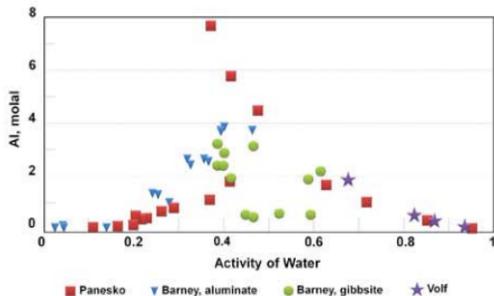
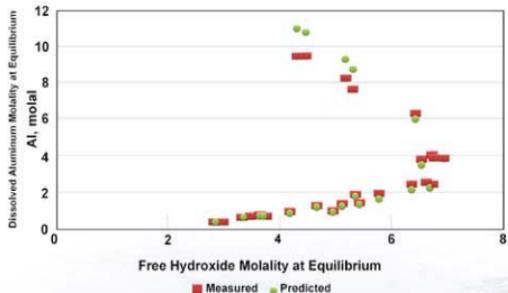


The History of Modeling Aluminum Solubility in Hanford Tank Waste

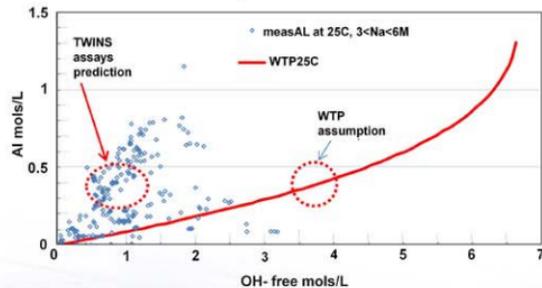
Water Activity and Aluminum Solubility from WHC-EP-0872



Gibbsite Solubility Data Between 30° and 40°C



TWINS Assays for 3 M < NA < 6M



1. Overview of Modeling Approaches used

- Empirical models (1970s to present)
- Rigorous Thermodynamic Models (1990s to present)
- Models designed specifically for Hanford (1970s to present)
- Literature Models from the aluminum industry (Pre 1978)
- Leach Factors (1998 to present)

2. 1970's, The Barney Diagram:

Waste is not like simple NaOH(aq) solutions

3. 1980's, The Era of Empirical Models Based on Simulant Data

- Jansky's Re-work of Barney
- Herting-Reynolds Model and PREDICT Computer Code
- Welsh Statistical Model

4. The 1990's, Speciation based thermodynamic models and Leach Factors

- Environmental Simulation Program (ESP) and applications
- ORNL Data and Pitzer Model
- Den Reynolds Speciation Approach and Associated Water Activity Plot
- The Rise of Leach Factors

5. The 2000's, Empirical models based on bounding objectives, models

- Reynolds 2006, used in conjunction with leach factors
- Reynolds Temperature specific models to improve precision
- The 7 molal phenomena (Figures 2)
- ASPEN Custom Modeler for the Waste Treatment Plant
- Mixed Solvent Electrolyte Model in ESP

6. 2009-2010, Agnew's characterization based models

- Based on correlations of real tank waste characterization data (Figure 3)
- Assume Dawsonite controls aluminum solubility

1970s

1980s

1990s

2000s

2010s



washington river
protection solutions

Jacob Reynolds and Dan Herting, at Washington River Protection Solutions Steve Agnew, at Columbia Energy and Environmental Services, Inc.

