



U.S. DEPARTMENT OF **ENERGY**

Journey to Excellence Goal 2

Reduce the life-cycle costs and accelerate the cleanup of the Cold War environmental legacy

EMAB Presentation

June 23, 2011

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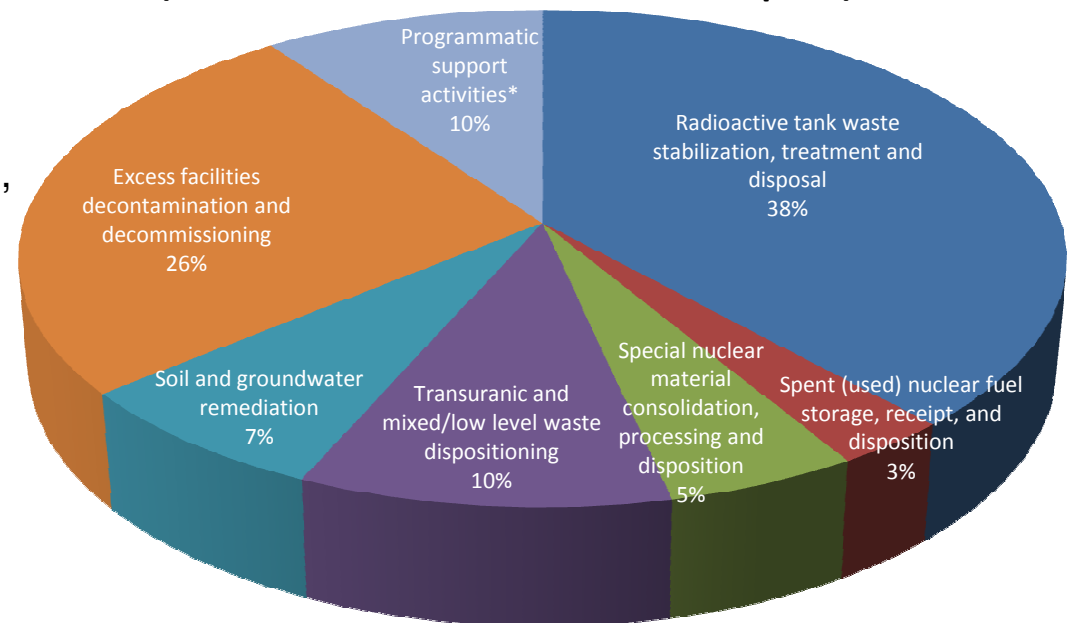
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EM Priorities:

- Activities to maintain a **safe, secure, and compliant** posture in the EM complex
- **Radioactive tank waste** stabilization, treatment, and disposal
- **Spent (used) nuclear fuel** storage, receipt, and disposition
- **Special nuclear material** consolidation, processing, and disposition
- **Transuranic and mixed/low-level waste** disposition
- **Soil and groundwater** remediation
- Excess facilities **decontamination and decommissioning (D&D)**

“To-Go Life-Cycle Costs”
(\$185B - \$218B as of the FY 2012 Request)



* Program Direction, Program Support, Community & Regulatory Support, Technology Development & Deployment, and Post-Closure Administration



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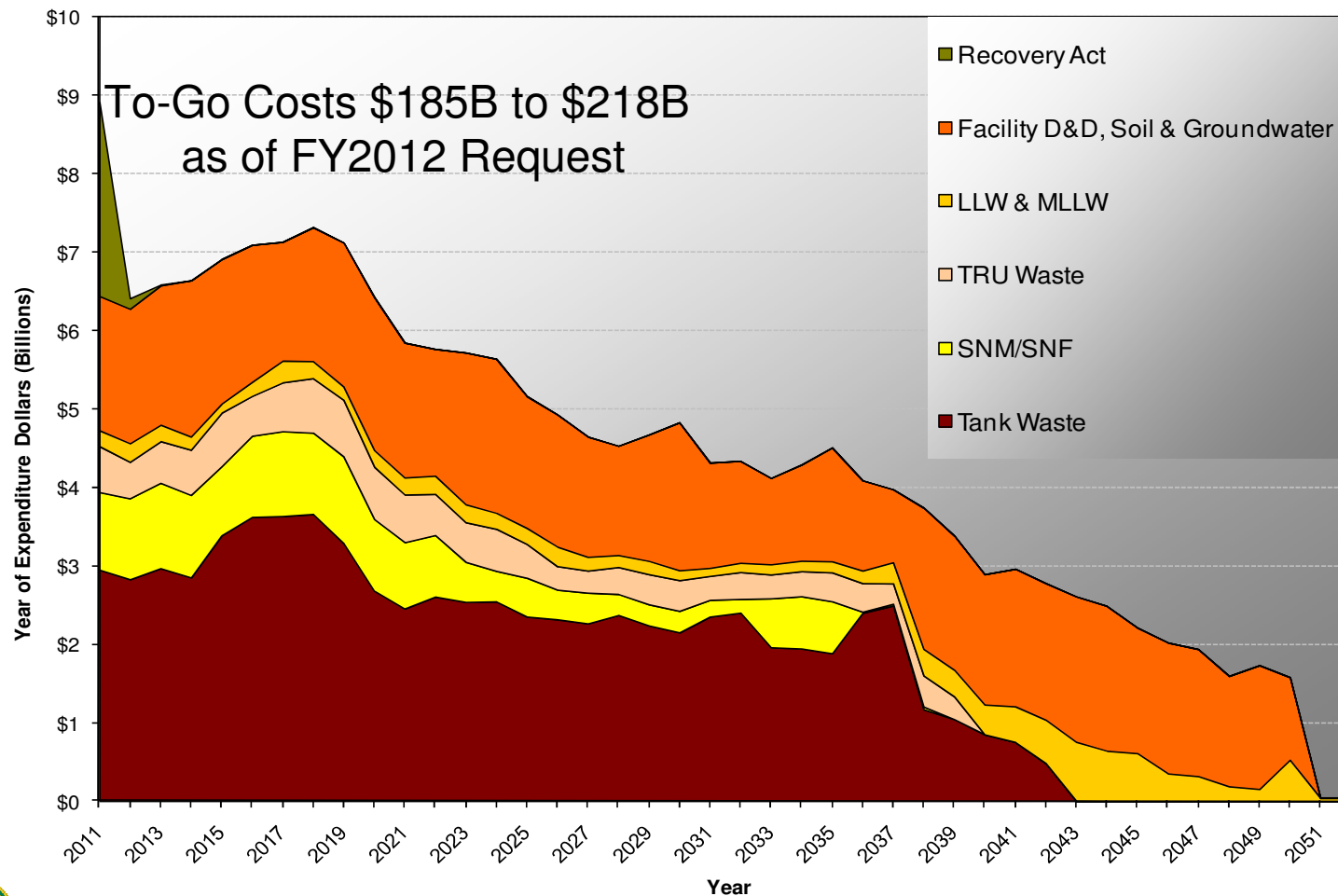
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Life-Cycle Cost Profile

Environmental Management Costs by Program Area



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Program Goals

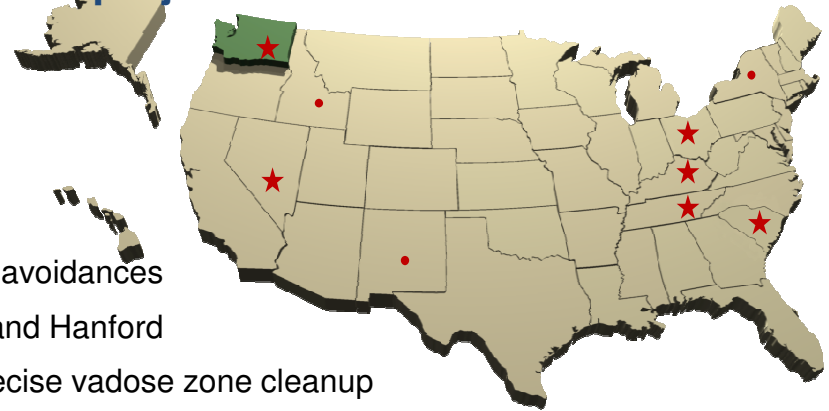
Building on the ARRA momentum, the EM team will:

➤ **Complete the three major tank waste construction projects:**

- Waste Treatment Plant by 2016 (operational 2019)
- Salt Waste Processing Facility by 2014 (operational 2014)
- Sodium Bearing Waste Facility by 2011 (operational 2012)

➤ **Reduce the life-cycle costs by up to \$43B:**

- Recovery Act investments – \$7 billion in cost savings and cost avoidances
- Transformational tank waste technology – up to \$19B at SRS and Hanford
- Advanced simulation tool – up to \$10B saved through more precise vadose zone cleanup
- Accelerate Gaseous Diffusion Plant facilities D&D by turning valuable metals into assets - \$6.9B savings



➤ **Disposition 90% of legacy TRU waste by 2015**

- All EM cleanup waste to WIPP by 2020, except for Hanford
- Approximately 41,000 m³ of TRU waste remains to be disposed to accomplish the 2015 goal. Through 2010, approximately 77,000 m³ of the 118,000m³ (90% of the adjusted inventory) has been dispositioned.

➤ **Shrink the EM legacy footprint 90% by 2015**

- In 1989, legacy cleanup footprint was 3,125 sq miles. By 2015, it will be reduced to 90 sq miles
- All Material Access Areas eliminated
- 2,636 facilities complete; 7,745 remediations complete



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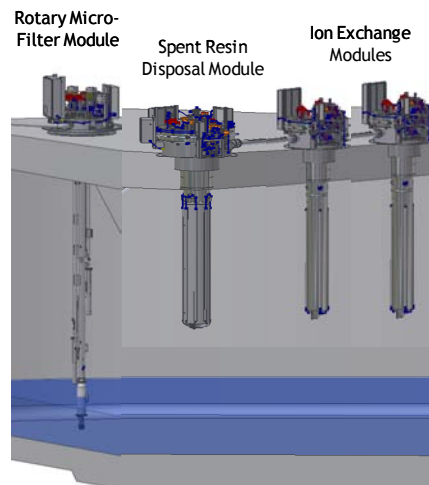
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Reduce the life-cycle costs by up to \$43B and accelerate the cleanup of the Cold War environmental legacy

- Enhanced Tank Waste Strategy:
 - ✓ SRS – accelerate cleanup completion by 6 years, reducing LCC by \$3.2 Billion
 - ✓ Hanford – accelerate cleanup completion by 7 years, reducing LCC by \$16 Billion
 - ✓ Idaho – develop treatment path forward for calcine waste, commence FBSR on sodium-bearing waste
- Develop passive remediation technologies – reduce reliance on active pump-and-treat systems, use Advanced Simulation Capability for Environmental Management (ASCEM) high-performance modeling to enable risk-based vadose zone cleanup decisions
- Generate revenue to accelerate D&D by recovering valuable metals from GDP facilities



Pilot-Scale WFE,
Vapor Discharge End



Fluidized Bed Steam Reformer



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Goal 2

Enhanced Tank Waste Strategy

Hanford -- \$16B savings

- ▶ Small Column Ion Exchange (SCIX) and Rotary Microfilter (RMF)
- ▶ FBSR as supplemental treatment
- ▶ HLW improved vitrification capacity
- ▶ Tank Waste Retrievals
 - ▶ Single Shell Tank (SST) waste staging
 - ▶ Hard heel retrieval technology
 - ▶ Wiped film evaporators
 - ▶ Tank chemical cleaning
- ▶ FBSR as secondary waste treatment
- ▶ Package contact-handled TRU tank waste for offsite disposition

Key Strategies

SRS -- \$3.2B savings

- ▶ Small Column Ion Exchange (SCIX) and Rotary Microfilter (RMF)
- ▶ Next Generation Solvent (NGS) and ARP/MCU life extension
- ▶ DWPF throughput improvements
- ▶ Tank chemical cleaning

Key Strategies



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Enhanced Tank Waste Strategy

Updated SRS Liquid Waste Operations Baseline to reflect \$3.2 B savings

- Fall 2010, SRS presented the proposed ETWS savings in PBS-14C, Liquid Waste Operations, to the EMAAB and obtained their endorsement
- EM-1 approved the update to the PBS-14C baseline, implementing the ETWS savings, in advance of a complete, recertified site baseline
- SRS updated IPABS to reflect the improved baseline as well as updated PBS-14C performance metrics



Goal 2

Enhanced Tank Waste Strategy

SRS

RMF/SCIX



- ▶ Combination of Rotary Microfilters and Small Column Ion Exchange to process salt waste
- ▶ Technology maturation in progress with Technology Readiness Assessment planned in September 2011
- ▶ Detailed design in progress for installation into Tank 41
- ▶ Using non-elutable Crystalline Silicotitanate (CST) resin with grinder to prepare resin to be fed into DWPF
- ▶ Close integration with Hanford to share lessons learned for Hanford's development and deployment

Key Activities in 2011



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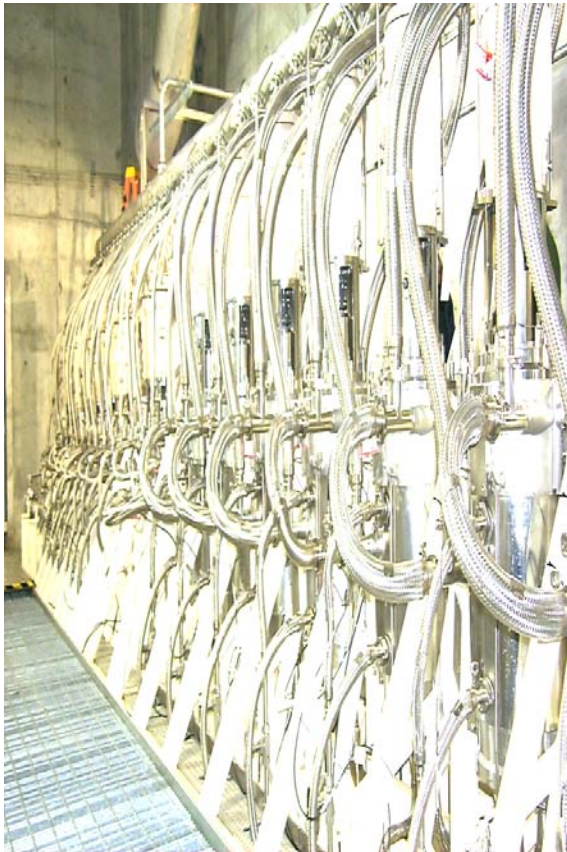
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Goal 2

Enhanced Tank Waste Strategy

SRS

Next Gen Solvent



- ▶ Next Generation Solvent (NGS) under development for use in the Actinide Removal Process/Modular Caustic Side Solvent Extraction Unit (ARP/MCU)
- ▶ Will provide operational experience for the Salt Waste Processing Facility under construction
- ▶ NGS testing demonstrated improved Cesium extraction – technology maturation strategy in place to insert new chemistry in existing equipment
- ▶ TRL 6 to be achieved by September 2011
- ▶ Extend the operations of ARP/MCU till SWPF startup through process/equipment upgrades, performance monitoring, and appropriate regulatory approvals

Key Activities in 2011



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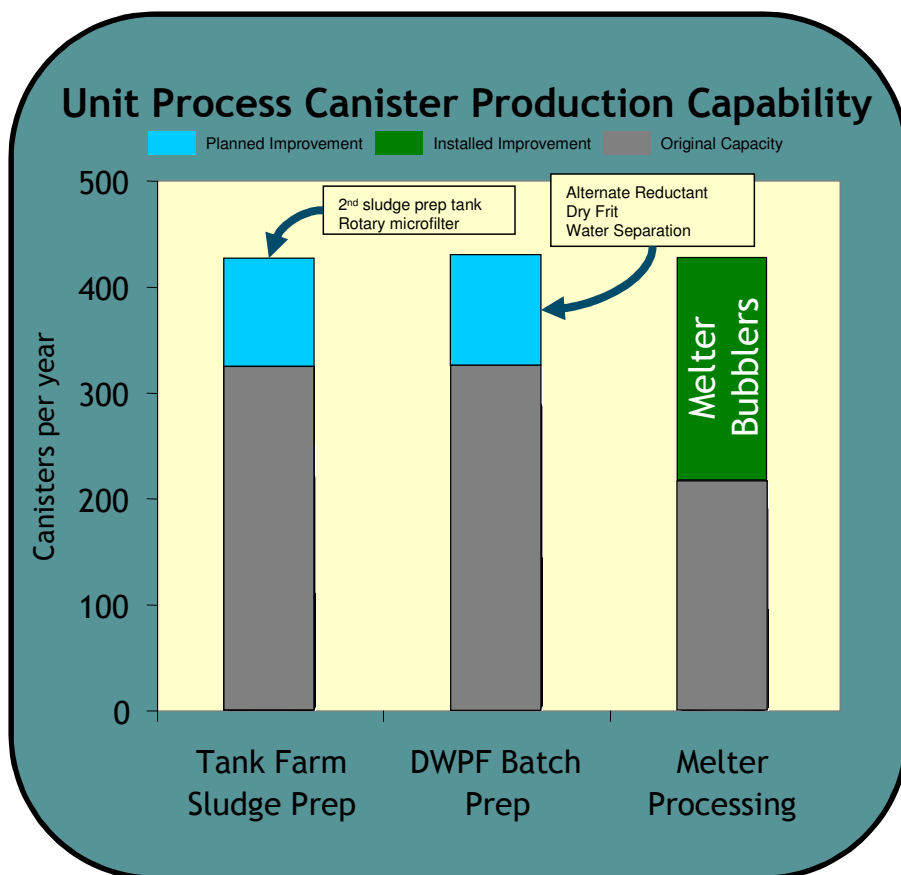
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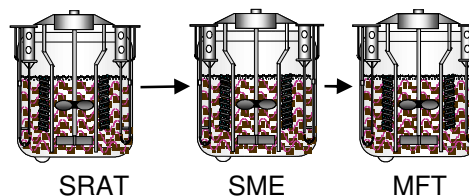
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ETWS SRS DWPF Enhancements

Several efforts underway to improve DWPF throughput – substantial improvement already gained through installation of bubblers in the melter.



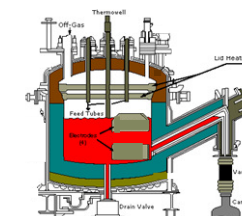
DWPF Chemical Process Cell



DWPF Batch Prep

- Alternate reductant
- Dry process frit addition
- Water separation from decon frit
- Provide flexibility for strip effluent addition
- Analytical Cycle Time Improvements

DWPF Melt Cell



Joule Heated Melter

Melter Processing

- Deployed melter bubblers
- Deploy high capacity canisters
- Improvements Melter Off Gas Operation



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Enhanced Tank Waste Strategy

SRS

Enhanced Chemical Cleaning



- ▶ Demonstrated successful combination of bulk retrieval using mixer pumps and hydrolances, and mechanical heel removal using robotic Sand Mantis in tanks with no cooling coils
- ▶ Developing Enhanced Chemical Cleaning for tanks with coils – using oxalic acid with an oxalate decomposition step to minimize impact on salt waste processing and vitrification
- ▶ Close integration with Hanford to share lessons learned as both sites develop new tools for tank waste characterization, retrieval, and closure

Key Activities in 2011



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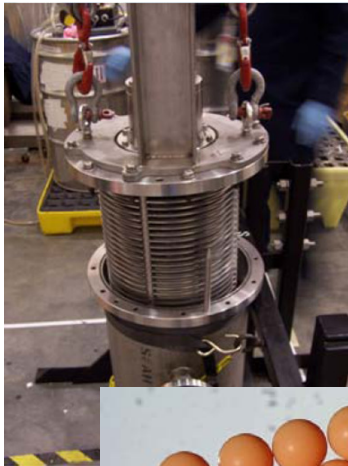
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Enhanced Tank Waste Strategy

Hanford

Rotary Microfilter and Small Column Ion Exchange



- ▶ Received Approval of Mission Need for the Supplemental Treatment Project in January 2011
- ▶ Performed Supplemental Pretreatment alternatives analysis – leveraging SRS development of Rotary Microfilter and Small Column Cesium Ion Exchange technologies for planned In-Tank Deployment – conceptual design by September 2011
- ▶ Supplemental Pretreatment deployment supports both ETWS and WTP 2020 Vision

Key Activities in 2011



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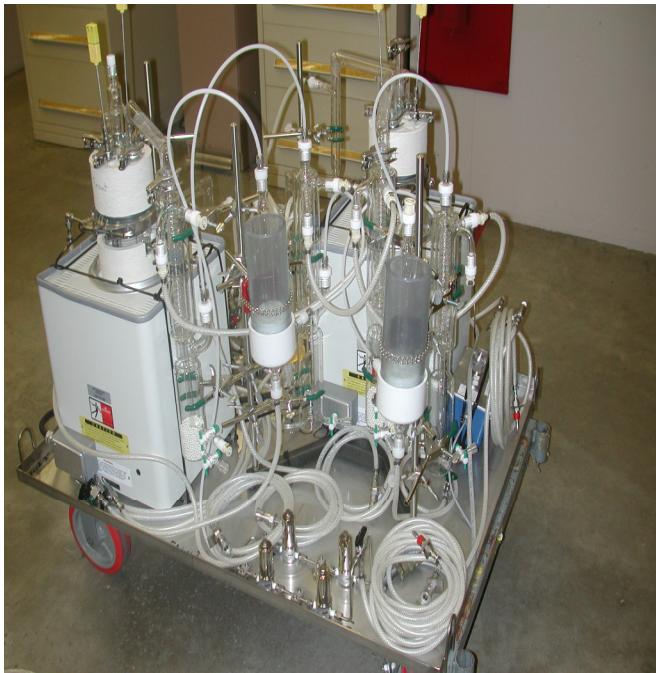
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Goal 2

Enhanced Tank Waste Strategy

Hanford

Fluidized Bed Steam Reforming



- ▶ Five different waste types undergoing Bench Scale Steam Reformer (BSR) testing at SRNL – including three Hanford tank waste samples
- ▶ BSR product – granular and monolith forms – undergoing waste form durability analysis at SRNL and PNNL – preliminary results promising – more results in Summer 2011
- ▶ Using BSR testing results from SRNL and PNNL to support development of Supplemental Immobilization data packages – DOE Expert Panel Review for alternative analysis planned for late 2011
- ▶ Alternatives analysis for Secondary Waste Treatment in Summer 2011 with FBSR among potential choices

Key Activities in 2011



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Goal 2

Enhanced Tank Waste Strategy

Hanford

Improved HLW Vitrification Capacity



- ▶ HLW improved vitrification capacity (1.5 – 2 X) starting in 2025 –using Next Generation Melters and enhanced glass formulations
- ▶ Potential technologies:
 - Advanced Joule-heated melters
 - Cold Crucible Induction Melter (CCIM)
 - Iron Phosphate glass
- ▶ Performing melter off-gas stream recycle testing at the Vitreous State Laboratory to validate assumptions for high Tc incorporation into glass

Key Activities in 2011



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Enhanced Tank Waste Strategy

Hanford

Single-Shell Tank Retrieval Improvements



- ▶ SST retrievals currently limited by available DST space
- ▶ Peak retrieval rates necessary to support WTP and Supplemental Immobilization presents challenge (>10 tanks per year at peak)
- ▶ Staging of SST waste from “leaker” tanks into sound SSTs “level-loads” the retrieval mission, reducing waste feed delivery risks
- ▶ Implementing expert panel recommendations to validate integrity of sound SSTs
- ▶ Developing modular wiped-film evaporators to minimize liquid volume in sound SSTs used for staging – building full scale model and planning for lab scale testing with actual waste in hot cell
- ▶ Deploying Mobile Arm Retrieval System (MARS Sluicing version) in Tank C-107
 - ▶ Testing demonstrated substantial improvement in bulk waste and hard heel retrieval
 - ▶ Performing integrated testing of MARS Eductor version for use in “assumed leaker” tanks.
- ▶ Integrating with SRS on development of tank chemical cleaning.
- ▶ Kicked off effort to develop a contact-handled TRU tank waste retrieval, treatment, packaging, and shipment program (8-11 tanks)

Key Activities in 2011



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Savannah River/Idaho

- Perform integrated system testing of RMF/SCIX at SRS while performing detailed design
- Institute ARP/MCU life extension program
- Deploy Next Generation Solvent into the ARP/MCU
- Implement DWPF improvements in frit delivery, replacement reductant, and capability to deliver SWPF Cs effluent to DWPF
- Continue development and real waste testing of the Enhanced Chemical Cleaning System
- Enhance capacity and reliability of the saltstone facility to support accelerated salt waste disposition
- Upgrade utilities and services to support RMF/SCIX and ARP/MCU



Journey to Excellence Goal 2 - Next Steps

Hanford

- Perform detailed design of RMF/SCIX at Hanford while building on the testing of similar systems at SRS
- Complete comprehensive waste form performance testing of FBSR immobilization using Hanford waste in support of the downselect process for LAW and secondary waste
- Complete Tc recycle testing at VSL in support of Hanford's supplemental LAW immobilization downselect
- Complete supplemental LAW immobilization conceptual design
- Continue Next Generation HLW Melter and Tank Chemical Cleaning technology development
- Perform integrated testing of the Mobile Arm Retrieval System with waste vacuum capability for suspected leaker tanks
- Continue SST integrity evaluation in support of SST Waste Staging
- Develop and submit Class 3 Permit Modification Request to CBFO to include waste from the contact-handled TRU tanks into the WIPP permit



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