

Reactive Transport Simulation of Radioactive Tank Waste Retrieval

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Objectives

- Investigate interactions of chemical reactions, rheology and waste mixing
- Assist waste retrieval operational decision making

Retrieval Operation Decision Making

- Require accounting for
 - Chemical reactions
 - rheology changes
 - physical waste mixing
- Use coupled reactive transport modeling

TEMPEST Reactive Transport Code

- 3-D hydrodynamics/transport
- Chemistry of equilibrium aqueous reactions and kinetic reactions of precipitation/dissolution
- Rheology and density estimation

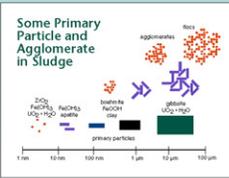
Summary and Conclusions

- TEMPEST simulated
 - Sludge tank mobilization by a pump jet
 - Mixing of chemically reacting waste
 - Non-Newtonian slurry with less mixing
- Results confirm importance of
 - Yield strength in sludge mobilization
 - Mixing differences between non-Newtonian and Newtonian slurries
 - Interactions among chemical reactions, rheology and mixing

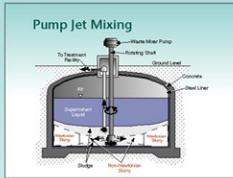
Potential Model Uses

- Decide operational parameters of pump jet mixing, e.g.,
 - How many mixer pumps will be needed?
 - How much and how quickly solids will be dissolved and mixed?
 - How uniform mixed waste will be distributed?
- Other potential uses for waste retrieval
 - Evaluate compatibility of various tank waste
 - Select proper solvents/diluents

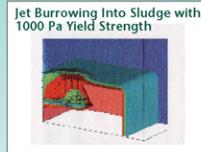
Tank Waste Characteristics



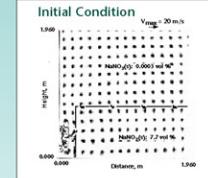
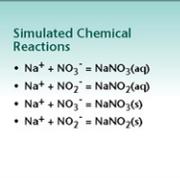
Waste Retrieval



Erosion-Resisting Sludge Mobilization by 18-m/s Pump Jet



2-D Chemically Reactive Non-Newtonian Slurry Mixing



3-D Chemically Reactive Non-Newtonian Sludge Mixing with Water

