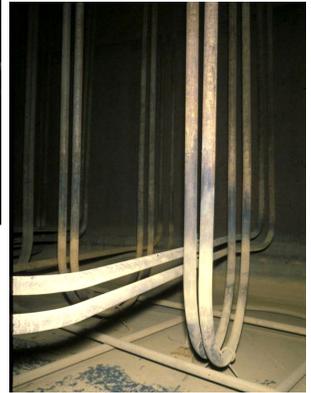


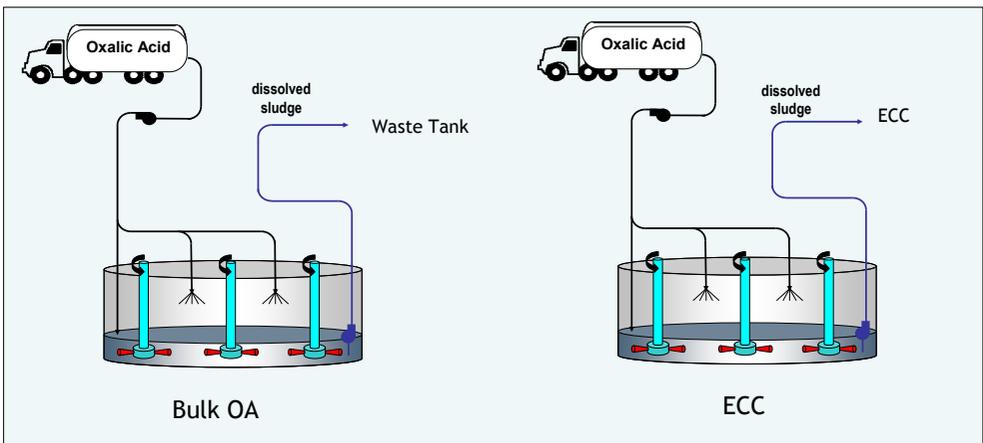
## History of Chemical Cleaning

- Oxalic acid has been used since the 1980's to clean waste tanks
  - Tank 16 in 1983
  - Tank 24 in 1985
  - Tanks 5-6 in 2008
  - Tank C-106 in 2002
- Also used in the commercial nuclear industry to clean secondary side steam generators



## Objective

- Recognizing that the dissolution step of previous oxalic acid campaigns and the dissolution step of ECC are the same:



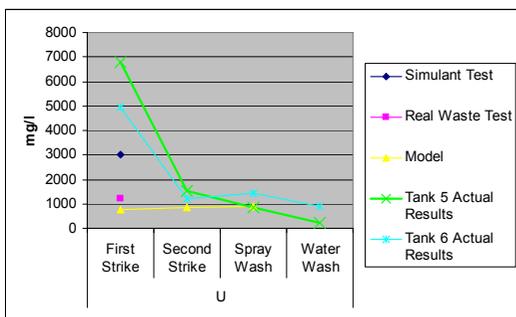
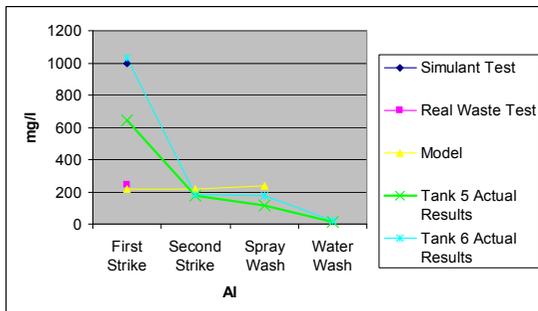
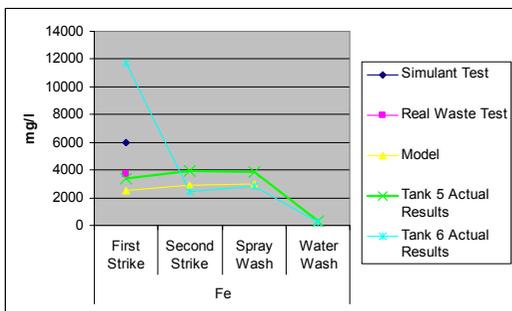
The objective is to:

- Describe each oxalic acid cleaning campaign in the SRS and Hanford tanks
- Compare and contrast the campaigns
- Apply the knowledge gained to planned ECC dissolution

## Actual Experience

Tank	16	5	6	24	C-106
Volume Reduction(%)	93	5	42	42	77
Strikes	3 oxalic acid strikes of equal volume	3 oxalic acid strikes, first strike was the largest	3 oxalic acid strikes, first strike was the largest	Two oxalic acid strikes	Six oxalic acid strikes added, last four with sluicing
Oxalic Acid Concentration	4 wt% diluted to 1 wt %	First strike was 4 wt%, second strike was 8 wt%, last was 4 wt%	First two strikes were 8 wt%, last was 4 wt%	First strike was 5 wt%, second was 8 wt%	8 wt%
Mixing	3 pumps directed at mounds operated for 40 hours or more	Two pumps operated on first strike only	Two pumps operated on first strike only	Two pumps operated	Gentle mixing
Temperature (°C)	Acid added at 90°C 59 - 66°C	Acid added at 50°C Tank at 35°C	Acid added at 50°C Tank at 35°C	Oxalic acid added at 80°C	Ambient (25-30°C)
Summary	3 strikes of equal volume, hot unsaturated oxalic acid with mixing	3 strikes of saturated oxalic acid with mixing on the first batch	3 strikes of saturated oxalic acid with mixing on the first batch	High aluminum heel with in-tank neutralization and mixing. Insufficient oxalic acid added	High aluminum heel with 6 strikes of saturated oxalic acid and gentle mixing

## Concentration

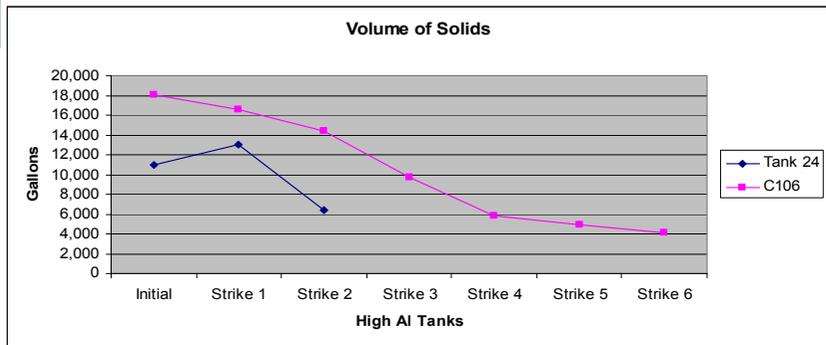
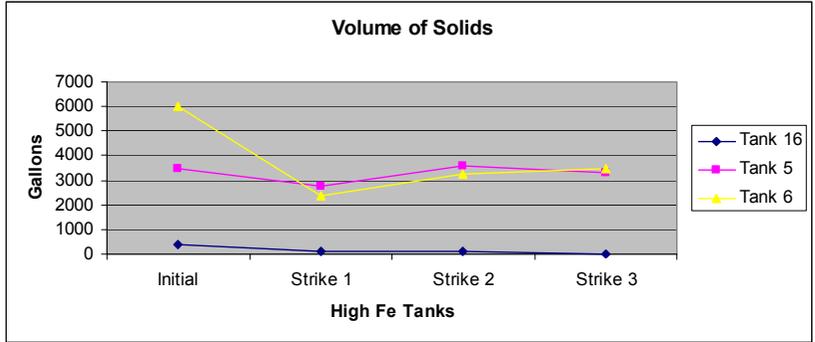


Concentration profile shows that dissolution of major sludge components was not complete

- Mixing had a huge positive impact on quantity dissolved in the first strike
- Dissolution in subsequent strikes followed the model predictions (without mixing)
- Repeated strikes with mixing drive dissolution to completion

# Volume

Oxalate precipitation contributed to an increase in solids volume in several cases



Knowledge gained from past oxalic acid cleaning campaigns is being used to increase the effectiveness of dissolution through ECC:

- Use dilute oxalic acid
  - free oxalic acid ions to react
  - the capacity to dissolve the newly created oxalates
- Keep the temperature high and the pH low
  - improves dissolution
  - minimizes re-precipitation
- Mixing is critical
  - facilitates mass transfer and promotes dissolution
  - suspends undissolved solids so that they can be transferred out
- Repeat strikes
  - aids in removing the more soluble metal ions
  - allows dissolution of the less soluble radionuclides