Enhanced LAW Glass Formulations

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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

Develop high waste loading glasses to treat Hanford LAW

- Hanford LAW spans a range of sodium and sulfur concentrations.
- Some LAW contain high potassium concentration.
- Higher waste loadings result in smaller amounts of glass to be produced. This reduces both operating and disposal costs, and mission duration.
- Through glass formulation optimization, substantial increases in waste loadings are possible.

Project Description – Technical Strategy/Approach

- Define LAW compositions of interest.
- Develop glass formulations with high waste loadings.
- Prepare and characterize crucible glass melts
  - *PCT, VHT, $T_{1\%}$ (temperature at which crystal content = 1 vol%), viscosity, electrical conductivity, K-3 refractory corrosion, sulfur solubility.*
- Based on crucible test results, select glass compositions for melter tests.
- During melter tests, progressively increase sulfur concentration until a secondary sulfate phase forms on the melt surface.

Technical Status and Results

- Likely limits of Na_2O and SO_3 loadings for a range of Hanford LAW compositions were determined.
- For fully compliant glass formulations, sodium and sulfur loadings ranged from 24 wt% Na_2O and 0.9 wt% SO_3 to 16 wt% Na_2O and 1.5 wt% SO_3.
- Verified in melter tests.
- VHT alteration rate, K-3 refractory corrosion and secondary sulfate phase formation were the major challenges in increasing waste loading.
- Potential for an average Na_2O loading of 20.6 wt% in Hanford LAW glasses was demonstrated. This compares to a WTP baseline average Na_2O loading of ~13 wt%.

Technical Status and Results (continued)

- Overall relative increase of ~58% in waste loading was achieved.
- This work identified the likely limits of viable waste loadings.
- Additional work is needed to define processing envelopes and expand property models for LAW processing, with due consideration for factors such as likely process variations, feed make-up errors, feed sampling and analysis errors, etc.

Project Impact

- The increase in waste loading of ~ 58% would result in potential reduction in LAW glass to be produced at Hanford by ~230,000 MT.
  - *This value will change based on assumptions about fraction of LAW sent to supplemental treatment and any increases in sodium addition in pretreatment.*

- The above waste loading improvement, together with the higher processing rates at moderately higher temperatures demonstrated by VSL and Energy*Solutions* for ORP, show the potential for treating a much larger portion of the LAW through the WTP.