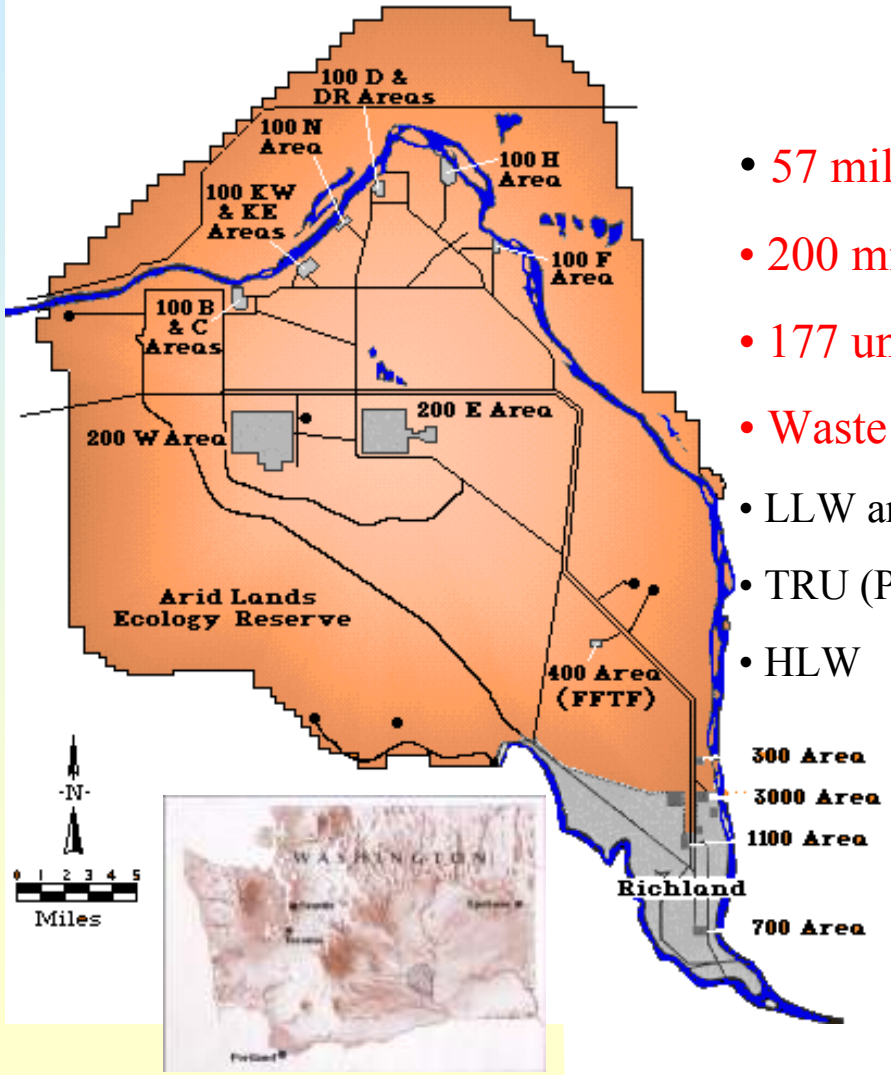
Hanford Nuclear Site

Remediation & Decommissioning at Hanford Site

Dismantle → Remove waste → Treat → Store → Dispose: onsite LLW disposal site
: ship to TRU WIPP site
: ship to HLW disposal site



- 57 million gallons of solid and liquid radioactive waste
- 200 million curies of radionuclides
- 177 underground storage tanks
- Waste retrieval from tanks and waste treatment
- LLW and its mixed waste
- TRU (Pu, U, etc.) and its mixed waste
- HLW

Along the Columbia River,

- 50 burial grounds
- 579 waste sites
- 357 excess facilities for decommission
- 8 out of 9 reactors for decommission

Hanford Remediation

Hanford remediation is

- Large scale and technically complex
- Long duration from 1989 to 2090 with the active remediation until 2050
- Very expensive
  - Annual budget of $2 billion dollars
  - Total remediation cost of $110 billion dollars

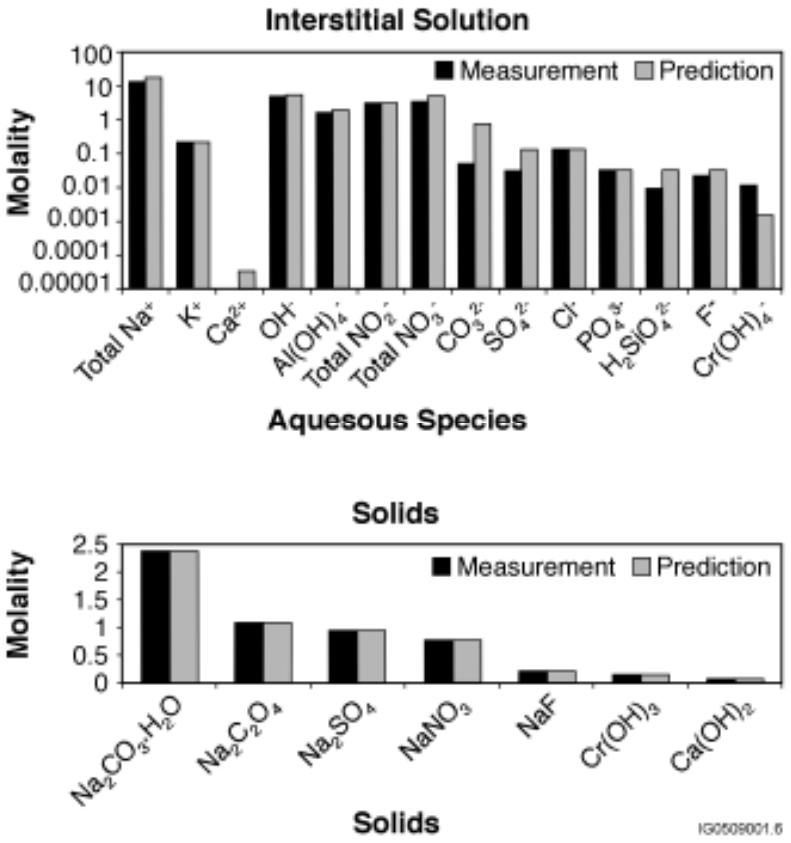
Remediation affects future lives of locals

- How clean is clean
- Future land use
- Future local industry development

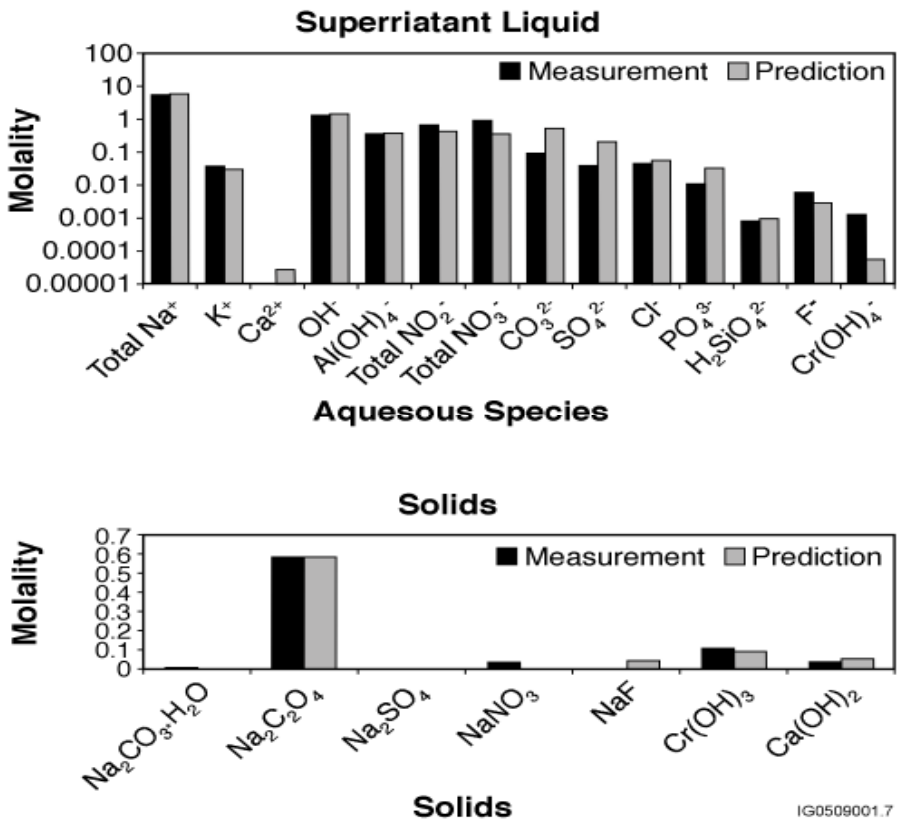
Long-term R&D is needed for Hanford remediation.

Tank Waste Chemistry Modeling for Waste Retrieval from Storage Tanks and subsequent Waste Pipeline Transport to a Waste Treatment Plant

Original Waste

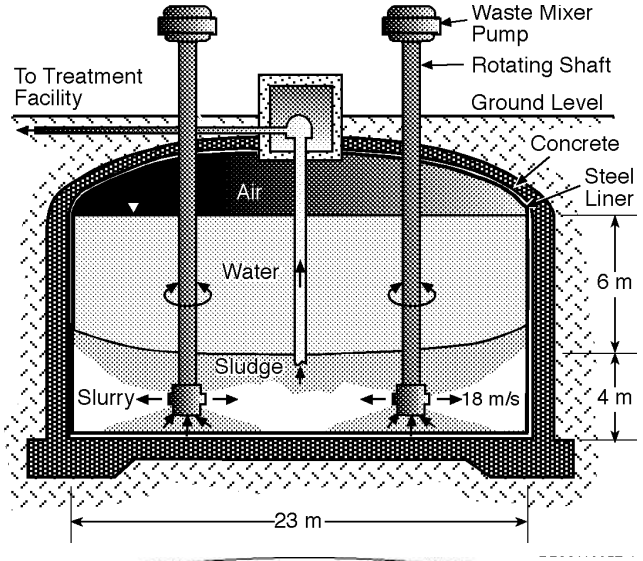


Waste Diluted by Water

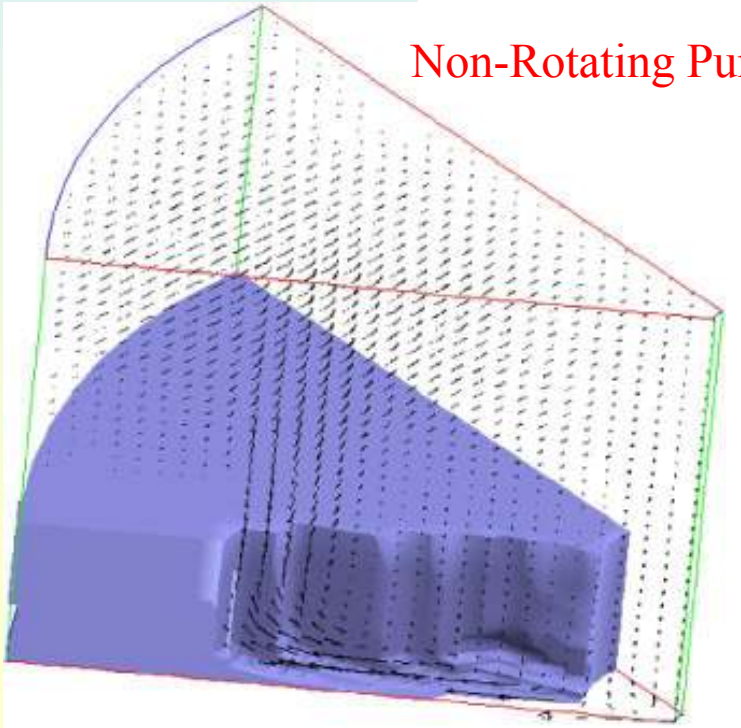


3-D TEMPEST Code: Tank Waste In-Tank Mixing Modeling

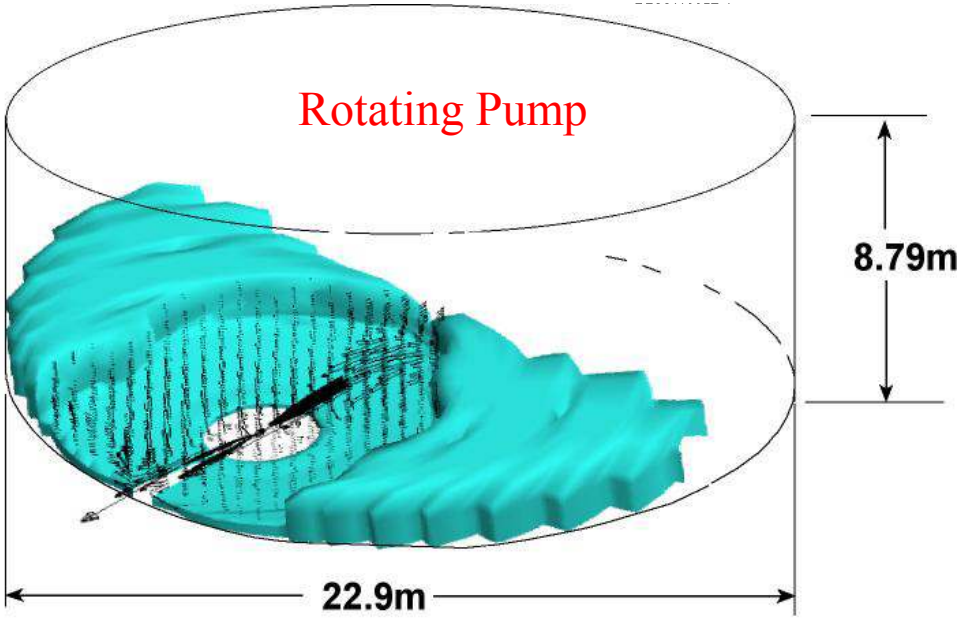
Simulation of in-tank waste mixing with two 300 hp pumps



Non-Rotating Pump



Rotating Pump



3-D Ariel Code's Coupled Reactive Transport Modeling: Radioactive Tank Waste Chemical Reactions and Mixing

Simulation of in-tank waste chemistry and mixing

$$Na^+ + NO_3^- = NaNO_3(aq)$$

$$Na^+ + NO_2^- = NaNO_2(aq)$$

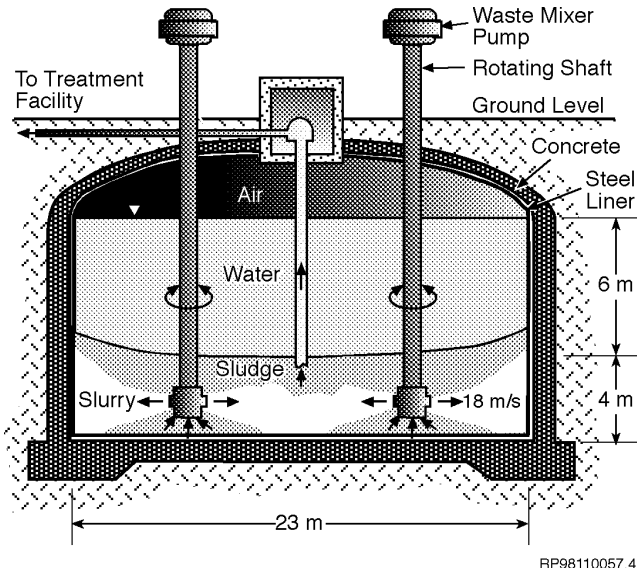
$$Na^+ + NO_3^- = NaNO_3(s)$$

$$Na^- + OH^- = Na^- + OH^-$$

$$2Na^+ + CO_3^{2-} + H_2O = Na_2CO_3 \cdot H_2O(s)$$

$$2Na^+ + SO_4^{2-} = Na_2SO^4(s)$$

$$Al(OH)_4^- = Al(OH)_3(s) + OH^-$$



C Tank and AN Tank