Journey to Excellence Goal 2 & Enhanced Tank Waste Strategy

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Agenda

- Office of River Protection (ORP) Mission
- Journey to Excellence – Goal 2 on reducing EM's Life Cycle Costs
- Tank waste scope and challenges
- Enhanced Tank Waste Strategy – What it is and what we need to do collectively to make this a reality
- Questions/challenges
- Support from EM-TEG and EMAB

ORP Mission

- Safely retrieve and treat Hanford's tank waste and close the Tank Farms to protect the Columbia River
- Major scopes of work
  - Safe, Compliant Tank Farm and Laboratory Operations
  - Single-Shell Tank Retrieval and Closure
  - Waste Treatment Plant Support
  - Supplemental Treatment and Immobilization

EM Challenge

- EM’s life-cycle cost ranges between $190 to $244 billion to complete EM’s remaining mission
- EM’s tank waste mission is critical path, accounts for >43% of the total EM cleanup cost, and is the major contributor to EM's cleanup liability

National Research Council Input

- 2009 Advice on DOE's Cleanup Technology Roadmap – "…include research in the following:
  - Alternative and advanced waste forms and production methods"
- 2010 Waste Forms Technology and Performance: Interim Report
  - "DOE-EM will have opportunities to incorporate emerging developments…on waste forms…to increase program efficiencies, reduce lifecycle costs and risks"

EM Journey to Excellence

- December 2010 – Assistant Secretary for Environmental Management released a Roadmap for EM's Journey to Excellence – with 7 goals
- Goal 2 – Reduce the life-cycle costs and accelerate the cleanup of the Cold War environmental legacy
  - Key Success Indicator – Develop an EM Enhanced Tank Waste Strategic Investment Portfolio that prioritizes technology development and base funding with the goal of accelerating the tank waste cleanup schedule by …7 years at Hanford, and reducing EM's environmental liability and life-cycle cost by … $16 billion at Hanford

EM

Journey to Excellence - Goal 2

Reduce Life-cycle Costs

- Prioritize base, TDD and Recovery Act funds
- Integrate and manage the TDD investment from 2010 to 2018 and insert technologies at appropriate maturity.
- Use National Academy of Sciences, Environmental Management Advisory Board, EM Technical Experts Group to inform us on how best to achieve reductions in the life-cycle cost for the tank waste mission
- Use appropriate system planning models to demonstrate benefit of deploying state-of-the-art technologies to reduce the life-cycle cost

Key Strategies

- Accelerate tank waste cleanup by 6 years at SRS and 7 years at Hanford and reduce life-cycle cost by up to $19B
- End of FY 2011, develop/modify system-planning tool to illustrate benefits of more effective strategies and technology deployments
- NOTE: No baseline changes until dictated by project management process, with substantial involvement by regulators per the TPA

Key Success Indicators

3 Major Initiatives in Progress

- Enhanced Tank Waste Strategy
- Supplemental Treatment and Immobilization Project
- 2020 Vision
  - All three share the need for alternative supplies of Low Activity Waste (LAW) feed to immobilization facilities prior to completion of the Waste Treatment Plant Pretreatment Facility

Enhanced Tank Waste Strategy

Key Strategies

- At-Tank/In-Tank treatment solutions to prepare Low Activity Waste (LAW) feed to supplemental immobilization technology
- Fluidized Bed Steam Reformer (FBSR) as supplemental immobilization vs 2nd LAW Facility
- HLW improved vitrification capacity (1.5 – 2 X) starting in 2025 using combination of enhanced glass formulation and melter performance
- Next Generation Melter development
- Single Shell Tank (SST) Waste Staging
- Hard Heel Retrieval Technology
- Redundant and flexible evaporation capability
- Contact-handled transuranic waste (11 tanks) dried, packaged, stored onsite pending offsite disposition
- Next Generation Solvent – Savannah River Site only

Supplemental Treatment and Immobilization Project

Key Activities

- Supplemental Treatment – preparation of Low Activity Waste (LAW) feed to the immobilization technology
  - Re-affirmed 2008 decision to evaluate In-Tank/Near-Tank filtration and Cesium removal alternatives
  - Anticipate alternatives analysis and conceptual design report available by September 2011
- Supplemental Immobilization – four alternatives under consideration:
  - 2nd LAW Facility
  - Fluidized Bed Steam Reforming
  - Bulk Vitrification
  - Cast Stone
- For immobilization, anticipate alternatives analysis and conceptual design report by March 2012

2020 Vision

- Work backwards from 2020 to determine the best way to startup the entire Waste Treatment Plant (WTP)
- Achieve the earliest possible hot operations of completed WTP facilities, starting with:
  - Low Activity Waste (LAW) Facility
  - Analytical Laboratory (LAB)
  - Balance of Plant Facilities (BOF)
- Supply LAW feed directly to the WTP LAW Facility using In-Tank/Near Tank Supplemental Treatment technologies
- Secondary waste streams from WTP would be returned to the Double-Shell Tanks

Key Strategies

EM

Enhanced Tank Waste Strategy

Supplemental Treatment – Supplying LAW Feed

- Delivery of Low Activity Waste (LAW) feed prior to completion of the Waste Treatment Plant Pretreatment Facility is required to:
  - Shorten the tank waste treatment duration (Enhanced Tank Waste Strategy)
  - Enable startup of the WTP LAW facility by 2016 (2020 Vision)
- Under the former "Interim Pretreatment System" project (2008), alternatives analysis led to a down-select decision to use filtration (solids removal) and ion exchange (Cesium removal)
- December 2010 – the Tank Operations Contractor reaffirmed the down-select decision
- Filtration options:
  - Cross-flow filters – similar to Ultrafilter design in the WTP PT Facility
  - Rotary Microfilters – extensive testing at 222-S Lab and Savannah River National Laboratory
- Ion Exchange options:
  - Spherical Resourcinol Formaldehyde (sRF) – to be used in WTP PT Facility
  - Crystalline Silicotitanate (CST) – to be used at the Savannah River Site
- Deployment options:
  - In-Tank – install filters and ion exchange columns into tank through 42" risers
  - At-Tank – install filters and ion exchange columns into vault near tank farm

Key Decision Points

Enhanced Tank Waste Strategy

Fluidized Bed Steam Reformer Testing

- Testing of 5 different radioactive waste samples planned in 2011:
  - Savannah River Site (SRS) Defense Waste Processing Facility (DWPF) secondary waste modified to mimic WTP secondary waste
  - SRS Low Activity (LAW) Waste modified to mimic Hanford LAW
  - 3 actual Hanford waste samples
- Two samples of actual Hanford tank waste at Savannah River National Laboratory (SRNL), third Hanford tank waste sample to be shipped in March 2011 – all for Bench Scale Steam Reforming (BSR) testing
- Producing both simulant BSR product and actual waste BSR product
- BSR product – granular and monolith forms – undergoing waste form durability analysis at SRNL and Pacific Northwest National Laboratory (PNNL) – expect results by April 2011
- Testing supports the Supplemental Immobilization alternatives analysis
- A Hanford Tank Waste Supplemental Treatment Technologies Report is required by October 2014 if a supplemental immobilization technology other than 2nd LAW is proposed – per Tri-Party Agreement milestone M-62-40
- Any Supplemental Immobilization selection must be negotiated with Washington Department of Ecology by April 2015 per Tri-Party Agreement milestone M-62-45 (3)

Key Decision Points

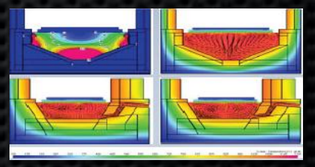
EM

Enhanced Tank Waste Strategy

Improved Vitrification Capacity

Challenges

- Need to increase design melter throughput by a factor of 2
- Need to better understand melter chemistry to promote retention of long-lived radionuclides
- Need to verify assumptions regarding secondary waste recycle in the HLW and LAW Facilities



Possible Solutions

- Consider improved glass formulations
- Develop next-generation melters such as advanced joule-heated melter and cold crucible induction melter
- Develop advanced process understanding of cold-cap chemistry
- Perform secondary waste recycle testing at VSL melter

Benefits

- Increase WTP efficiency by increasing melter throughput/waste loading
- Increase flexibility in alternative waste forms
- Increase steady state operations by reducing process upsets
- Improve retention of long-lived radionuclides in vitrified waste

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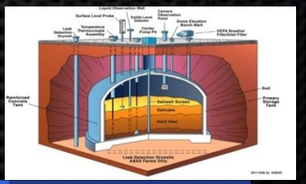
Enhanced Tank Waste Strategy

Tank Waste Retrieval and Closure

- Need reliable, cost-effective tank waste retrieval technologies to meet TPA goals and required waste feed delivery rates
- Need to maximize waste storage capacity to maintain retrieval progress
- Need to implement timely tank farm closure process with regulators, tribal nations, and stakeholders



Challenges

- Deploy new tank waste retrieval technologies
- Continue efforts to maximize Double-Shell Tank space availability
- Evaluate cementitious materials for in-tank closure
- Consider staging waste in sound Single-Shell Tanks to maintain retrieval progress and expertise and prevent bow wave effects in retrieval rates

Possible Solutions

- Reduces retrieval time and improves efficiencies
- Reduces further environmental impact when retrieving unsound tanks
- Reduces waste volume to maximize available tank space
- Provides backup evaporative capability to single large evaporator
- Provides predictive modeling and materials for tank closure decisions

Benefits

Enhanced Tank Waste Strategy

Enhanced Tank Waste Technology Needs

- Small Column Ion Exchange (SCIX) and Rotary Microfilter (RMF) at-tank/in-tank treatment solutions
- FBSR waste form qualification as a secondary waste form and supplemental LAW immobilization option
- Secondary waste recycle, next generation solvent
- Next generation melters and enhanced glass formulations
  - Advanced Joule-heated melters
  - Cold Crucible Induction Melter (CCIM)
  - Iron Phosphate glass
- Melter cold cap chemistry
- Single-Shell Tank Integrity non-destructive examination
- Chemical cleaning techniques to remove tank hard heels
- Wiped Film Evaporator (WFE) for waste staging and 242-A backup
- Solids drying and packaging unit for transuranic waste packaging

Key Technology Needs

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Journey to Excellence - Goal 2

EM's FY2011 Tank Waste Focus

- Established Enhanced Tank Waste Strategy (ETWS) team
- Aligning scope, funding and plans to ensure clear focus
- Developing integrated schedule of all base, ARRA and TDD activities that support the ETWS scope
- Engaging HLW Corp Board, EM-TEG, EMAB Tank Waste Subcommittee, regulators and stakeholders to ensure credible results from technology testing
- Leveraging TDD, CRESP, Universities and SRS, Hanford and Idaho project funding to prioritize resources

ETWS Near Term Actions

- Performing critical waste form qualification tests
- Addressing several technical issues to ensure well-developed information available for decision makers
- Completing actions to support secondary waste and supplemental treatment and immobilization down-select decisions by ORP
- Alignment of EIS and IDF PA with Enhanced Tank Waste Strategy

ETWS Longer Term Actions

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Journey to Excellence - Goal 2

Questions Challenging Near Term Decisions

- Tc-99 drives residual risk in Hanford IDF performance assessments
- ILAW glass chosen largely because its durability limits Tc-99 leaching
- Hanford regulator expectation that all LAW be immobilized in glass
- SST consolidation/staging tied to demonstrating integrity
- ETWS drives retrieval rates as critical path vs treatment

Facts/Assumptions

- Single-pass Tc-99 retention in ILAW glass – large uncertainties
- Recycling Tc-99 has not been demonstrated; may cause other problems
- Effects of bubblers to improve waste loading and melter throughput may have negative effects on Tc-99 retention
- 2nd LAW recycling impacts on WTP, secondary waste and overall mission duration uncertain
- Tc-99 partition between LAW, Supplemental Immobilization, and secondary waste uncertain

Questions/Challenges

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Journey to Excellence - Goal 2

Enhanced Tank Waste Strategy Progress

- Bench-Scale Steam Reformer (BSR) product – granular and monolith forms – undergoing waste form durability analysis at SRNL and PNNL – expect results by April 2011
- Continued development of in-tank Rotary Micro-Filter and Small Column Cesium Ion Exchange technologies for Savannah River Site with possible Hanford applications
- Continued development of Wiped Film Evaporators – modular design to augment the 242-A Evaporator and better stage waste for treatment
- Planned testing in 2011 of engineering-scale melter with off-gas recycle loop to better understand Tc-99 retention in LAW glass
- Next generation melters development and enhanced glass formulations

Key Activities in 2011

EM-TEG Near Term Support

- Task 1 – Low Activity Vitrification Waste Loading Evaluation
  - Evaluate major chemical loading for LAW, 2nd LAW, sec. waste
  - Identify unaddressed risks in baseline assumptions used in WTP/TOC models and impacts on LAW treatment projections
- Task 2 – LAW Tc-99 Capture in LAW Glass
  - Determine if Tc-99 retention assumptions in LAW, 2nd LAW, and secondary waste are defendable
- Task 3 – Tc-99 in Other Secondary Wastes
  - Determine if unaccounted Tc-99 could deposit in process equipment or canisters, increasing risks beyond what is analyzed in the Performance Assessment and EIS
- Task 4 – Hanford Tank Waste LAW Samples for FBSR Testing
  - Evaluate adequacy of FBSR waste form qualification process to support FBSR treatment of LAW and secondary waste

EM-TEG Task Requests

EMAB Support

- Task 1 – Review Modeling for Life-Cycle Analysis
- Task 2 – Assess Candidate LAW Forms
- Task 3 – Assess At-Tank/In-Tank Technologies
- Task 4 – Evaluate Various Melter Technologies
- Task 5 – Evaluate Reliability of Waste Delivery Plans
- Task 6 – Identify Other Tank Waste Vulnerabilities

EMAB Tasks

EM Summary

- Tank Waste Mission drives the EM LCC
- ETWS, if successful, offers significant opportunity to reduce EM's LCC
- Several questions to answer, issues to address, and work to complete to make this a reality
- Engage Regulators, Tribes, and Stakeholders
- HLW Corporate Board, EM-TEG, and EMAB to assist EM Leadership in this Journey to Excellence