Need Title: Technetium Removal from INEEL High Level Waste
Need Summary: Calcine stored in bins at the INEEL Calcine Solids Storage Facility contains approximately 190 kg of technetium. Processing the calcine by dissolution and solvent extraction separations processes, as now configured, results in a high proportion of technetium being partitioned to low activity waste streams. The technetium in these wastes, when denitrated and grouted, will approach or exceed the U.S Nuclear Regulatory Commission Class A limit for technetium. Technology is needed to remove technetium such that it can be immobilized with other HAW streams into a glass waste form, and permit disposal of low activity wastes as Class A wastes. Solvents used in the separations processes, namely the TRUEX and SREX processes, are known to remove technetium. Testing of these extraction processes to date had not focused on ways to optimize extraction of technetium or to strip technetium from the solvents. Alternative methods of removal of technetium may also be possible, i. e. ion exchange or volatilization and collection of gaseous forms of technetium.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B501, INEEL Integrated Radionuclide Separations Process, TFA priority #42.

Site Need ID: ID-2.1.69
Site Need Title: Solids Waste (Calcine) Retrieval from CSSF1
Need Summary: Highly radioactive waste material is being stored in bins in the First Calcined Solids Storage Facilities (CSSF1). The material was in the form of free granular solids and fines when it was sent to storage and is still expected to be free flowing. Systems are needed to retrieve the calcined solids out of CSSF1 and transfer them to a processing facility to be processed into an even more stable waste form or to another storage facility because CSSF1 is not seismically qualified.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B331, Dry Solid Waste Retrieval, TFA priority #57.

Site Need ID: ID-2.1.72
Site Need Title: Simplified Tank Solids and Vault Sampling and Sludge Volume Determination Systems
Need Summary: Development and testing of an alternate (simplified) sampling system for retrieving samples from TFF tanks and from vault sumps is needed. There may be situations where light-duty utility arm (LDUA) cannot support sampling efforts during closure activities due to conflicts or space/weight allocation over the tanks. LDUA cannot sample vault sumps and the existing vault sampling systems are not functional. Vault samples could be required in support of closure activities. In addition, the ability to determine the volume of solids/sludge in the tank bottoms would allow planning for impacts to transfer and processing of the heel materials.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B201, Sludge Mapping and Volume Estimates, TFA priority #32.
- B203, Residual Waste Sampling, TFA priority #21.

Site Need ID: ID-2.1.74
Site Need Title: Alternative Melters to Joule Heated Design for Applications to INEEL Calcine
Need Summary: Given the long lead-time prior to processing the calcine waste in the bins, investigation of alternative melter technology is needed. The great volume of calcine in the bins, when considered versus the estimated throughput for a Joule Heated melter approximately the size of DWPF, may put the prospect of processing the calcine via direct vitrification by 2035, the date agreed upon in the Settlement Agreement, at risk. In addition, the unknowns regarding the many separations options for dividing out the (HAW fraction for subsequent vitrification begs the question as to whether another melter type might be more suited to this kind of service. Identification of more cost-effective vitrification technologies will also help reduce the DOE Office of Environmental Management cleanup costs. INEEL cannot presently meet its cleanup goals with the projected flat budget. Hence, it is desirable to use the time leading up to the final decision as to the ultimate home of the calcined waste to explore alternative melter types and designs.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B7S2, New Melter Technology, TFA priority #0.

Site Need ID: ID-2.1.75
Site Need Title: Glass and Alternative Glass-Ceramic Waste Forms
Need Summary: The INEEL high level waste calcines that are presently stored in the bin sets at INTEC, need to be immobilized into durable waste forms. While their vitrification into glass is one option, there is need for a parallel investigation into forming alternative waste forms to determine the technologically most appropriate path forward for their immobilization. Therefore in addition to the continuing investigation of evolving glass, the alternatives of interest are glass-ceramics formed by processes of either vitrification

or hot isostatic pressing (HIP). The sparse knowledge in the science and technology for developing the glass-ceramic waste forms is currently the major obstacle in arriving at measures for assessing their performance relative to glass forms. Thus arises the need to evolve the process methodology, transport mechanisms, and protocol to qualify these alternative waste forms for the national geologic repository.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B751, Alternative HLW Waste Forms, TFA priority #62.
- B773, Improve Waste Loading in HLW and LLW Glasses, TFA priority #7.

Site Need ID: ID-2.1.76
Site Need Title: Selection of Refractory Materials Based Upon Glass Chemistry
Need Summary: Refractory materials corrosion is a persistent technological issue in HLW glass melters. How this refractory material interacts with the glass melt chemistry may or may not cause changes to the processability of a glass melter. Significant changes to glass viscosity and durability may result. Corrosion studies to determine the best performing refractory materials to be used in glass melter construction, and pilot scale melter tests to provide the data necessary to establish process operating parameters and life expectancy of the vitrification system are needed. In addition, these pilot scale tests will provide the data needed to verify that the candidate vitrifying formulations are processable and meet the requirements for repository storage.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B768, Specify and Enhance Design of HLW Glass Melters, TFA priority #6.

Site Need ID: ID-2.1.77
Site Need Title: Dry Feed Handling - Pumpability, Homogeneity, Uniform Mixing, and Pre-Process Sampling
Need Summary: It is as yet unclear how calcine at INEEL will be processed. The process of choice may be direct vitrification. In that event, the ability to transport, mix to appropriate homogeneity, and sample dry calcine feed, both pre and post feed preparation (glass former addition, etc.) will be required. Both the technology for such transport and mixing, as well as the technical development of appropriate hardware is required. These operations are critical to the ability to make a compliant waste form and establish its compliance.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B232, Dry Materials Sampling, TFA priority #31.
- B333, Dry Materials Transfer and Blending, TFA priority #61.

Site Need ID: ID-2.1.78
Site Need Title: Fate and Impacts of Sulfates in Vitrification Processes
Need Summary: Sulfate presence in waste vitrification can be extremely troublesome, potentially requiring a significant decrease in otherwise acceptable waste loadings. Information on sulfur partitioning in the melter is needed. The unacceptable salt layer can

potentially be reduced or eliminated through formulation optimization or, preferably, redox control of the melt.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B773, Improve Waste Loading in HLW and LLW Glasses, TFA priority #7.

Site Need ID: ID-2.1.79
Site Need Title: Upgrade INEEL HLW Tanks Corrosion Monitoring Capability
Need Summary: The INEEL has 1.33 million gallons of radioactive liquid sodium bearing waste that needs to be safely stored the INTEC Tank Farm in 300,00 gallon stainless steel tanks. These tanks must be monitored for general and localized corrosion to assure safe storage conditions until the year 2015. This need addresses the further development of the Multi-Function Corrosion Monitoring System to include new corrosion coupons and remote Electrochemical Noise (EN) probes that will provide a direct readout of corrosion rate and give an indication of initiation of localized corrosion.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B143, HLW Tank Corrosion Control and Monitoring, TFA priority #1.

Site Need ID: ID-2.1.80
Site Need Title: Low-Activity Waste Gas Generation
Need Summary: An evaluation is needed of the scrubber waste composition, the grout former composition, and the known literature compositions to determine the extent/possibility of hydrogen gas generation and diffusion rates through the waste forms. Once the evaluation is complete, the grout formulation may need to be adjusted to reduce the problem to acceptable levels.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B719, Conditioning and Immobilization of Low-Activity Waste, TFA priority #20.

Site Need ID: ID-2.1.81
Site Need Title: Materials Development Needs for Vitrification of INEEL Acidic, Sodium Bearing High Level Waste
Need Summary: The INEEL has been directed to pursue direct vitrification of acidic, Sodium Bearing Waste (SBW). It is anticipated there will be significant materials problems in the melter and off-gas systems based on the experience at SRS's DWPF, and therefore information on off gas treatment is needed. The INEEL chemistry is different than that at SRS and may be more aggressive due to halogens such as F- and Cl- ions.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B722, HLW Process Offgas Treatment, TFA priority #27.

Site Need ID: ID-2.1.82
Site Need Title: Melter Components - Electrodes, Heaters, Top Head, Drain System Erosion/Corrosion Rates

Need Summary: High Level Waste at the INEEL is the product of cold-war fuel reprocessing. Much of this reprocessing has led to waste that could 1) be highly acidic, 2) contain most of the elements in the periodic table, or 3) both of the above. These factors, combining with the complex chemistry of the vitrification process, lead to concerns of corrosion and errosion of the key melter components, namely electrodes, heaters, top head, and drain systems. Understanding of these effects is needed to both choose the best materials and component set up configurations, as well as to envelope the expected mean-time to failure, as well as the reliability, operability, and maintainability of melters for use in engineering design of vitrification facilities.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B768, Specify and Enhance Design of HLW Glass Melters, TFA priority #6.

Site Need ID: ID-2.1.83
Site Need Title: Decommissioning a High Level Waste Melter System and Change Out of its Components
Need Summary: Methods to decommission a HLW melter at end of life and to change out individual melter system components during hot operations are needed. To date, no radioactively contaminated full scale melters have been decontaminated. Considerable cost savings for melter decommissioning and component change out activities would be achieved if these technologies are developed and incorporated in the design of the melter system.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B777, Remote Disassembly of HLW Melters and Other Processing Equipment, TFA priority #14.

Site Need ID: ID-2.1.84
Site Need Title: Removal of Mercury from SBW Vitrification Off-Gas
Need Summary: Mercury releases in the off-gas from the vitrification of SBW are expected to be in excess of the MACT limit promulgated by the Environmental Protection Agency for Hazardous Waste Combustors. It is also expected that mercury emissions will be required to be in compliance with the MACT limit. Wet scrubbers for off-gas treatment will not provide the required mercury removal efficiency to meet the MACT limit. Therefore, a sorbent bed of activated carbon, or other sorbent will be required downstream of the wet scrubbers to remove additional mercury before venting the off-gas. Research and development activities will be required to test candidate sorbents, select a sorbent and provide data for scale-up.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B521, Acid-Side Radionuclide Separations, TFA priority #28.
- B722, HLW Process Offgas Treatment, TFA priority #27.

Site Need ID: ID-2.1.85
Site Need Title: Offgas Control System and Technologies
Need Summary: DOE plans to treat liquid SBW and calcined HLW at INEEL using vitrification to convert these wastes into glass and cemented waste forms for final disposal. Vitrification of these wastes will generate an offgas that could contain entrained and volatilized radionuclides, heavy metals, acid gases, particulate matter, and organic compounds. Design, construction, and safe and effective operation of the offgas system for this vitrification facility is needed.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B722, HLW Process Offgas Treatment, TFA priority #27.

Site Need ID: ID-2.1.86
Site Need Title: HLW Melter Offgas Monitoring and Control
Need Summary: Future waste treatment processes at INTEC will require offgas treatment and controls to ensure compliance with air emission standards and limits, such as MACT, for radionuclides, toxic heavy metals, hydrocarbons, halogenated organics, and priority pollutants (e.g., CO). On-line monitoring of mercury, CO, NOX, total hydrocarbons, and other species is needed to facilitate compliant operation and provide independent verification of process offgas samples.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B205, Continuous Emissions Monitor for Offgas Analysis, TFA priority #46.

Site Need ID: ID-2.1.87
Site Need Title: Development of Real Time NDE Technology for Quality Verification of Canister Closure Seal Welds
Need Summary: Remote welding and real time nondestructive examination are important in the U.S. Nuclear Regulatory Agency licensing strategy for the INEEL Glass Storage Canister. In addressing these issues, qualified data must be generated to provide reasonable assurance that the fabrication process will produce a glass canister with a high quality seal weld. This data will be gathered through parametric studies and testing. These studies should directly address, or support, two general areas: 1) fabrication effects on canister materials, and 2) integrity of deposited welds. The end result will be the development of an integrated welding and inspection system that will meet the American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section III, Division 3, Sections IX and V.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B753, HLW Canister Closure and Integrity. TFA elected not to fund this response because canister integrity and welding have been demonstrated in production and further advances have been thoroughly piloted. The need is beyond technology development and is ready to be adapted at the engineering level to the vitrification facility in the design process. The TFA does not plan any further technology development in this area.

Site Need ID: ID-2.1.88
Site Need Title: Evaporation or Pretreatment of Liquid Sodium Bearing Waste (SBW) Prior to Feeding Melter
Need Summary: A cost/benefit analysis is needed to determine if a pretreatment step, such as evaporation, to prepare liquid SBW for feeding to a glass melter would be cost effective. The effects of pretreatment on melter performance and rheology need to be quantified.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B769, Conditioning of HLW for Immobilization, TFA priority #13.

Site Need ID: ID-2.1.89
Site Need Title: SBW Vitrification Offgas System Components Optimization
Need Summary: An EIS has been prepared by DOE-ID to select the best alternative to treat the liquid wastes in the tank farm to meet the Consent Order commitments. Although a final Record of Decision is pending, current program direction indicates that direct vitrification will be selected as the preferred method of treatment for remaining SBW. It is anticipated that a vitrification facility will be built, with the offgas train as a major system in the design. Hence, selection, placement, and optimization of the components in this system will be critical to obtain the required performance, operability, and reliability of the offgas train.
A flowsheet model is needed to ensure that the offgas system design meets the functional performance requirements outlined above.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B709, Waste Treatment Process Flowsheet Model, TFA priority #12.
- B722, HLW Process Offgas Treatment, TFA priority #27.

Site Need ID: ID-2.1.90
Site Need Title: SBW Vitrification Offgas NOx Abatement and PIC/HAP Destruction
Need Summary: An EIS has been prepared by DOE-ID to select the best alternative to treat the liquid wastes in the tank farm to meet the Consent Order commitments. Although a final Record of Decision is pending, current program direction indicates that direct vitrification will be selected as the preferred method of treatment for remaining SBW. It is anticipated that a vitrification facility will be built, and offgas NOx and PIC [products of incomplete combustion] abatement will be required in order to permit this facility. In order to meet this need, further development of NOx abatement technology is required to address concerns specific to this facility and this waste.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B722, HLW Process Offgas Treatment, TFA priority #27.

Site Need ID: ID-2.1.91
Site Need Title: Vitrification Secondary Waste Characterization & Disposition Path Regulatory Development
Need Summary: Vitrification of SBW will result in significant quantities of secondary wastes that may pose challenges to disposition unless they are adequately characterized and regulatory strategies defined to mitigate these challenges. RCRA listed codes will be attached to these waste streams, although the baseline treatment is vitrification followed by offgas treatment in a noxidizer, which destroys all organics. In addition, mercury concentrations may exceed 260 ppm to obtain a cost-effective waste form. These characteristics could have significant impact on the life-cycle cost of processing and dispositioning the SBW inventory if they are not adequately identified and addressed during the design and permitting phases.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B719, Conditioning and Immobilization of Low-Activity Waste, TFA priority #20.
- B722, HLW Process Offgas Treatment, TFA priority #27.
- B730, Acceptance Criteria for High Activity Waste, TFA priority #65.

Site Need ID: ID-2.1.92
Site Need Title: Structural Integrity Program for Interim Storage of INEEL HLW Glass Canisters
Need Summary: The INEEL has been directed to pursue direct vitrification of acidic SBW. The glass waste will be encapsulated in the INEEL Waste Glass Canister. The INEEL must develop a structural integrity program to monitor these canisters in interim storage that meets the requirements of DOE Order 435.1.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B753, HLW Canister Closure and Integrity. TFA elected not to fund this response because canister integrity and welding have been demonstrated in production and further advances have been thoroughly piloted. The need is beyond technology development and is ready to be adapted at the engineering level to the vitrification facility in the design process. The TFA does not plan any further technology development in this area.

Site Need ID: ID-2.2.1
Site Need Title: Post-Closure Monitoring Techniques for HLW Tank Farm
Need Summary: DOE Order 435.1 requires post-closure monitoring of deactivated HLW facilities to ensure that environmental and health compliance standards are being met. Reliable monitoring techniques are required to detect any leakage of residual waste form individual specific tanks. Long-term stewardship need.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B292, Contaminant Migration Monitors. TFA elected not to fund this effort because the need has been assigned to the SCFA for appropriate new technology development and technical assistance to the sites. The CMST Liaison to TFA will

monitor developments that may be of interest to TFA via periodic consultation with the CMST Liaison to SCFA. This Multiyear Technical Response (MYTR) will be updated on an annual basis to reflect the relevant work being conducted by SCFA.

Site Need ID: ID-9.1.01
Site Need Title: Underground Instrumentation Placement for Buried Tanks
Need Summary: Access to underground tanks and placement of instrumentation immediately beneath those tanks for monitoring is only solved by both costly and sometimes risky excavation or by having a relatively straight-line access for horizontal drilling. An accurate tunneling device, at least 1 foot dia., with directional capability is required to maneuver through soil and rock for at least 100 yards to provide an avenue for sensor packages to be placed beneath suspect targets.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B292, Contaminant Migration Monitors. TFA elected not to fund this effort because the need has been assigned to the SCFA for appropriate new technology development and technical assistance to the sites. The CMST Liaison to TFA will monitor developments that may be of interest to TFA via periodic consultation with the CMST Liaison to SCFA. This MYTR will be updated on an annual basis to reflect the relevant work being conducted by SCFA.

Site Need ID: ID-9.1.02
Site Need Title: Pipe Explorer for Pipes Less Than Three Inches in Diameter
Need Summary: Access to tanks is sometimes limited to connect piping. In many of the smaller tanks the piping is less that three inches in diameter. Before a tank can be decommissioned the interior contents must be characterized, which required sampling of the contents or a determinations of empty. A pipe explorer capable of navigating through small diameter pipe is needed to provide the user with the ability to sample the contents without overtly breaching the container and contending with the associated risks. A robotic pipe crawler able to navigate through < 3 diameter pipe to access tanks through the existing piping system and collect a sample of the contents.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B203, Residual Waste Sampling, TFA priority #21.

Site Need ID: ID-9.1.03
Site Need Title: Access To Tanks Below Liquid Level
Need Summary: Some tanks contain liquid that has risen above the access level. Opening those tanks at the access port would cause an immediate spill. The seriousness of that spill would depend on the nature of the contents. A technology needs to be developed that would allow the users to open access ports under the fluid level to sample the contents with minimal risk to the operating personnel and the environment. A technology needs to be developed which could enter existing ports (even though they are below the liquid level of the tank) to sample the contents without causing a spill and then resealing the system until a determination of the tanks contents can be established.

Technical Disposition: The TFA responded to this need within the following technical response(s):

- B203, Residual Waste Sampling, TFA priority #21.

Site Need ID: ID-9.1.04
Site Need Title: Certifiable In-field Chemical Characterization of Tank Contents
Need Summary: The only valid method for determining the constituents of a tank is to extract a sample and ship it to a certified laboratory for analysis. This is a time consuming and expensive process that delay disposition and increases the environmental and personal risk as the process wait for the laboratory complete the analysis. An in-field real-time analysis methodology needs to be developed and certified which will be acceptable to the regulating agencies to eliminate the delays and program risks. An in-field, real-time analysis technology which is acceptable to the regulating agencies needs to be developed to expedite the determination of hazardous material, planning, and disposition of Voluntary Consent Order (VCO) tanks.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B202, In-Situ Waste Characterization, TFA priority #33.

Site Need ID: ID-9.1.05
Site Need Title: Non-intrusive Characterization of Waste Material
Need Summary: The only valid method for determining the constituents of a tank is to extract a sample and ship it to a certified laboratory for analysis. This is a time consuming and expensive process that delays disposition and increases the environmental and personal risk as the process waits for the laboratory to complete the analysis. A non-intrusive method for determining contents of waste tanks is needed to allow the user to make hazards determination without breaching the containment. A non-intrusive technology for determining the constituents of waste material needs to be developed to expedite the determination of hazardous material, planning, and disposition of VCO tanks. The process would be tremendously accelerated and risk reduced by knowing, before breaching the containment, what the operators would be facing and prepare plans to address those specific contingencies.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B202, In-Situ Waste Characterization, TFA priority #33.

Site Need ID: ID-9.1.06
Site Need Title: Internal Obstructions Navigation/Avoidance for Waste Tanks
Need Summary: The interiors of some tanks are obstructed with mechanical baffles, tubing, or barriers that make extracting a sample very difficult. A device is needed to maneuver in and around these obstructions to collect a sample of the contents at various locations to ensure that a true representation of the contents is obtained. A remote device able to navigate through the interior of a tank to a position where a sample can be extracted is needed. This device must be able to maneuver in or around internal obstacles and avoid disturbing contents until the sample is extracted.

Technical Disposition: The TFA responded to this need within the following technical response(s):

- B203, Residual Waste Sampling, TFA priority #21.

Site Need ID: ID-9.1.07
Site Need Title: Waste Tank Resealing Technology
Need Summary: In order to sample the contents of many tanks it is necessary to create a new access. Once those accesses are created it is essential to reseal the opening and return the containment vessel to the same integrity prior to the entry. After a new access port is made in a tank and a sample taken it is necessary to reseal the tank to the same containment integrity prior to entry. That seal may have to last for an extended time until the tank is finally decontaminated and disposed. A durable in-field resealing technology is required to secure the contents of the tank until final disposition.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B157, Tank Leak Mitigation, TFA priority #8.

Site Need ID: ID-9.1.08
Site Need Title: Tanks/Piping Information Base for Configuration Control and Statusing
Need Summary: There is no site-wide user-friendly information base available to provide operations with the status of tanks and piping systems configuration. Operations needs a computer based system that maintains all the piping runs and tank status to expedite maintenance and efficiently plan decontamination and decommissioning or plant modifications. A current and maintained user-friendly tank status and pipe configuration database is needed to minimize the on site survey prior to planning and execution.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B190, Database for Tanks and Piping Configuration Control. TFA did not fund this response because the site withdrew the need.

Site Need ID: ID-S.1.02
Site Need Title: Continuous Emissions Monitors for Offgas Analysis
Need Summary: There are two areas of operation requiring extensive offgas monitoring, the high level waste management operations at INTEC and the mixed and low level waste management operations at the Waste Experimental Reduction Facility. The contaminants of primary concern under the new MACT standards are mercury, polychlorinated dibenzodioxins, and polychlorinated dibenzofurans. The emission limits are being lowered and there are requirements to provide continuous monitoring. The ideal on-line monitor would sample directly in the in the offgas or a flowing side stream. Optical emission spectroscopy techniques which work for other elements (such as laser induced breakdown spectroscopy) fail for mercury and arsenic due to the wavelength transmission cutoff of 200 nm for quartz optics and fibers. Work is needed to overcome this barrier. There is also a data quality issue associated with creating reliable mercuric chloride gas phase standards.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B205, Continuous Emissions Monitor for Offgas Analysis, TFA priority #46.

Site Need ID: ID-S.1.29
Site Need Title: Glass and Alternative Glass-Ceramic Waste Forms
Need Summary: The INEEL high level waste calcines that are presently stored in the bin sets at INTEC, need to be immobilized into durable waste forms. While their vitrification into glass is one option, there is need for a parallel investigation into forming alternative waste forms to determine the technologically most appropriate path forward for their immobilization. Therefore in addition to the continuing investigation of evolving glass, the alternatives of interest are glass-ceramics formed by processes of either vitrification or HIP. The sparse knowledge in the science and technology for developing the glass-ceramic waste forms is currently the major obstacle in arriving at measures for assessing their performance relative to glass forms. Thus arises the need to evolve the process methodology, transport mechanisms, and protocol to qualify these alternative waste forms for the national geologic repository.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B751, Alternative HLW Waste Forms, TFA priority #62.
- B773, Improve Waste Loading in HLW and LLW Glasses, TFA priority #7.

Site Need ID: ID-S.1.30
Site Need Title: Selection of Refractory Materials Based Upon Glass Chemistry
Need Summary: Refractory materials corrosion is a persistent technological issue in HLW glass melters. How this refractory material interacts with the glass melt chemistry may or may not cause changes to the processability of a glass melter. Significant changes to glass viscosity and durability may result. Corrosion studies need to be conducted to determine the best performing refractory materials to be used in glass melter construction, and pilot scale melter tests need to be used to provide the data necessary to establish process operating parameters and life expectancy of the vitrification system. In addition, these pilot scale tests will provide the data needed to verify that the candidate vitrifying formulations are processable and meet the requirements for repository storage.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B768, Specify and Enhance Design of HLW Glass Melters, TFA priority #6.

Site Need ID: ID-S.1.31
Site Need Title: Dry Feed Handling-Pumpability, Homogeneity, Uniform Mixing, and Pre-Process Sampling
Need Summary: It is as yet unclear how calcine at INEEL will be processed. The process of choice may be direct vitrification. In that event, the ability to transport, mix to appropriate homogeneity, and sample dry calcine feed, both pre and post feed preparation (glass former addition, etc.) will be required. Both the technology for such transport and mixing, as well as the technical development of appropriate hardware is required. These operations are critical to the ability to make a compliant waste form and establish its compliance.

Technical Disposition: The TFA responded to this need within the following technical response(s):

- B232, Dry Materials Sampling, TFA priority #31.
- B333, Dry Materials Transfer and Blending, TFA priority #61.

Site Need ID: ID-S.1.32
Site Need Title: Fate and Impacts of Sulfates in Vitrification Processes
Need Summary: Sulfate presence in waste vitrification can be extremely troublesome, potentially requiring a significant decrease in otherwise acceptable waste loadings. Sulfur partitioning in the melter needs to be better understood. The unacceptable salt layer can potentially be reduced or eliminated through formulation optimization or, preferably, redox control of the melt.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B773, Improve Waste Loading in HLW and LLW Glasses, TFA priority #7.

Site Need ID: ID-S.1.33
Site Need Title: Upgrade INEEL HLW Tanks Corrosion Monitoring Capability
Need Summary: The INEEL has 1.33 million gallons of radioactive liquid sodium bearing waste that needs to be safely stored the INTEC Tank Farm in 300,00 gallon stainless steel tanks. These tanks must be monitored for general and localized corrosion to assure safe storage conditions until the year 2015. This need addresses the further development of the Multi-Function Corrosion Monitoring System to include new corrosion coupons and remote EN probes that will provide a direct readout of corrosion rate and give an indication of initiation of localized corrosion.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B143, HLW Tank Corrosion Control and Monitoring, TFA priority #1.

Site Need ID: ID-S.1.34
Site Need Title: Materials Development Needs for Vitrification of INEEL Acidic, Sodium Bearing High Level Waste
Need Summary: The INEEL has been directed to pursue direct vitrification of acidic SBW. It is anticipated there will be significant materials problems in the melter and off-gas systems based on the experience at SRS DWPF. The INEEL chemistry is different than that at SRS and may be more aggressive due to halogens such as F- and Cl- ions.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B722, HLW Process Offgas Treatment, TFA priority #27.

Site Need ID: ID-S.1.35
Site Need Title: Melter Components - Electrodes, Heaters, Top Head, Drain System Erosion/Corrosion Rates
Need Summary: HLW at INEEL is the product of cold-war fuel reprocessing. Much of this reprocessing has led to waste that could 1) be highly acidic, 2) contain most of the elements in the periodic table, or 3) both of the above. These factors, combining with the

complex chemistry of the vitrification process, lead to concerns of corrosion and errosion of the key melter components, namely electrodes, heaters, top head, and drain systems. Hence, it is desireable to understand these effects to both choose the best materials and component set up configurations, as well as to envelope the expected mean-time to failure, as well as the reliability, operability, and maintainability of melters for use in engineering design of vitrification facilities.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B768, Specify and Enhance Design of HLW Glass Melters, TFA priority #6.

Site Need ID: ID-S.1.36
Site Need Title: Offgas Control System and Technologies
Need Summary: DOE plans to treat liquid SBW and calcined HLW at INEEL using vitrification to convert these wastes into glass and cemented waste forms for final disposal. Vitrification of these wastes will generate an offgas that could contain entrained and volatilized radionuclides, heavy metals, acid gases, particulate matter, and organic compounds. Roadmapping activities at the INEEL have identified various technology needs ranging from basis science research to applied technology demonstrations that will be required to provide information for design, construction, and safe and effective operation of the offgas system for this vitrification facility.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B521, Acid-Side Radionuclide Separations, TFA priority #28.
- B722, HLW Process Offgas Treatment, TFA priority #27.

Site Need ID: ID-S.1.37
Site Need Title: SBW Vitrification Offgas Compositional Data and Predictive Models
Need Summary: An EIS has been prepared by DOE-ID to select the best alternative to treat the liquid wastes in the tank farm to meet the Consent Order commitments. Although a final Record of Decision is pending, current program direction indicates that direct vitrification will be selected as the preferred method of treatment for remaining SBW. It is anticipated that a vitrification facility will be built, with the offgas train as a major system in the design. In order to produce an adequate offgas system design, pilot-scale offgas characterization data is required. Additionally, predictive models will be required tools to evaluate and compare offgas treatment options.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B709, Waste Treatment Process Flowsheet Model, TFA priority #12.

Site Need ID: ID-S.1.38
Site Need Title: Update DOE Order 435.1 Guidance Document # BNL-52527
Need Summary: The report that defines thestructual integrity program requirements as defined by DOE Order 435.1 needs to be updated to address the materials and environments of INEEL HLW tanks.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B175, Tank Integrity Inspection Techniques, TFA priority #2.
- B1S1, Pre-Closure Interim Tank Maintenance, TFA priority #0.

Site: ORR

Site Need ID: ORTK-01
Site Need Title: Tank Waste Characterization
Need Summary: Waste storage tanks must be emptied, and the tanks must be characterized for closure or returned to active service. Characterization technologies are needed to determine the quantity of sludge in the tanks before and after emptying. Characterization technologies are also needed to determine the structural integrity if they are to be returned to long-term service. Routine structural integrity verification is required to keep the tanks in service.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B175, Tank Integrity Inspection Techniques, TFA priority #2.
- B201, Sludge Mapping and Volume Estimates, TFA priority #32.

Site Need ID: ORTK-02
Site Need Title: Tank Solid Waste Retieval
Need Summary: Vertical concrete storage tanks on the Oak Ridge Reservation must be remediated. Process heels, hard sludge, and debris from the inside of old concrete storage tanks must be removed in order to remediate the tanks. Concrete walls which are contaminated from contact with radiological materials must be cleaned. Retrieval technologies are needed for these tanks, which have limited access (usually one entrance port).
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B367, Unobstructed Tank Heel Retrieval, TFA priority #10.

Site Need ID: ORTK-04
Site Need Title: Sludge Mixing and Slurry Transport
Need Summary: A system to transport bulk quantities of sludge from Oak Ridge National Laboratory (ORNL) underground tanks through miles of pipeline to consolidation tanks and treatment facilities is needed. Monitoring of the retrieved sludge is required to eliminate plugging and ensure slurry content.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- TFA-ORTK-04, Slurry Transfer and Tank Waste Mixing Monitors. The TFA did not develop a technical response for this need because no additional technical development has been identified at this time. TFA has funded tasks at ORNL between FY 1997 and FY 2000 to meet the need.

Site Need ID: ORTK-05
Site Need Title: Tank Sludge and Supernatant Separations
Need Summary: There is a need to manage the excess water generated during sludge retrieval operations. Sludges and supernate/sluice water must be separated in a fast, cost-effective manner during waste transfer and treatment operations.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B586, Evaporation and/or Separations Pretreatment Deployment. TFA is not funding this response as the work is complete and the need has been met.

Site Need ID: ORTK-06
Site Need Title: Tank Sludge Supernatant Immobilization
Need Summary: The baseline plan for concentration and treatment of ORNL tank waste is to solidify waste for disposal at the Nevada Test Site (NTS) or the Waste Isolation Pilot Plant (WIPP). Pretreatment may be needed to meet feed envelope needed by immobilization vendor. Waste form development is needed to meet land disposal restriction (LDR) requirements.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B719, Conditioning and Immobilization of Low-Activity Waste, TFA priority #20.

Site Need ID: ORTK-09
Site Need Title: Tank Closure
Need Summary: Old deteriorating waste storage tanks exist which contain sludge heels that have been determined to be of negligible risk to health, safety, and environment. However, it will be very costly to remove the waste from tanks with limited access ports. Residual waste in the concrete walls and liners of the waste tanks may also dictate the need for tank closure. A technology is needed to in situ stabilize these sludge heels as a part of tank closure. Fill material which can meet acceptance criteria for tank closure is also required. Pre- and post-closure monitoring are needed.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B292, Contaminant Migration Monitors. TFA elected not to fund this effort because the need has been assigned to the SCFA for appropriate new technology development and technical assistance to the sites. The CMST Liaison to TFA will monitor developments that may be of interest to TFA via periodic consultation with the CMST Liaison to SCFA. This MYTR will be updated on an annual basis to reflect the relevant work being conducted by SCFA.
- B923, Enhanced Grout Formulations for Tank Closure, TFA priority #18.
- B985, Demonstration of Grout Injection Technology for Tank Closure. TFA elected not to fund this effort. West Valley's grout deployment and mixing needs are not yet sufficiently defined to determine if they have a need for an aggressive grout mixing and deployment technology. The MPI® technology is available if it is determined that it is needed.

Site Need ID: ORTK-11
Site Need Title: Tank Supernatant Pretreatment
Need Summary: The baseline plan for treatment of ORNL tank waste is to remove cesium from the supernate by ion exchange, evaporate to remove excess water, and solidify the waste for disposal at the NTS or WIPP. However, pretreatment to remove certain radionuclides and/or to reduce the volume of high-activity transuranic (TRU) waste is needed.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B555, Sludge Washing and Dissolution, TFA priority #11.
- B586, Evaporation and/or Separations Pretreatment Deployment. TFA is not funding this response since the work is complete.

Site: SRS

Site Need ID: SR01-2027
Site Need Title: Demonstrate Alternative Filtration Technologies to Replace Conventional HEPA Filters
Need Summary: In situ cleanable HEPA filter technology is needed to increase the life of high level waste tank HEPA filters and to reduce the solid waste volume associated with spent paper filters. An alternative filtration technology such as a HEPA filter constructed of washable media such as sintered metal or ceramic will provide a HEPA filter, which is not subject to water damage. The filter media can be installed with built in regenerative system in the filter housing which will be used to wash the filter in situ. Preliminary tests indicate that use of these filter media eliminate the release of particulates to the atmosphere with the same efficiency as filtration with a fiberglass filter medium, but can be cleaned with water or other liquids, and is not subject to water damage. Test data with a 9 CFM test apparatus indicates that a means of water removal from the clean side of the filter is required to maintain acceptable filter operation. Cylindrical filters mounted vertically were found to provide the geometry for effective cleaning.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B171, Alternative Air Filtration Technology, TFA priority #23.

Site Need ID: SR01-2028
Site Need Title: Alternative Waste Removal Technology
Need Summary: Improved removal technology is needed to remove salt waste from the HLW storage tanks at SRS. Conventional waste removal techniques using 150HP slurry pumps are considered costly and overly invasive. As a follow-on to extensive alternate mixing equipment (Flygt Mixer) testing in FY98-99 and 50HP Flygt mixer deployment in FY00, additional Flygt mixer operation is underway in FY01. The focus of this follow-on Flygt mixer program in FY02 will include evaluations of mixer sizing and operational strategies for salt dissolution for salt removal. Testing will determine the deployment operational strategies and orientation for mixing in Type I, II, and III tanks that contain cooling coils and other physical obstructions.

Technical Disposition: The TFA responded to this need within the following technical response(s):

- B359, Waste Mobilization and Mixing, TFA priority #17.
- B362, Low Liquid Volume Saltcake Retrieval, TFA priority #4.

Site Need ID: SR01-2029
Site Need Title: Alternate DWPF Canister Decon Technology
Need Summary: A new more effective technology is required to decontaminate the DWPF canisters after being filled and welded. DWPF canister decontamination is a water-frit slurry blast technique that removes contamination and oxides from the entire canister exterior surface. The waste from this process is in two forms. An off-gas is routed to the facility vessel ventilation system and on to facility controlled ventilation exhaust. A water-frit slurry waste stream is pumped into the facility chemical process and fed into the vitrification process stream, to minimize liquid waste production. This coupling of canister decontamination with chemical processing is less than optimum and could limit production rates in the future.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B972, Alternative HLW Canister Decontamination Techniques, TFA priority #40.

Site Need ID: SR01-2031
Site Need Title: Develop Remote Technology to Improve DWPF Operations
Need Summary: The DWPF needs new and enabling robotic/remote equipment to perform needed operations in the DWPF process cells. The DWPF is limited in the ability to perform remote maintenance, inspection, and cleanup activities within the shielded facility (canyon). The only access to the majority of the facility for maintenance, etc. is via overhead crane using hooks and an impact wrench. Viewing capability within the facility is limited to video cameras mounted on the Main Process Cell Crane. It is desirable to develop improved capabilities to inspect, perform maintenance, and perform dencontamination/cleanup activities within the facility.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B374, Remote Technologies for Process Cell Operations and Maintenance, TFA priority #41.
- B777, Remote Disassembly of HLW Melters and Other Processing Equipment, TFA priority #14.

Site Need ID: SR01-2032
Site Need Title: Optimize Melter Glass Chemistry and Increase Waste Loading
Need Summary: The total number of canisters required to vitrify all of the current and future inventory of SRS HLW can be reduced by reducing the uncertainty of models used to ensure the glass produced meets all quality and processing constraints. Improvements in the liquidous model are needed to reduce uncertainty in the model.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B768, Specify and Enhance Design of HLW Glass Melters, TFA priority #6.

- B773, Improve Waste Loading in HLW and LLW Glasses, TFA priority #7.

Site Need ID: SR01-2033
Site Need Title: Provide Alternative Processing and/or Concentration Methods for DWPF Recycle Aqueous Streams
Need Summary: Technology is required to process the DWPF recycle stream to reduce the impact of: 1) the volume of the recycle stream being returned to the tank farm and 2) the silicon content of the waste stream being sent to the tank farm.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B554, Tank Waste Chemistry, TFA priority #5.
- B566, Waste Chemistry During Evaporation, TFA priority #15.
- B584, Cross-Flow Filtration, TFA priority #16.

Site Need ID: SR01-2034
Site Need Title: Second Generation Salt Feed Preparation
Need Summary: Science and technology is needed to support the design and construction of a replacement facility to process high level salt waste at Savannah River. For each alternative, including alpha and strontium removal, there are significant science and technology questions and issues which must be answered to complete the design and construction activities in a time frame which allows HLW tank decommissioning in accordance with compliance agreements with the State of South Carolina and the (EPA. These technology assurance issues must be addressed in concert with the overall SRS Salt Disposition Project activities. Science and technology is needed to support design and construction in the following three basic categories: process chemistry, process engineering, and HLW System interface.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B570, Salt Processing Project, TFA priority #0.

Site Need ID: SR01-2035
Site Need Title: Develop Advanced Techniques for Life Extension of High Level Waste Tanks and Piping
Need Summary: Optimization of the the HLW Structural Integrity Program is needed to ensure safe continued operation of high level waste and pipeline systems for another 30-40 years of expected operations. Advanced techniques needed for life extension include, 1) establishing a thorough understanding of potential damage mechanisms including metal and concrete components of HLW confinement structures and associated piping systems, 2) improve inspection technology and apply computer aided records retention/analysis to effectively monitor and manage the damage mechanisms of interest, 3) establish a materials property data base and apply consensus Code flaw evaluation procedures to resolve inspection findings, and 4) develop HLW tank remote repair processes including deployment platforms to allow restoration of tanks as practical to maintain the confinement function.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B144, Tank Materials Properties, TFA priority #54.
- B157, Tank Leak Mitigation, TFA priority #8.
- B175, Tank Integrity Inspection Techniques, TFA priority #2.
- B176, Piping Integrity Inspection Techniques, TFA priority #43.

Site Need ID: SR01-2036
Site Need Title: Develop Improved HLW Melter
Need Summary: Improvements to melter design are needed to increase reliability of glass pouring and ensure long life for future DWPF melters. The glass melter is one of the most expensive and most complicated components in DWPF. Although DWPF Melter-1 has exceeded its two-year design life expectancy, it is desirable to evaluate/improve it's design life by improvements to heater systems, etc. and by developing enhancements to address processing of future feeds containing high levels of noble metals.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B768, Specify and Enhance Design of HLW Glass Melters, TFA priority #6.

Site Need ID: SR01-2037
Site Need Title: Tank Heel Removal/Closure Technology
Need Summary: As much as 40,000 gallons of residual waste can remain after conventional waste removal techniques are completed. Tank closure is not possible unless this residual waste is removed. The 242-F Evaporator-CTS system (typically called 1F) reduced the volume of liquid waste by boiling supernate from the mid-60s until placed out of service in 1998. Residual waste in the 1F vessels, containment structures, and piping must be characterized and potentially removed prior to closure of this system. The 1F System is located in the center of the F Tank Farm Tanks 17 – 20 4-pack area. A similar system in H Tank Farm has also been placed out of service and must be characterized and evaluated for future residual removal and closure. Equipment and techniques must be developed to visually inspect and to obtain representative samples of the F and H Tank Farm evaporator-CTS systems. Upon characterization, residual waste removal must be accomplished to render the systems ready for closure.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B157, Tank Leak Mitigation, TFA priority #8.
- B175, Tank Integrity Inspection Techniques, TFA priority #2.
- B202, In-Situ Waste Characterization, TFA priority #33.
- B278, Slurry Transfer and Tank Waste Mixing Monitors, TFA priority #38.
- B303, Waste Retrieval from Confined Spaces, TFA priority #45.
- B311, Long-Length Equipment Handling, TFA priority #25.
- B352, Remote Systems for Pit Operations and Maintenance, TFA priority #26.
- B359, Waste Mobilization and Mixing, TFA priority #17.
- B363, Chemical Cleaning of Tanks, TFA priority #9.
- B365, Waste Transfer Pumping, TFA priority #34.
- B367, Unobstructed Tank Heel Retrieval, TFA priority #10.

- B382, Horizontal and Small Tank Sludge Mixing and Retrieval, TFA priority #19.
- B387, Improved Mixing Methods, TFA priority #52.
- B554, Tank Waste Chemistry, TFA priority #5.
- B555, Sludge Washing and Dissolution, TFA priority #11.

Site Need ID: SR01-2039
Site Need Title: Methods to Unplug Waste Transfer Lines
Need Summary: As the tank clean-out and decommissioning program becomes active at SRS, there is an increasing potential that the transfer lines, which are in place, will become plugged (unable to facilitate waste transfer from one tank to another or from waste tanks to the DWPF In-Tank Precipitation (ITP), or Saltstone, etc.). Methods are needed to prevent and unplug waste transfer lines.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B376, Pipeline Plugging Prevention, Unplugging, and Cleaning, TFA priority #24.
- B554, Tank Waste Chemistry, TFA priority #5.

Site Need ID: SR01-2040
Site Need Title: Demonstrate Remote Decommissioning and Disassembly of High Level Waste Processing Equipment
Need Summary: Technology is needed to develop remote and or robotic systems to disassemble contaminated high level waste processing equipment. This includes failed high level waste glass melters, process vessels and process equipment. The current approach to dealing with this equipment is long term storage in the canyon facilities, on regulated storage pads or in underground "Failed Equipment Storage Vaults." While storage is acceptable for the short term, technology must be developed to properly dispose of this equipment.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B777, Remote Disassembly of HLW Melters and Other Processing Equipment, TFA priority #14.

Site Need ID: SR01-2041
Site Need Title: Develop Advanced Mixing Technology
Need Summary: Vertical shafted 150 HP slurry pumps are used to agitate waste solutions. The waste solutions are stored in one (1) million gallon storage tanks in the F- and H-Area Tank Farms. The pumps mix the waste into a solution/slurry so that it can be pumped to either the Extended Sludge Processing facility or the ITP facility for further processing. Removing waste from a waste tank using the slurry pump method cost between $6-10 million, therefore, cost effective alternatives to agitating the waste are desired. Conventional waste removal mixing techniques using 150HP slurry pumps have left up to 40,000 gallons of residual sludge waste heels. New technology for alternate mixer pumps is needed for tank mixing service.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B359, Waste Mobilization and Mixing, TFA priority #17.

Site Need ID: SR01-2044
Site Need Title: In-Situ Technology for Waste Characterization and Level Monitoring
Need Summary: In-situ real time waste slurry characterization is needed to support the waste removal process. Remote methods to determine sludge level and volume are needed to provide data for the fate and transport modeling for tank closure. Remote methods to determine tank liquid level, sludge level, and physical obstructions under the liquid and sludge are needed for tank monitoring and waste removal equipment installation. A tank deployed sample and characterization system is needed to provide real time radionuclide data to support evaluation for compliance with the Waste Acceptance Criteria for waste removal operations. Additionally, radiological properties and sludge volume must be determined for fate and transport modeling to evaluate tank cleanliness for compliance with the performance objective for tank closure.

Technical Disposition: The TFA responded to this need within the following technical response(s):

- B201, Sludge Mapping and Volume Estimates, TFA priority #32.
- B202, In-Situ Waste Characterization, TFA priority #33.
- B278, Slurry Transfer and Tank Waste Mixing Monitors, TFA priority #38.
- B292, Contaminant Migration Monitors. TFA elected not to fund this effort because the need has been assigned to the SCFA for appropriate new technology development and technical assistance to the sites. The CMST Liaison to TFA will monitor developments that may be of interest to TFA via periodic consultation with the CMST Liaison to SCFA. This MYTR will be updated on an annual basis to reflect the relevant work being conducted by SCFA.

Site Need ID: SR01-2045
Site Need Title: In-Situ Waste Tank Corrosion Probe
Need Summary: A variable depth corrosion and corrosion species probe is needed to monitor the corrosion chemistry of SRS high level waste tanks. It is desirable to have a probe instrument which will provide a readout of the corrosion rate as well as the analytical content of the chemical species which affect corrosion in a high level waste tank.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B143, HLW Tank Corrosion Control and Monitoring, TFA priority #1.

Site Need ID: SR01-2051
Site Need Title: Technology to Mitigate Effects of Technetium Under Tank Closure Conditions
Need Summary: A better understanding of the chemistry of technetium is needed under the conditions of waste removal and under the conditions after tank closure. A better understanding would allow SRS to 1) more reliably characterize the inventory in waste tanks in preparation for tank closure, and 2) reduce the conservatism of performance modeling in tanks closed with reducing grout. A better understanding is needed of the

chemistry of technetium during the waste generation processes, under the conditions of waste removal, and under the conditions after closure. This better understanding will provide a tool for estimating the Tc-99 concentrations in waste tanks when waste removal is being planned, and will reduce the conservatism of Tc-99 modeling. Also, a better understanding of the chemistry may suggest better ways to remove Tc-99 effectively from the waste tank.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B588, Leaching and Treatment of Technetium for Tank Closure, TFA priority #30.
- B923, Enhanced Grout Formulations for Tank Closure, TFA priority #18.

Site Need ID: SR01-2052
Site Need Title: Aluminum Dissolution from HAW Sludge and Its Impact on Downstream Salt Processing
Need Summary: Technology is needed to support the preparation of sludge feeds for HLW vitrification processes. Information obtained may also be applicable to the salt vitrification process to be used at Hanford. The ability to remove as much of the aluminum oxide content of sludge, irrespective of the form of the aluminum oxide present, must be demonstrated for radioactive "high aluminum" sludge to meet present projections for the total number of waste glass canisters. Conditions that assure NaAlO2 generated from aluminum dissolution does not revert to an insoluble hydrous oxide during subsequent evaporation, storage as concentrated supernate or salt cake, dissolution and subsequent treatment must also be demonstrated. The fate of NaAlO2 through other downstream waste processes must be determined to confirm that the aluminum removed from sludge will eventually be diverted to processing and disposal as a component of saltstone.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B554, Tank Waste Chemistry, TFA priority #5.
- B555, Sludge Washing and Dissolution, TFA priority #11.
- B773, Improve Waste Loading in HLW and LLW Glasses, TFA priority #7.
- B7S2, New Melter Technology, TFA priority #0.

Site Need ID: SR01-2055
Site Need Title: Increase in Applicability/Efficiency of High-Level Waste Planning Tool
Need Summary: The Chemical Process Evaluation System (CPES), and its associated chemical database, is used to support HLW system planning efforts and flowsheet evaluations. Conversion of this DuPont program to ASPEN+ and the addition of glass property models will allow a more widely supported program at SRS and across the DOE complex and faster system planning outputs. The SRS High Level Waste System Flowsheet has been developed and refined using CPES. An efficient flowsheet tool is still needed during operations to support evaluation of waste tank blending scenarios, make flowsheet improvements, and generate necessary data for regulatory and other needs. CPES does not currently include the product acceptance models that are contained

in the Product Composition Control System which is used to judge DWPF melter feed acceptability.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B709, Waste Treatment Process Flowsheet Model, TFA priority #12.

Site Need ID: SR01-2056
Site Need Title: Development of an Improved Understanding of the Causes of Foam Formation During Radioactive Waste Processing and Identification or Development of More Effective Antifoam Agents
Need Summary: A better understanding of the chemistry surrounding the formation and stabilization of three phase foams (presence of solid, liquid and gas in foam) is needed. This will lead to the identification or development of improved antifoams for the minimization of foaming during waste processing. Foam is present in many areas in HLW processing including in the HLW Evaporator, melter feed preparation in the DWPF, and in the precipitation of cesium in the tetraphenylborate process. In addition, other DOE sites, especially Hanford, will be processing low and high activity waste, which will require the development of more effective antifoam agents.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B542, Antifoam Agents for Waste Evaporation, TFA priority #44.
- B570, Salt Processing Project, TFA priority #0.

Site Need ID: SR01-2057
Site Need Title: Technology to Determine The Wind Flow Patterns Around Windbreaks
Need Summary: A better understanding of the wind flow patterns in and around radiation protection windbreaks is needed during the excavation, testing, and/or removal of contaminated products/equipment in high level waste storage/handling facilities. Better understanding will allow 1) more reliable planning and understanding possible consequences of a radiological release should one occur while performing work; also, in the case of a radiological release, 2) a better understanding of the most likely places to search for radioactive particles and deposition patterns downwind. A better-designed windbreak is also needed since current designs are the result of accumulated empirical results over the past several years. An improved, tested, generic windbreak that has the advantage of wind tunnel testing over a wide variety of conditions could potentially reduce or prevent costly radiological cleanup operations in the wake of inadvertent releases of radionuclides. A better understanding of the flow patterns around radiation protection windbreaks used at DOE sites is needed. A better understanding will enable better planning and execution of jobs with the potential of releasing radioactive particles into the ambient air.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B191, Aerodynamic Greenhouses, TFA priority #51.

Site Need ID: SR01-2049-S
Site Need Title: Technetium Chemistry Under Waste Removal Conditions
Need Summary: A better understanding of the chemistry of technetium and other significant waste contaminants is needed to improve waste removal in preparation for tank closure. A better understanding is needed of the chemistry of technetium and other compounds critical to HLW Tank Closure under the conditions of waste removal. During waste removal, conditions are different than during normal operation of the tank. A better understanding of these new chemical conditions is needed to properly plan and execute waste removal and closure of HLW tanks.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B588, Leaching and Treatment of Technetium for Tank Closure, TFA priority #30.

Site Need ID: SR01-2050-S
Site Need Title: Fracture Toughness Properties for Carbon Steel Utilized for Nuclear Waste Containment Vessels
Need Summary: Fundamental research is needed to build a materials property database which includes fracture toughness properties. These properties are critical for the analysis of current structural integrity and life extension of nuclear waste containment vessels.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B144, Tank Materials Properties, TFA priority #54.

Site Need ID: SR01-2053-S
Site Need Title: Develop an Alternative Sorbent to Replace Monosodium Titanate for Sr and Actinide Removal
Need Summary: New materials having improved Sr and Actinide removal performance are needed to replace monosodium titanate. Significant cost reduction in the permanent disposal of HLW can be achieved by concentrating the radioactive components into a small volume for incorporation in a highly durable borosilicate wasteform such as borosilicate glass and the disposing of the bulk of the waste in a less expensive low-level wasteform. To meet regulatory requirements for low-level waste disposal, liquid wastes must be treated to remove radioisotopes of cesium, strontium and transuranics. Salt processing alternatives under evaluation at the Savannah River Site currently specify the use of a monosodium titanate material for the removal of strontium and actinides. An improved material capable of removing strontium and actinides from alkaline waste solutions is needed.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B570, Salt Processing Project, TFA priority #0.

Site Need ID: SR01-2054-S
Site Need Title: Develop Improved Radiochemical Analysis for High Ionic Strength Samples
Need Summary: Fundamental research is needed in analytical chemistry to develop methodology to analyze high ionic strength samples without the attendant problems associated with dilution. Common methods for the elemental analysis of HLW include atomic absorption spectroscopy, inductively coupled plasma emission spectroscopy, and inductively coupled plasma mass spectrometry. These methods feature the capability to detect most of the periodic table over a wide range of concentrations. Pretreatment and disposal of HLW requires elemental characterization to ensure that radionuclide separation and solidification processes will operate as designed and that all regulatory requirements are met.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B264, Improve Waste Analytical Methods, TFA priority #55.

Site Need ID: SR01-2058-S
Site Need Title: Develop Solvent Extractant System for Co-Removal of Cesium, Strontium, and Other Actinides
Need Summary: A composite blend of crown eithers working in the same solvent extraction system has the potential for co-removal of cesium, strontium and actinides to reduce the cost of processing HLW at Savannah River. A solvent-extraction methodology is needed that meets the site decontamination requirements and is robust to degradation by chemical and radiolytic pathways. For acceptable performance, the technology should possess high selectivity, efficient extraction and stripping, and good hydraulic behavior. The strip effluent concentrated in the target radionuclides should be compatible with the current vitrification process being used at Savannah River. Downstream impact of the raffinate on production of the low-level wasteform should be minimal.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B570, Salt Processing Project, TFA priority #0.

Site: WVDP

Site Need ID: OH-WV-902
Site Need Title: Decontamination of High-Level Waste (HLW) Canisters (WVDP-2-99)
Need Summary: The vitrification of HLW at WVDP has produced more than 250 canisters of HLW (with a limited number to be generated in the future) requiring disposal in a deep geologic repository. The canisters are currently stored in a shielded cell within the Main Process Building at the WVDP. Prior to transport off-site for continued interim storage or disposal, the outer surfaces of the canisters must be cleaned to remove radioactive contamination resuling from filling, and from storage in a contaminated environment. A decontamination process that produces a secondary waste stream that can be managed readily for packaging, storage, and disposal is needed. A method such as Laser Induced Spectroscopy to perform radiological surveys of canisters after decontamination is also needed.

Technical Disposition: The TFA responded to this need within the following technical response(s):

- B204, Characterization Methods for Contaminated Large Equipment, TFA priority #64.
- B972, Alternative HLW Canister Decontamination Techniques, TFA priority #40.

Site Need ID: OH-WV-903
Site Need Title: Vitrification Expended Material Processing (WVDP-3-99)
Need Summary: A tooling system is needed to segregate, size reduce, decontaminate, and package metallic materials removed from the Vitrification Facility which are contaminated with HLW glass or slurry. The HLW removed from the materials would be returned to the operating melter, which itself has a finite life. The remaining metallic materials also need to be converted to a disposable form. The various tools must be deployable remotely for use in a highly radioactive environment.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B777, Remote Disassembly of HLW Melters and Other Processing Equipment, TFA priority #14.

Site Need ID: OH-WV-904
Site Need Title: High Level Waste Tank Closure
Need Summary: High level waste tank closure options being considered include tank removal and in-place stabilization. Technologies are needed for exhuming the tank that include remote decontamination equipment and dismantling equipment and for development of tank stabilization closure plans that may include grout mixing and delivery plans and performance assessments.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B310, Tank Decontamination and Dismantling, TFA priority #53.
- B985, Demonstration of Grout Injection Technology for Tank Closure. TFA elected not to fund this effort. West Valley's grout deployment and mixing needs are not yet sufficiently defined to determine if they have a need for an aggressive grout mixing and deployment technology. The MPI® technology is available if it is determined that it is needed.

Site Need ID: OH-WV-905
Site Need Title: Removal of Tank Residuals
Need Summary: A method to dislodge residual HLW affixed to the tank walls and internal structures of Tanks 8D-1 and 8D-2 may be needed to support future program needs.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B361, Heel Retrieval from Obstructed Tanks, TFA priority #3.

Site Need ID: OH-WV-906
Site Need Title: Radioactivity Measurement of High-Level Waste Residuals in Tanks and Ancillary Equipment
Need Summary: At the completion of High Level Waste retrieval the Residual radioactivity important to Low-level waste class C remaining in the tank farm needs to be measured accurately to provide tenable information that will support future program needs. When most of the HLW wastes are removed, the residual wastes remaining in the tanks will be in the form of sludge, diffused to corrosion products and adhered to tank internal support structures. Measuring residual activity of the radioactive waste material in the tanks is important to verify completion of HLW retrieval operations and to determine when the tank is clean enough to meet the Waste Incidential to Reprocessing criteria as described in DOE Order 435.1. Accurately measuring the remaining radioactivity levels of key radionuclides as set out in 10 CFR Part is necessary. An investigation of advanced assessment technology and measurement methods is necessary. Improvements in the methods being employed currently such as visual inspections, in-situ radiation sensors, and in-situ samplers may be needed. In addition, methods to assess piping and ancillary equipment radiological contamination are also needed.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B202, In-Situ Waste Characterization, TFA priority #33.

Site Need ID: OH-WV-907
Site Need Title: High-Level Waste Tank Interim Maintenance
Need Summary: Subsequent to the end of HLW processing, the tanks will contain residual waste that must be maintained in a stable configuration pending development of the final closure method. Interim maintenance methods for prevention of tank corrosion, monitoring the tank integrity, and implementing structural stability measures are needed.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B175, Tank Integrity Inspection Techniques, TFA priority #2.

Site Need ID: OH-WV-908
Site Need Title: Decontamination of High-Level Waste Contaminated Equipment
Need Summary: Methods to decontaminate equipment removed from the tanks to Class C radioactivity levels during waste retrieval operations are needed. Equipment could include items such as mobilization pumps, transfer pumps, and mechanical arms.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B311, Long-Length Equipment Handling, TFA priority #25.

Site Need ID: OH-WV-914
Site Need Title: Development of Grout for In-Situ Closure
Need Summary: A grout recipe is needed that includes reducing agents and sorbents for capturing and/or binding mobile radiological and chemical contaminants. The grout would also serve to stabilize residual salts in-place in the tanks. The grout would be used for in-situ high- level waste tank closure and for building stabilization to preclude the

release of contaminants to the environment when wastes are closed in place. The grout would also have the characteristics of being pourable/pumpable, possess structural strength, and able to be readily excavated in the event that an alternative method of closure is developed.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B923, Enhanced Grout Formulations for Tank Closure, TFA priority #18.

Site Need ID: OH-WV-915
Site Need Title: Processing of High Activity Waste with High Sodium Content
Need Summary: A means of treating highly radioactive waste to remove excess amounts of sodium in the form of sodium nitrite and sodium nitrate is needed. The amount of sodium is restricted by the current approved high level waste glass recipe to 8 % as sodium oxide. At such a limit, approximately 60 additional canisters of high level waste would be produced. The final waste form must stabilize the residual salts even at high concentrations.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B511, Sodium Salt Removal for Waste Volume Reduction, TFA priority #48.

Site Need ID: OH-WV-916
Site Need Title: Hazardous Waste Measurement of Residuals in Tanks Piping and Ancillary Equipment
Need Summary: A plan and necessary tooling (e.g., sampling tools, analytical protocols, computer based models, etc.) that allow the WVDP to characterize the remaining residues in the HLW tanks for purposes of closure plan development activities in accordance with the Resource Conservation and Recovery Act is needed. This task would also support implementation and documentation of the results.
Technical Disposition: The TFA responded to this need within the following technical response(s):

- B202, In-Situ Waste Characterization, TFA priority #33.

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