Tank Farm Mixing and Sampling to Support DWPF Operations

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Overview

- Background
- Mixing
  - Historical
  - Criteria
  - Current Strategy
- Sampling Techniques and Procedure
- Defense Waste Processing Facility (DWPF) Requirements
  - Waste Acceptance Criteria
  - Tank Farm Compliance

Sludge Batch Preparation and Feed

Bulk Waste Removal Tank(s)

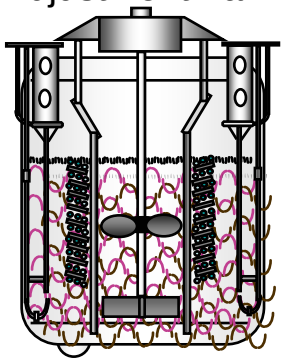
Sludge from one or more waste storage tanks
- Wetting
- Mixing by Pumps
- Sample

Tank 51 (Batch Tank)
- Mixing by Pumps
- Wash
- Settle
- Decant
- Sample

Qualified Batch Transferred Forward

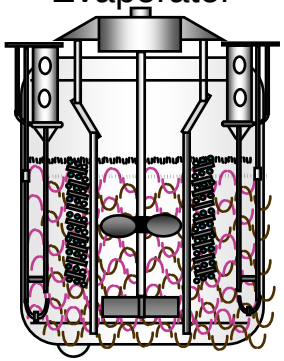
Tank 40 (Blend Tank)
- Mixing by Pumps
- Sample

Sludge Receipt Adjustment Tank



- 10,000 gal vessel
- Mixing by Agitator
- Sample

Slurry Mix Evaporator



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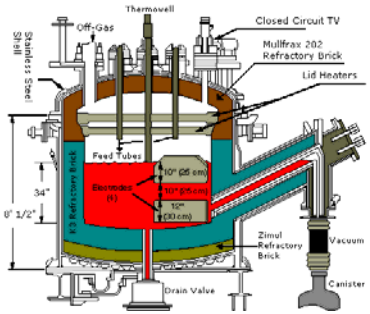
- Mixing by Agitator
- Sample

Melter Feed Tank

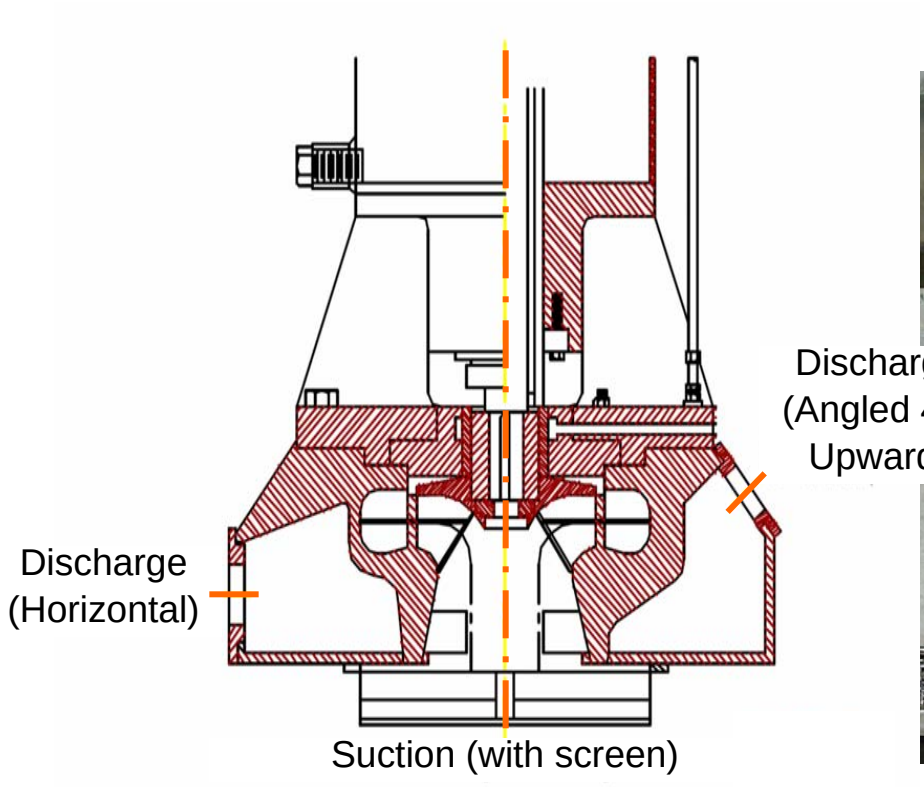


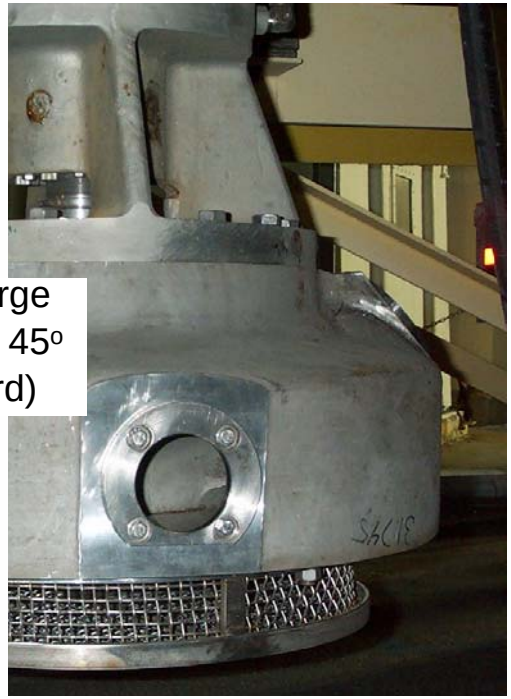
Melter

Tank 51 and Tank 40 Mixing

- The installed mixing (slurrying) pumps for Tank 51 and Tank 40 are
  - Quad-volute slurry pumps are designed for the agitation of large volumes of waste solids
    - Four discharge nozzles, spaced 90 degrees apart.
    - Three of the nozzles are horizontal, the fourth nozzle is slanted upward at a 45-degree angle.
    - Two horizontal nozzles, spaced 180 degrees apart from each other are sealed shut.
    - 5200 GPM, 2200 Max RPM, 300 HP, 40 ft Cleaning Radius

Quad-volute Slurry Pump





Tank 51 and Tank 40 Mixing

- In order to obtain a well-mixed or representative sludge slurry sample from Tank 51 or Tank 40 is a function of operating the mixing pumps for a sufficient time
- Defining the amount of sufficient time
  - Historically, 4 pumps for Tanks 51 and 40 were operated as long as 48 hours (not always continuously)
  - The pump mixing run-time was systematically reduced
    - Pump run-time reduction is key to extending pump operability life
    - Justified by documented data collection and sample analysis
    - Tank samples were taken and compared after varied mixing times
  - Currently, 4 pumps for Tanks 51 and 40 are operated for an 8 hour period prior to sampling

SRAT and SME Mixing

- The SRAT and SME vessels at DWPF are equipped with agitators and sample pumps
  - Each agitator has the following attributes
    - Two 36-inch impellers
    - Two-speed
      - high-speed setting is 130 rpm, low-speed setting is 65 rpm
      - SME agitator has a Variable Frequency Drive (VFD)
  - Each sample pump has the following attributes
    - Rated flow: 58 gpm, TDH: 133 ft
    - Motors are connected to VFD

Sampling Methodology

- For a given sludge batch, a sample plan will typically act as a road map to successfully achieve the necessary characterization
- Sludge characterization is an initial focus for sludge batch preparation and continues throughout the qualification process
- Mixing the sludge with supernate in the batch preparation tank to provide a representative slurry sample for batch qualification is very important

DWPF Waste Acceptance

- DWPF Waste Acceptance Criteria (WAC) Program ensures the composition of the waste stream to be received into DWPF are within the Documented Safety Analysis (DSA) limits prior to transfer
- Before processing of a sludge batch begins in DWPF, SRNL characterizes samples of the sludge from the Tank Farm
- The composition of the sludge will also be used by SRNL to recommend the most suitable frit for DWPF

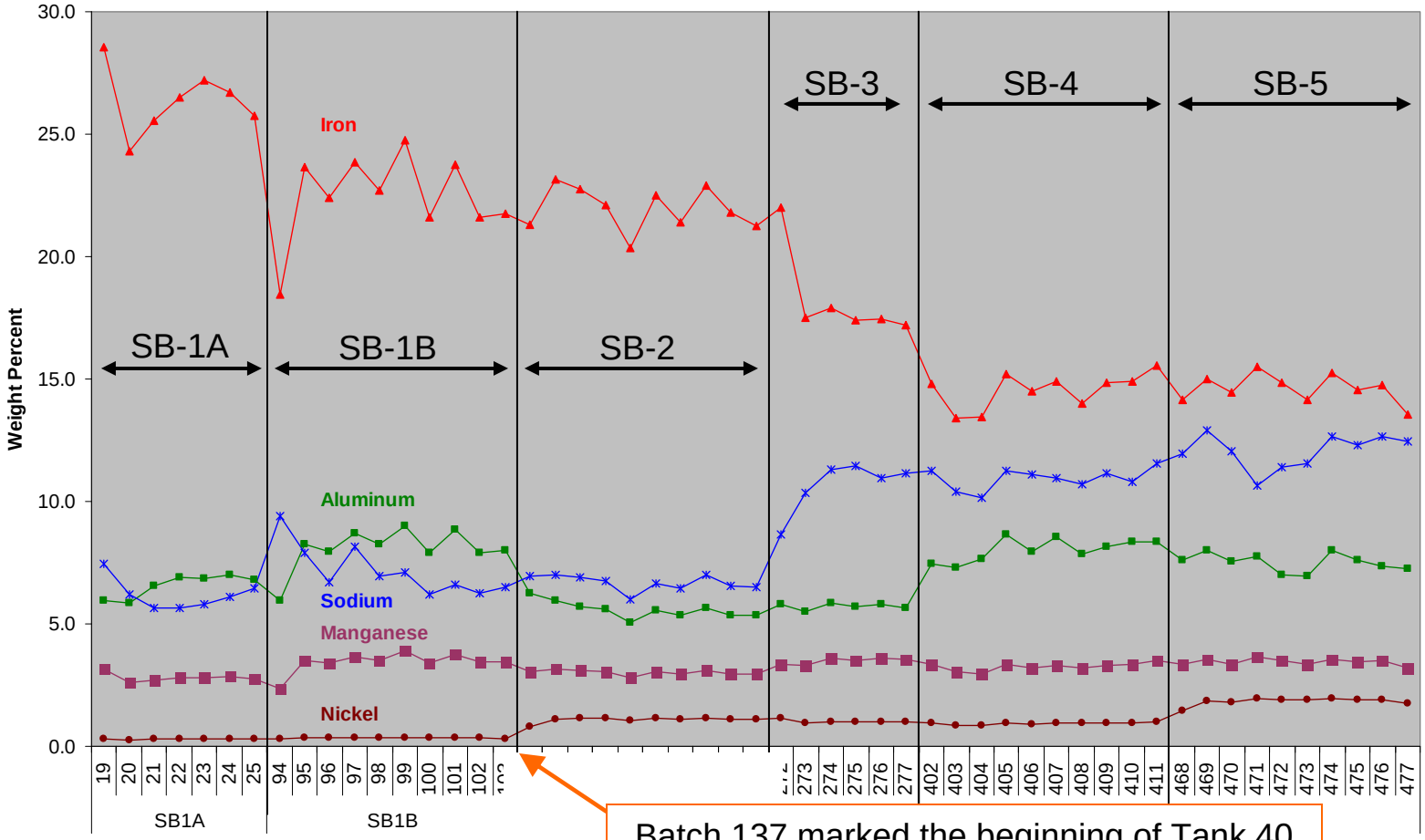
Tank Farm Compliance with DWPF

- To ensure DWPF receives an acceptable waste stream, sampling is used for validation
- Sample needs to be of sufficient size for processing in a laboratory demonstrating DWPF process steps
  - Also providing adequate material to perform chemical and radionuclide analysis of the waste
- This sample may be a single sample or it may be a composite of several smaller samples

Tank 51 or Tank 40 Sampling

- The criteria for mixing is driven by the DWPF WAC
  - Tank Farm complies by providing a representative sludge slurry sample for analysis
- Two methods are employed to collect a sludge slurry sample:
  - Surface (dip) Sample
    - If the calculated Minimum Estimated Sample Depth (MESD) [based on Sludge Settling Rate and Sample Collection Event time] is within 6 inches
  - Variable Depth Sample
    - Alternative, if the MESD is calculated to be greater than 6 inches
- Sample bottle sizes range from 75 mL to 3 L
  - The Sample Request Form defines the conditions and type of sample

SRAT Receipt Sample

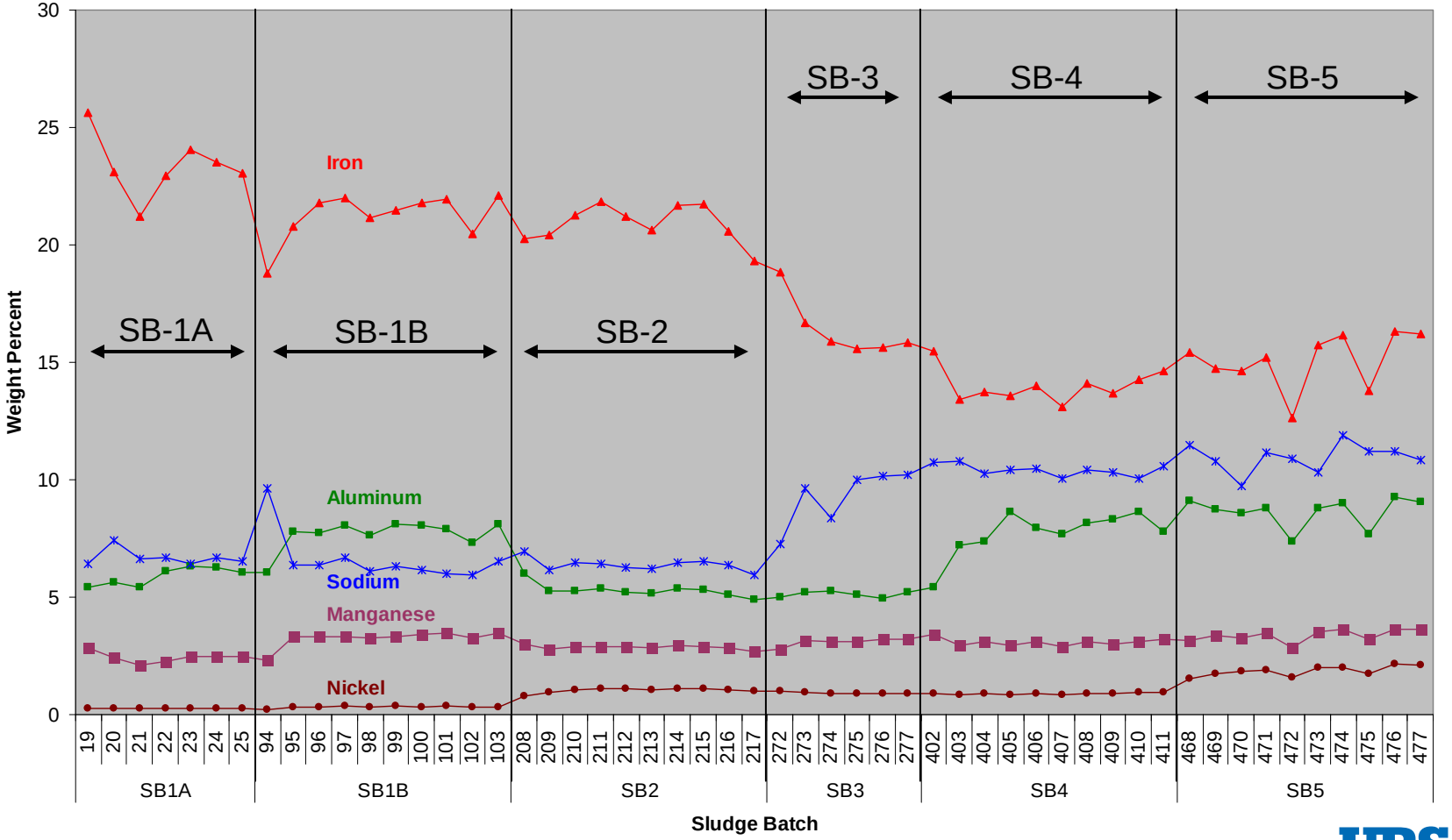


Batch 137 marked the beginning of Tank 40 slurry pump operation during a transfer to DWPF

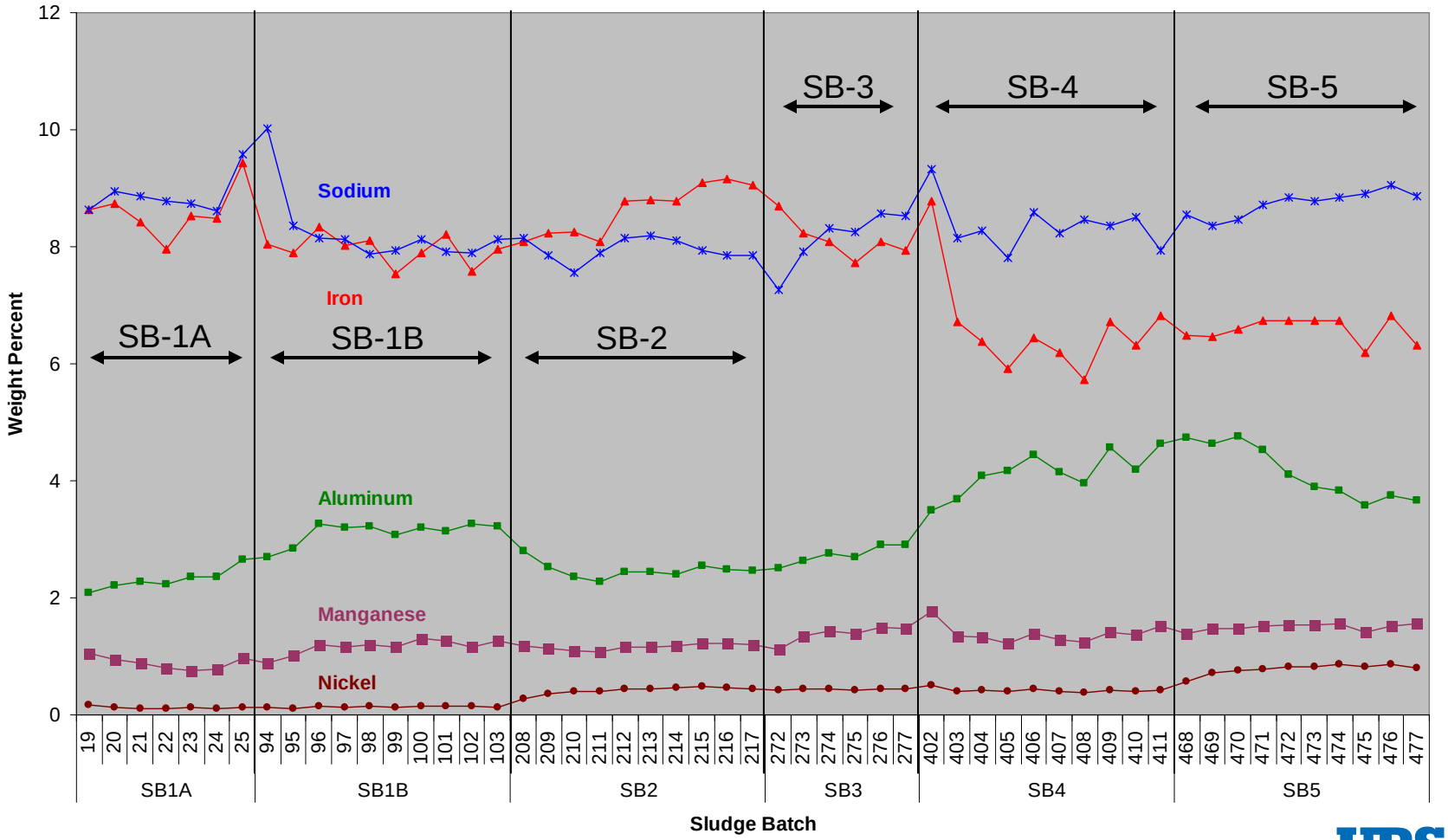
SRAT and SME Sampling

- The SRAT is sampled for the following purposes:
  - Waste Receipt
    - Sample analysis used to determine formic and nitric acid addition volumes; adjusting the waste redox chemistry for processing
  - Final Product
    - Sample analysis confirms processing is complete and ready to transfer to SME for frit addition
- The SME is sampled for the following purposes:
  - Final Product/Acceptability
    - Waste Compliance control sample, ensuring glass acceptability
- Each vessel has specific agitation operation times and sample pump recirculation times prior to obtaining a sample to ensure a representative sample is acquired.

SRAT Product Sample



SME Product Sample



Questions

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