Tank Waste Strategy Update

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Waste Processing: Treatment and Disposal of Radioactive Waste

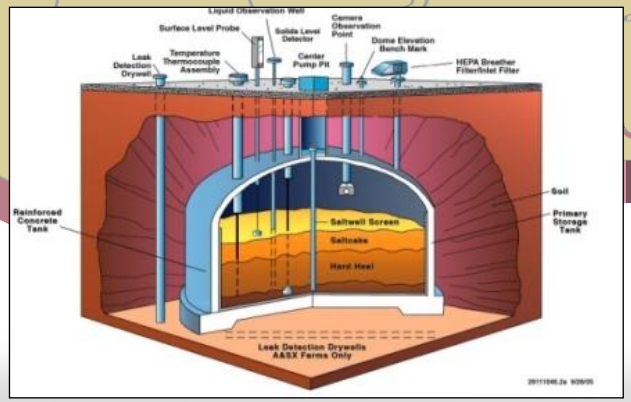
Mission: Treat 92 million gallons (343 million liters)
505 million curies of radioactive tank waste (7.39×10^{18} becquerels)

Hanford –
176M curies; 55M gallons
177 Tanks

Idaho –
37M curies, 900K gallons
15 tanks (11 closed)

Savannah River Site – 292M curies; 37M gallons
51 Tanks (4 closed)

West Valley Demonstration Project– ~ 25M curies in 275 vitrified waste canisters
4 tanks



Tank Waste Strategy Overview

- **Treatment and disposal of tank waste is the most technically challenging and expensive component of the EM Cleanup program.**
  - Current estimates indicate it will take 35 years and $90 billion to complete.

- **The development of new technologies can reduce the schedule and cost by up to one third.**

Tank Waste Strategy Challenges

- The key challenges facing the tank waste program are to reduce technical uncertainties associated with waste treatment, meet compliance commitments and reduce the life-cycle cost of the program:
  - Reduce the technical uncertainty associated with the treatment and disposal of tank waste, in particular at the Waste Treatment Plant;
  - Accelerate treatment and processing schedules;
  - Reduce or eliminate the need for additional large processing facilities;
  - Develop more effective and efficient treatment and processing technologies;
  - Final disposal of High Level Waste; and
  - Maintain core technical competencies at national laboratories and other institutions.

Tank Waste Budget

- EM Budget for FY-2012; $ 5.65B

- Tank Waste Budget for FY- 2012: $ 2.12B
  - ORP: $1.18B
  - SRS: $ 0.83B
  - ID: $ 0.11B

- The Budget for Tank Wastes is approximately 37% of the total EM budget.

20 Years of Progress in the Management of Tank Waste

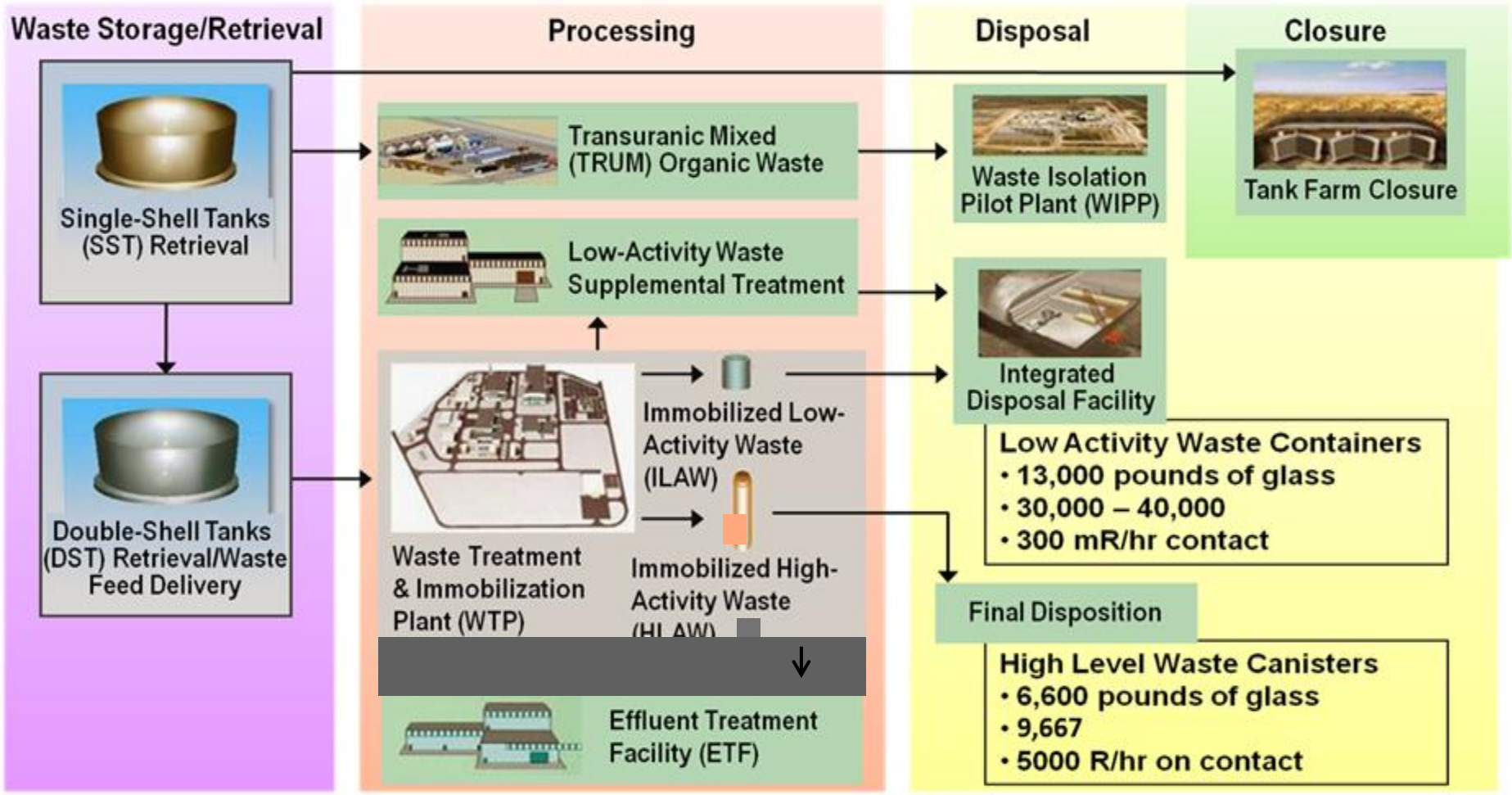
- Stabilized millions of gallons of radioactive tank waste
- Completed 15 tank closures (4 tanks at Savannah River; 7 large and 4 small tanks at Idaho)
- Completed 16 tank retrievals
- Savannah River Site Tank Waste Processing
  - Defense Waste Processing Facility operational in 1996
    - Over 3,500 canisters produced
  - Salt processing facilities operational in 2008
    - Approximately 3 million gallons of salt waste processed.

20 Years of Progress in the Management of Tank Waste (cont'd.)

- West Valley Demonstration Plant
  - Vitrification facility operational in 1996
  - Produced 275 canisters of vitrified high level waste
  - Completed processing in 2002

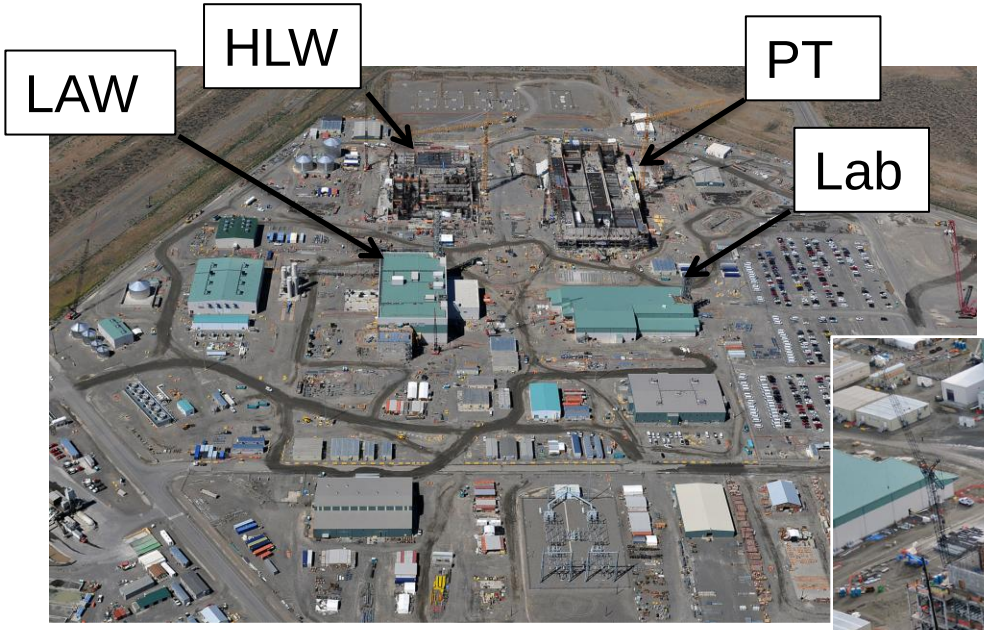
- Began Construction on three additional tank waste processing facilities
  - Hanford Waste Treatment and Immobilization Plant (2003)
  - Savannah River Salt Waste Processing Facility (2007)
  - Idaho Sodium Bearing Waste Treatment Facility (2007)

Tank Waste Processing: Hanford



Waste Treatment and Immobilization Plant Facility in Construction

Hanford Site Waste Treatment and Immobilization Plant



- 257,000 cubic yards concrete
- 34,600 tons structural steel
- 980,000 feet piping

- 2,055 tons ductwork
- 946,000 feet electrical raceway
- 4.2 million feet electrical cable

Pretreatment Facility (PT)

Office of River Protection
WTP Technical Issue Resolution

➢ Waste Treatment Plant Design Completion Team

Teams are being formed, preliminary deliverable schedules will be available at end of 2012

- Core Team
  - Leadership and Management

- Technical Teams
  - Full Scale Vessel Testing
  - In-Service Inspection/Redundancy
  - Black Cell Analysis
  - Erosion/Corrosion
  - Tank Farm Pre-treatment Requirements

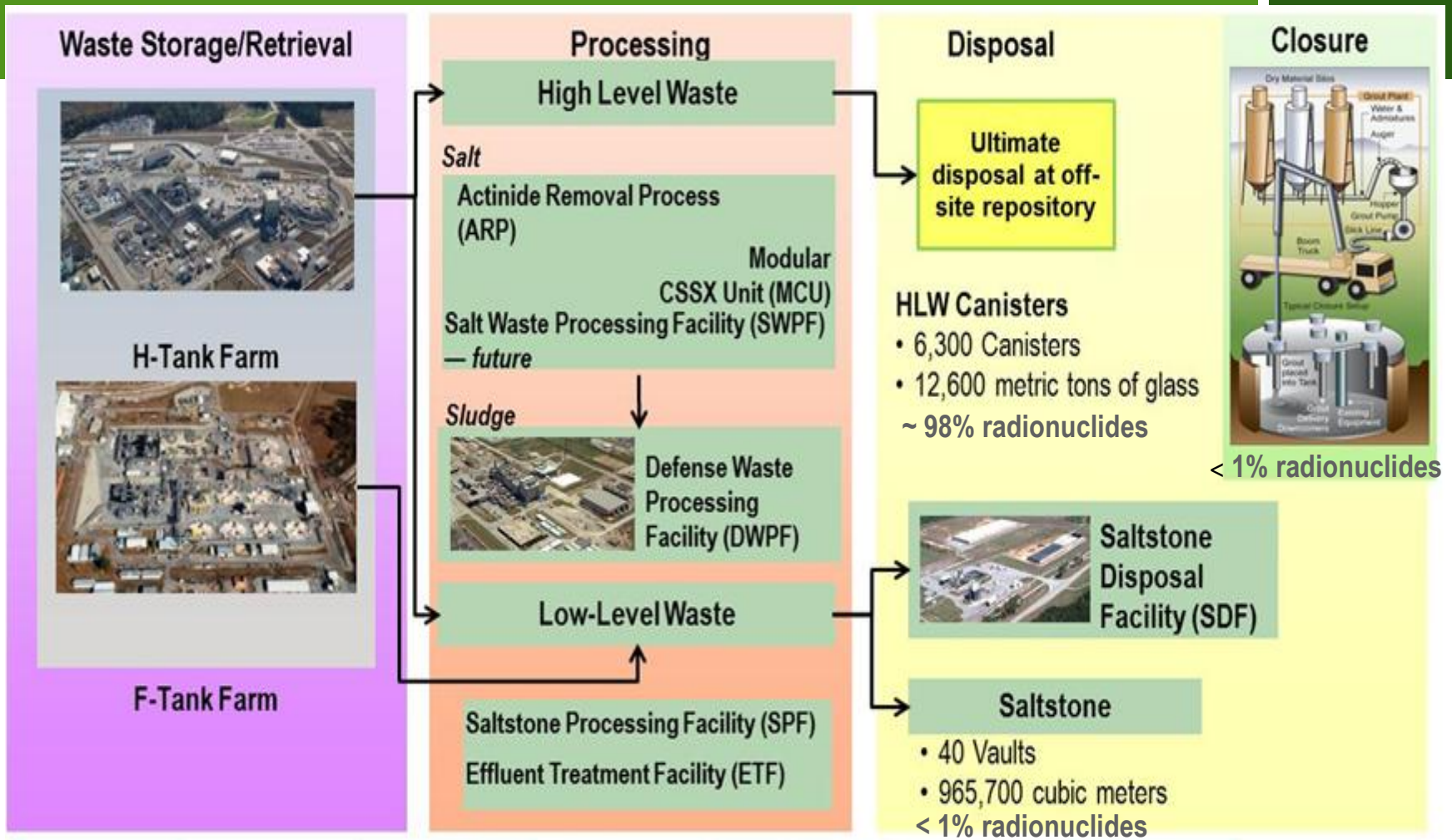
Office of River Protection
WTP Technical Issue Resolution

➢ River Protection Project Mission Definition Resolution Team

Teams are being formed, preliminary deliverable schedules will be available at end of 2012

- Evaluation of RPP Mission Alternatives
  - Subordinate Technical Teams
    - Select Supplemental Treatment LAW Waste Form and Secondary Waste Form
    - Evaluate System Changes for IHLW Waste Form Production and Disposal
    - Assess Alternative RPP Mission Strategies
      - ✓ Separate LAW Operation
      - ✓ Separate HLW Operation
      - ✓ TRU Waste Packaging

Tank Waste Disposition Process
Savannah River



Salt Waste Processing Facility in Construction

Savannah River Site Salt Waste Processing Facility

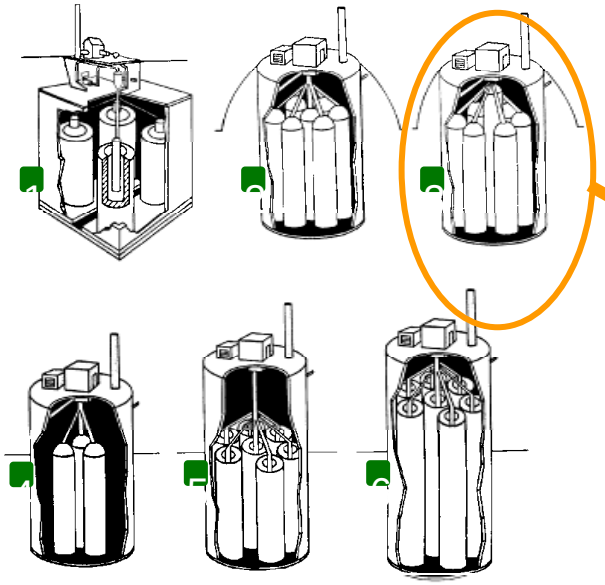
Savannah River Site Technology Activities

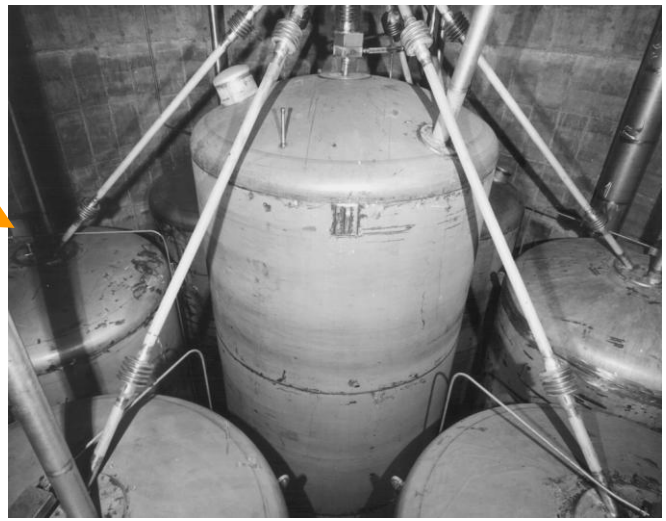
- SCIX is an in-tank supplemental salt waste processing technology that can augment SWPF capability by up to 2.5M gallons per year.
- Deployment of Next Generation Solvent in ARP/MCU to ramp-up production
- Improvements to glass loading, melter throughput, saltstone improvements

Tank Waste Processing: Idaho

Idaho National Laboratory (Three Waste Streams):

- Calcine (granular solid) 4,400 m^3 in 7 bin sets
- Sodium Bearing Waste (SBW) – 900,000 gal





Sodium Bearing Waste Treatment Facility in Startup

- Recovery plan in place from June 2012 offgas event
- Expect Resumption of startup in Spring 2013
- Approximately one year operation to treat remaining 900,000 gallons of liquid sodium-bearing waste

Idaho National Laboratory

Sodium Bearing Waste Treatment Facility

EM International Waste Processing Collaborations

Canada
- AECL: Discussions with CRL to identify areas of collaboration

United Kingdom
- Joint EM/NE /SC long-term HLW glass performance.
- NNL: Tank Waste Retrieval – Cryograb Technology, glass chemistry and analysis
- University of Sheffield: Sulfur solubility model

Russia
- ETU 'LETI': CCIM design enhancements, parametric studies for FeP and AlSi waste forms
- SIA Radon Institute: CCIM testing, glass analysis techniques
- KRI: Glass formulations, melt rate testing
- Joint EM/NE/SC long- term HLW glass performance – in discussion

South Korea
- KHNP/NETEC: Large Scale CCIM Design
- Joint EM/NE/SC long-term HLW glass performance – in discussion

France
- Joint EM/NE/SC long - term HLW glass performance
- CEA: Glass formulations
- AREVA: Large Scale CCIM Testing (ART).

Japan
- Fukushima NPP clean-up workshop and support
- Joint EM/NE/SC long -term HLW glass performance.
- JNFL: Waste forms, Vitrification technologies
- Joint EM/NE discussions on areas of potential collaboration

Belgium
- Joint EM/NE/SC long term HLW glass performance.

Italy
- Joint EM/NE/SC long- term HLW glass performance.

China
- PUNT JCC: Processing and disposal of HLW glass
- Joint EM/NE/SC long-term HLW glass performance

Germany
- Joint EM/NE/SC long- term HLW glass performance.

Australia
- ANSTO: Hot Isostatic Pressing for Calcine, Mineral analog waste forms
- Joint EM/NE/SC long -term HLW glass performance.

Tank Waste Corporate Board for Integration of Tank Waste Activities

- Why a Tank Waste Corporate Board?
  - Previous Tank Waste Boards since early 1990's had mixed success
  - Most recent Board had lapsed since October 2010
  - Viewed as cornerstone to re-energize EM focus on integration and collaborative solutions
- How did we get the Board started again?
  - First meeting in August 2012 at Idaho Falls included 40 attendees from:
    - DOE and prime contractor representatives from HQ and field sites,
    - National Laboratories, and
    - Invited guests from the Energy Facility Contractors Group (EFCOG)
  - Prepared and approved an updated Charter
  - Opened a productive and collegial dialogue

Tank Waste Corporate Board for Integration of Tank Waste Activities

- Achievements
  - Broad interest and engagement across the 'Tank Waste community'
  - Information exchange on key topics:
    - Laboratory Role in Tank Waste Management and Multi-Site System Approach
    - Technetium Technology and Next Generation Vitrification
    - Lessons Learned from Sodium-Bearing Waste project
  - Tank Waste Corporate Board chartered groups for further study:
    - *Tank Closure Working Group* - coordination on tank closures.
    - *Tank Waste Performance Measures Working Group* - improved tank waste PMs
- Next Steps
  - Continued engagement on key tank waste issues
  - Next meeting near Savannah River in March/April 2013

Summary of EMAB Recommendations:

Recommendation	Response
Support sequential WTP commissioning to include early LAW	The WTP project is currently being reviewed and rebaselined in connection with Secretarial review.
Support management realignment and integration between the Tank Farms and WTP.	The EM program has been reorganized to provide Mission Unit support to improve field alignment.
Implement and deploy a general planning model suited for uncertainty analysis, operator-based sensitivity analysis, and optimization of retrieval, blending, and processing.	Model development by MITRE for SR waste treatment is providing initial basis to address this recommendation. It is planned to expand MITRE to Hanford.
Evaluate failure of 242-A evaporator	The evaporator has been refurbished and the evaluation completed.
Develop risk strategy for waste delivery	This recommendation will be deferred until the WTP project review and rebaselining are completed.
Analyze alternatives for LAW	The WTP project is currently being reviewed and rebaselined in connection with Secretarial review.
Work with regulators to develop options to provide flexibility and improve permitting	DOE is coordinating closely with the State of Washington regulators.

Summary of EMAB Recommendations:
(Continued)

Recommendation	Response
Conduct full scale SCIX testing.	The SCIX system at SRS had be deferred because of a funding shortfall. It is anticipated that the project will be restarted in the future.
Conduct additional RMF testing with a range of actual Hanford tank waste samples.	The experimental program utilizes both actual waste samples as well as simulants. The focus is on SRS first.
Evaluate options, e.g. steam reforming, for Tank 48H processing.	The SRS Liquid Waste Stem Plan is currently being revised to include alternatives that do not use Tank 48H.
Evaluate alternatives to sRF ion exchange resin.	EM-21 is funding a TDD project in next generation cesium solvent which addresses this recommendation.
Evaluate Cross Flow Filtration (CFF) for supernate at Hanford.	Deferred due to lack of funding.
Near-term technological development focus on JHM. If an alternative melter technology is needed, develop CCIM .	EM-21 is funding research in advanced glass melters as well as advanced glass formulations that address this recommendation.
The difficulty in capturing volatile contaminants (e.g., Tc-99) in LAW glass should be considered in alternative treatment processes and waste forms for Hanford.	Alternative treatment and Tc studies are being evaluated as part of the Secretarial review.

Conclusions

- The integration of EM's Tank Waste programs is ongoing:
  - Tank Waste Corporate Board
  - Building on SRS successes – sludge preparation, salt preparation (ARP/MCU)
  - Technology development - Small Column Ion Exchange

- EM will be dispositioning recommendations as part of an integrated strategy.

- The Tank Waste Corporate Board will have a key role in formulating and promulgating the tank waste integrated strategy.

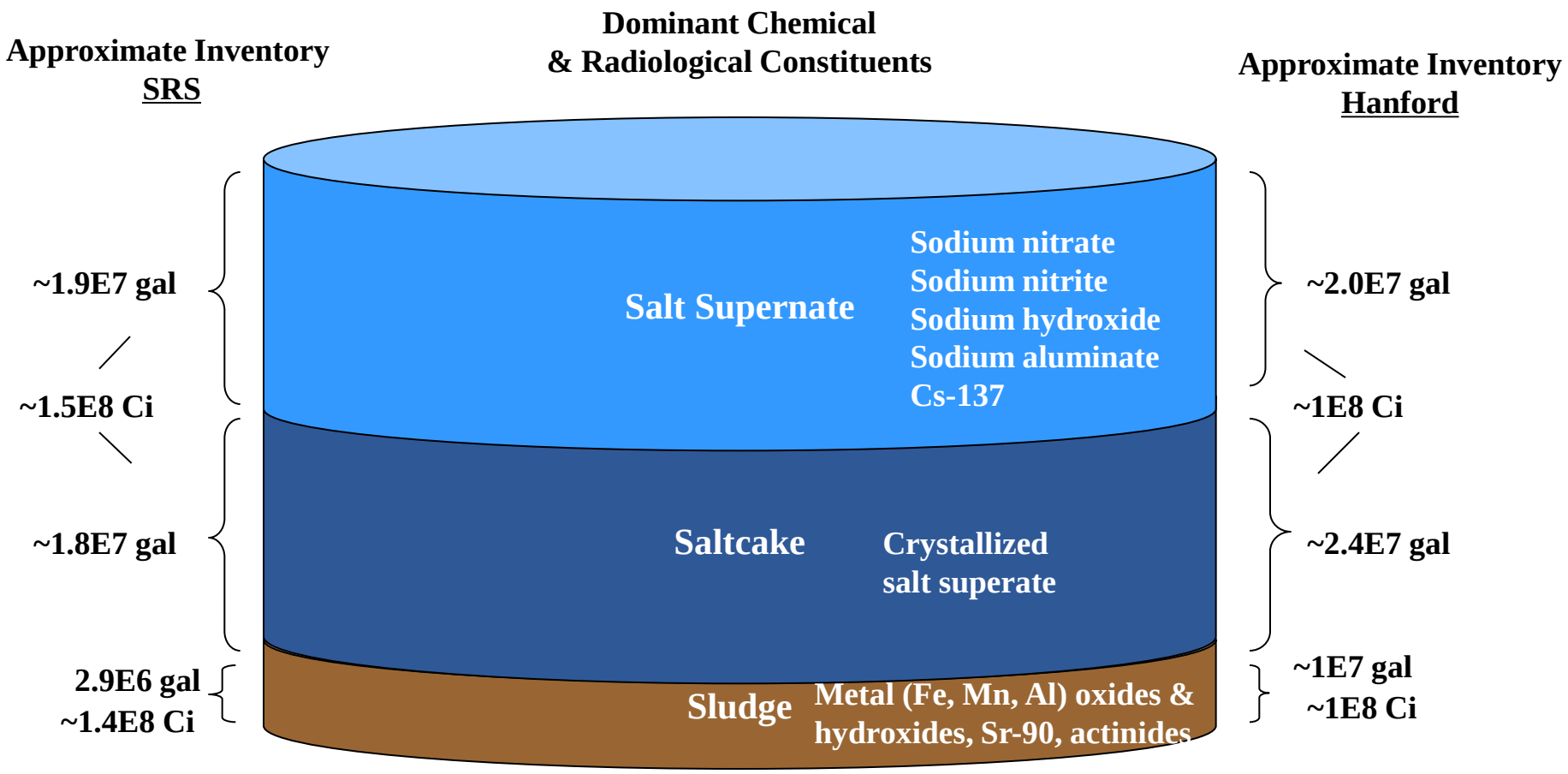
- Sharing of system planning and risk management tools will result in efficient and consistent systems plans at all tank waste sites.

- R&D directed to tank waste processing and waste forms may potentially yield significant cost savings.

Backup

Tank Waste Strategy Update

High Activity Waste Tanks



The Tank Waste program has been reviewed by:

- The Environmental Management Advisory Board (EMAB) Tank Waste Subcommittee
- Technical Expert Group (TEG) EM Tank Waste Strategy Review
  - Research and Development Plan
  - Technical Planning, Integration and Risk Management
  - Waste Retrieval and Tank Closure
  - Alternative Waste Treatment
  - Improved Vitrification Capacity and Increased Waste Loading
- Defense Nuclear Facilities Safety Board Recommendation on Tank Waste Management at SRS and ORP.
- Construction Project Reviews
  - Salt Waste Processing Facility (4 reviews – last October 2011)
  - WTP (5 reviews – last August 2011)
  - Specific set of Recommendations for each facility from each review
- Technical reviews of at-tank technologies
  - External Technical Review of Small-Column Ion Exchange (Feb 2011)
  - Technology Readiness Assessment of SCIX (Completing)
  - Secretary Team Review of WTP Black Cells