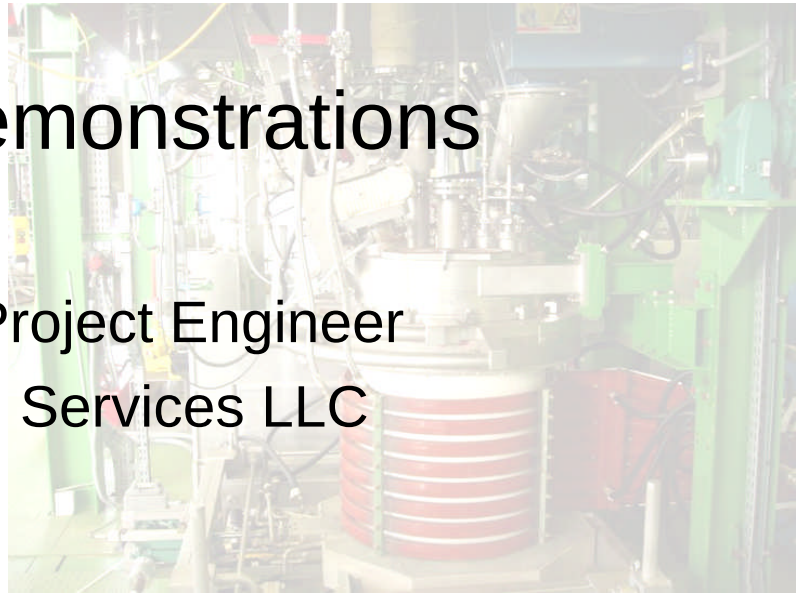
Advanced Remediation Technologies

Cold Crucible Induction Melter Technology Retrofit and Deployment

Phase II-A - Demonstrations



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Presentation Outline

- **Project Description**
- **Technical Strategy/Approach**
- **Technical Results and Status**
- **Impact on High Risk/Cost Reduction or Avoidance**

Project Description

- **Describe technology need / requirement(s)**
  - Enhanced Stabilization Technologies – Develop next-generation stabilization technologies and advanced glass formulations, as described in EM's Engineering & Technology Road-map (March 2008)
- **Relate to High-Impact Risk / Cost Issue**
  - End-state objective is to increase waste loading as compared to current vitrification melter technology, resulting in higher waste throughput, decreased volume of glass requiring permanent storage, and accelerated completion of EM's legacy tank waste closure missions at SRS and (potentially) Hanford

Project Description – Technical Strategy/Approach

- Apply Cold-Crucible Induction Melter (CCIM) technology that has been developed internationally to the specific facilities and tank waste forms encountered at the Savannah River Site
- Use a phased approach that matches funding commitments to increasing levels of technology readiness

Project Description – Technical Strategy/Approach

- **Phased approach under the ART program.**
  - **Phase I**
    - Assess potential improvements in costs/schedules to accomplish tank closure mission at SRS that can result from retrofitting DWPF with a next-generation Cold-Crucible Induction Melter
  - **Phase II**
    - Validate expected benefits identified in Phase 1 by pilot-scale demonstrations using simulated SRS waste forms
    - Validate feasibility of retrofit in DWPF by identifying the preferred maintenance approach, sizing major components, and developing a general design lay-out

Project Description – Technical Strategy/Approach

- **The ART CCIM Team for Phase II**
  - Participants continue from Phase I and include SRNL, CEA, INL, SGN, and AFS
    - SRNL provides R&D and laboratory services, and technical guidance on DWPF operations and facility configuration
    - CEA operates a 650mm pilot-scale CCIM in Marcoule, France, capable of performing a long-duration demonstration of the technology
    - INL operates a smaller pilot-scale melter (267mm) capable of characterizing CCIM parameters that could affect the DWPF off-gas system
    - SGN provides design and engineering expertise for developing a retrofit configuration adaptable to the existing DWPF facility
    - AFS provides project management and coordination among the project participants
  - This team assembles world-class leaders in development, design, deployment, and operation of HLW vitrification processes and has unique knowledge of the DWPF configuration and operating environment

Project Description – Technical Strategy/Approach

- **Phase II strategy**
  - ➢ This application development phase is staged so that cost commitments are limited until the expected benefits are validated
    - Phase II-A
      - – Demonstrate CCIM processing of a candidate SRS tank waste stream on existing pilot-scale facilities at CEA and INL (Sludge Batch 4 – a high-alumina content stream)
      - – Perform the initial engineering studies needed to retrofit the technology into the existing DWPF facility
    - Phase II-B
      - – Build and operate a near full-scale pilot melter, to ensure the process validated in Phase II-A can be scaled up and achieve waste processing rates which reduce life cycle costs for DWPF operations

Project Description – Technical Strategy/Approach

- Post-ART phases
  - Finalize design solution and process flow sheet
  - Implement design solution in DWPF at the next melter change-out (forecasted for 2012)

Technical Status and Results

- **Phase I completed in Jan 2007**
- **Phase II-A initiated in Oct 2007 (project duration of 18 months)**
  - Project objectives and plan were defined – Nov 2007
  - Candidate tank waste form was defined (Sludge Batch 4, a high-alumina content stream forecasted for processing at DWPF in 2012) – Dec 2007
  - Lab plan was completed and lab work was initiated – Jan 2008
  - Design inputs for engineering studies and melter frame layout were provided – Jan to May 2008

Technical Status and Results

- **Phase II-A (cont'd)**
  - Guidelines were agreed to for preparing simulant, ensuring demonstrations are representative of DWPF mission and consistent between the two pilot-scale facilities (INL and CEA) – April 2008
  - Initial lab results were reported – increased waste loading and decreased REDOX conditions employed by CCIM results in acceptable glass – April 2008
  - Melter feed composition was defined, including target waste loading level and suitable glass frit composition – May 2008 (Frit 303 R6, 46% waste loading)

Technical Status and Results

- **Phase II-A (cont'd)**
  - Preliminary engineering completed and presented to participants – Jan - May 2008
    - Design inputs and assumptions were assembled and validated
    - DWPF melt cell model was created and preliminary CCIM configuration was defined
    - Maintenance alternatives to be considered were defined
  - Variability testing in the lab was initiated (May 2008) to validate target waste loading and composition – forecast completion in July 2008
  - INL and CEA Demonstration Plans were prepared and circulated for comment among participants (May/June 2008)

Technical Status and Results

- **Phase II-A – Look-ahead**
  - Simulated waste and glass frit are to be prepared – July to Sept 2008
  - Demonstration plans are to be finalized, based on analysis of completed simulant – Sept 2008
  - Pilot-scale facilities are to be configured for demonstrations – Aug to Sept 2008
  - Material is to be staged and prepared for runs – Oct 2008

Technical Status and Results

- **Phase II-A – Look-ahead**
  - INL Demonstration is forecast for Nov 2008
  - CEA Demonstration is forecast for Nov 2008 to Feb 2009
  - Feedback of demonstration results to process flow sheet and engineering studies is forecast for Feb and March 2009
  - Final reports on demonstration runs and engineering studies are forecast for Mar 2009
  - Update to cost and schedule estimates for Phase II-B and beyond are forecast for May 2009 (opportunities for acceleration are being pursued).

Project Impact

- Preliminary assessment of impact of CCIM deployment on DWPF life-cycle costs indicates a $1B savings in operating costs and $250M savings in melter change-outs and disposition of spent melters
- Preliminary assessment of impact resulting from repository volume maximization points to a cost reduction of $450M

Project Impact

- Total ROI for deployment of CCIM at DWPF is currently estimated at about 20/1
- Estimated cost impacts will be refined at the conclusion of Phase II-A, once the process is validated and retrofit configuration is identified