History of Supplemental LAW Treatment Reviews

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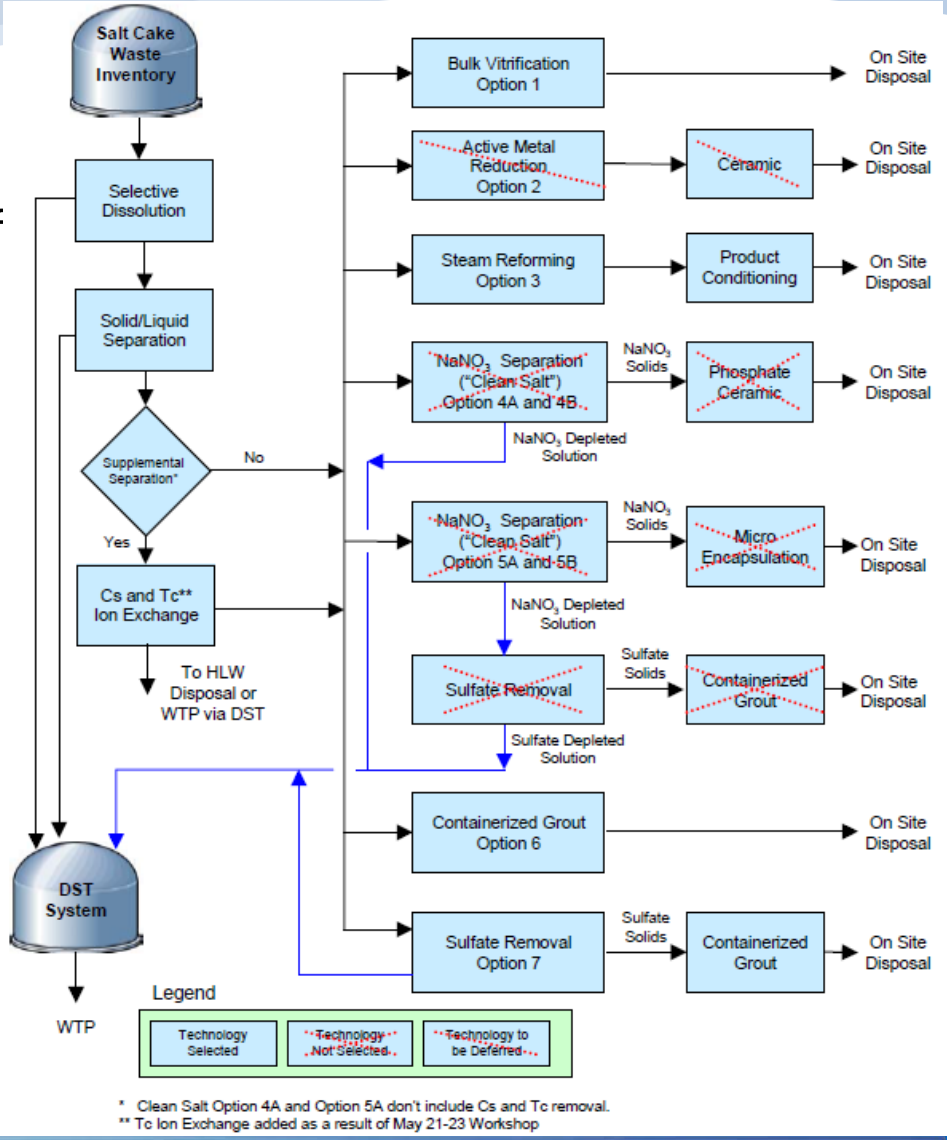
Decision to Treat Tank Waste

- DOE's Preferred Alternative in the TWRS EIS ROD (1997)
  - "Phased Implementation" for treatment of Tank Waste
  - Phase I was a planned 10 year Demonstration Phase
  - Phase II was an estimated 30 year full scale production phase
  - Phase II presumed to be LAW Vitrification but would consider other immobilization technologies provided the final waste forms would meet regulatory requirements
  - DOE committed to continue technology development to reduce uncertainties and evaluate emerging technologies
  - DOE also committed to use technology development and lessons learned from Phase I to improve efficiencies and reduce costs for Phase II

Mission Acceleration Initiative

- Mission Acceleration Initiative
  - Began in May 2002 with objective of evaluating technologies that could supplement the WTP planned throughput
  - Goal of reducing RPP mission duration by 20 years or more
  - Assessed two dozen candidate technologies
  - Down-selected to four technologies for further evaluation



MAI Downselect

- Technologies selected for further evaluation
  - Bulk Vitrification
  - Steam Reforming
  - Containerized Grout (Cast Stone)
  - Sulfate Removal
- Evaluation documented in RPP-11261, Recommendation for Supplemental Technologies for Potential Mission Acceleration, July 2002.
- Testing of technologies was recommended up to and including pilot scale tests with simulants and bench scale tests with real waste
- Selections further refined in RPP-17963, Initial Selection of Supplemental Treatment Technologies for Hanford's Low-Activity Tank Waste, February 2004.

Waste Form Testing to Support MAI

- Bulk Vitrification
  - Extensive design and testing up to a full scale demonstration system
    - RPP-30570, Technical Assessment of Bulk Vitrification Process & Product for Tank Waste Treatment at the Department of Energy Hanford Site, July 2006.
    - RPP-31314, A Comprehensive Technical Review of the Demonstration Bulk Vitrification System, September 28, 2006
    - CH2M-36501-FP, Design of the Demonstration Bulk Vitrification System for the Supplemental Treatment of Low Activity Tank Waste at Hanford, February 2008.
    - PNNL-15193, Bulk Vitrification Castable Refractory Block Protection Study, May, 2005.
    - PNNL-14985, Feed Variability and Bulk Vitrification Glass Performance Assessment, January 2005.
    - PNNL-16267, Investigation of Tc Migration Mechanism During Bulk Vitrification Process Using Re Surrogate, December 2006.
    - PNNL-15868, Analysis of Soluble Re Concentrations in Refractory from Bulk Vitrification Full-Scale Test 38B, June 2006
    - PNNL-16773, Bulk Vitrification Performance Enhancement: Refractory Lining Protection Against Molten Salt Penetration, July 2007.

Waste Form Testing to Support MAI

- Steam Reforming
  - Bench scale and engineering scale testing with simulants
    - WSRC-TR-2002-00317, Engineering Study of the Hanford Low Activity Waste Steam Reforming Process, July 2002.
    - PNWD-3288, Initial Evaluation of Steam-Reformed Low Activity Waste for Direct Land Disposal, 2003.
    - WSRC-TR-2005-00102 Durability Testing of Fluidized Bed Steam Reformer (FBSR) Waste Forms for High Sodium Wastes at Hanford and Idaho, 2005.
    - INEEL/EXT-04-02492, Fluidized Bed Steam Reforming of Hanford LAW Using THOR$_{sm}$ Mineralizing Technology, November 2004
- Containerized Cast Stone
  - Bench scale testing with simulants and real waste
    - RPP-RPT-26742, Hanford Containerized Cast Stone Facility Task 1 – Process Testing and Development Final Test Report
  - Related work
    - RPP-RPT-26851, Effluent Treatment Facility Waste Stream Stabilization Testing, August 2005.
    - RPP-RPT-31077, Effluent Treatment Facility Waste Stream Monolith Testing Phase II, Sept 2006.

System Planning Review

External Technical Review of System Planning for Low Activity Waste Treatment at Hanford – November 2008

- Review scope
  - Review system plans for Alternative Supplemental Treatment of Hanford LAW
  - Review the path forward for LAW disposition, including early LAW and Bulk Vit
  - Evaluation of the issues and benefits of potential installation of a third LAW melter
- Range of Alternatives Evaluated
  - Nine alternatives evaluated including 2nd LAW Vitrification and Bulk Vitrification
  - Life Cycle costs compared
  - No non-glass waste forms/immobilization processes evaluated
  - A range of processing and programmatic uncertainties were evaluated
- Recommendations
  - High priority for completing WTP construction and implementing a sodium management strategy – the latter drives mission duration and need for LAW treatment capacity
  - Further Testing of Bulk Vitrification is low priority

Kosson, D.S., et. al., External Technical Review of System Planning for Low-Activity Waste Treatment at Hanford, November 2008

Recent Evaluations

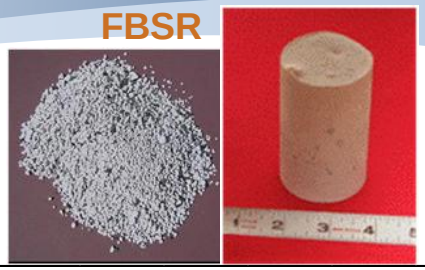
Enhanced Tank Waste Strategy – 2011

- Evaluate alternative waste forms and processes for Supplemental LAW treatment.
- Include any new data or technology development results since prior evaluations
- Determine whether waste form performance can meet IDF PA performance objectives
- Develop a regulatory compliance strategy and path forward
- Conduct fair and balanced cost comparison
- Generate data for TPA milestones M-62-40ZZ, One-time Report and M-62-45 Supplemental Treatment Technology Selection

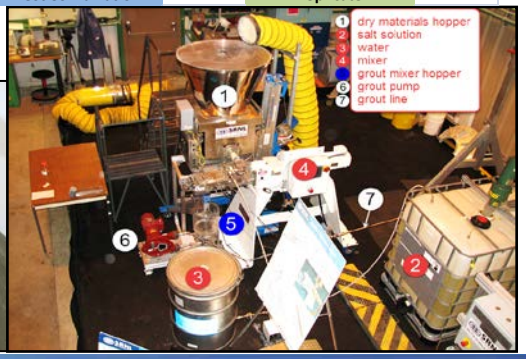
Data for Evaluation

- FBSR Demonstration FY10 – 12
  - Included bench scale demonstration w/ real waste
  - Waste form performance would easily meet IDF performance objectives
- Low Temperature Waste Form – Cast Stone FY13 – 16
  - Formulation screening matrix
  - Formulation enhancements incl. Tc & I getters
  - Leach Tests show 10 -100X decrease in Tc release rate (EPA-1315)
  - Meet or exceed IDF PA performance objectives

FBSR



	Cast Stone Formulation Screening Matrix Fly Ash Source/Blast Furnace Slag Source (Northwest or Southeast USA)							
Waste Composition	**NW/NW**	**NW/SE**	**SE/NW**	**SE/SE**	**NW/NW**	**NW/SE**	**SE/NW**	**SE/SE**
Average 5M	35	20						13 2
High SO_4 5M			1		10	31		
High Al 5M	28	4			24	37		17
SST Blend 5M			8		32	12		
Average 7.8M	5	29	6		27 36	3 22		
High SO_4 7.8M	15 25	33 38		14 7			26 21	
High Al 7.8M			19		30	9	11	
SST Blend 7.8M	16	34		18			23	
Mix Ratio (w/dm)	0.4	0.4	0.4	0.4	0.6	0.6	0.6	0.6
Original Mix No.								
Additional Mix No.			**Test Combination**			**Replicate**		



Path Forward Opportunities

- Recent development activities have shown significant improvements in performance of grout waste forms
  - Improved formulations and additives (e.g. getters)
- Goal to produce a safe and compliant waste form
- Analyses are needed to demonstrate the waste form will meet acceptance criteria for disposal
  - Meet IDF performance objectives
  - Protective of human health and the environment