Design of Acid Mine Drainage Collection and Treatment Facilities at the Brewer Gold Mine Site

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OVERVIEW

1. SITE AND PROJECT BACKGROUND

2. DESIGN GOALS AND OBJECTIVES

3. DESIGN ASPECTS AND FEATURES
Project Background

• Former Brewer Gold Mine in Jefferson, South Carolina. Operated Intermittently from 1828-1995
• Mercury Amalgamation and Cyanide Heap Leaching
• 230 Acres Disturbed by Mining, >1,000 Acres total
• 1993-95 Closure, Reclamation, Temporary WW Treatment Plant (magnesium Hydroxide Neutralization/Precipitation)
• 1999 EPA Assumed Responsibility and O&M of WWTP (GW and Surface Water)
• 2000 WWT Process Changed to Lime Neutralization/Precip.
• 2005 Site Added to NPL, B&V tasked to assume O&M, conduct RI, FS
Project Background (Cont.)

- EPA operating aging “Temporary System” since 1995
- 2014 - BV issued RD to Design New System
- Components Included:
  - Cap the 50-acre former waste rock disposal area
  - Improvements to AMD collection / conveyance Systems
  - Design new 56 MG annual capacity lime treatment plant
  - Effluent polishing to treat selenium
  - Sludge dewatering process modifications
- Objective is to protect surface water
Multi-Faceted Design

**Design Goals and Objectives**

- Reduce volume of mine-impacted water to be treated (80MG to 56MG)
- Flexible and automated water collection/treatment process
- High Reliability
- Reduce O&M requirements
- Incorporate Performance Based Contracting (PBC) for specialized process components (Selenium, Polymer, Anti Scaling)
- Potential Re-Use and/or Reclamation of Sludge
## Design Goals and Objectives (Continued)

### WATER QUALITY

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Influent Concentration</th>
<th>Monthly Average Discharge Criteria (µg/L)</th>
<th>Daily Max Discharge Criteria (µg/L)</th>
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<tbody>
<tr>
<td>pH</td>
<td>2.3</td>
<td>6.0-8.5</td>
<td>6.0-8.5</td>
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<tr>
<td>Aluminum (µg/L)</td>
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<td>None</td>
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<tr>
<td>Cadmium, total (µg/L)</td>
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<td>Copper, total (µg/L)</td>
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<td>Iron (µg/L)</td>
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<td>Manganese (µg/L)</td>
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<td>Nickel (µg/L)</td>
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<td>Selenium, total (µg/L)</td>
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<td>Sulfate (mg/L)</td>
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<tr>
<td>TDS (mg/L)</td>
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<td>None</td>
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</tbody>
</table>
Reduce Volume of Mine-Impacted Water

- SW runoff from waste rock area is acidic (pH 3.5) - Requires Treatment
- Collected in pond beneath the area
- Contributes ~30% of the total mine-impacted water for treatment
- Install vegetated cap to eliminate this WW Source
Earthen Vegetated Cap and Drainage Improvements - Design

- Earthen Cap – 50/50 blend of onsite borrow with dried alkali sludge from existing wastewater treatment process
- Drainage channels (100 yr)
- Apply Ag Lime beneath cap to neutralize acidity
- Testing/Monitoring Program
- Challenges:
  - Sheer rock slopes
  - Vegetation Establishment
Flexible & Automated Water Treatment Process

• Semi-continuous operation
• High density lime slurry to reduce scaling & maintenance
• Online water quality instrumentation & controls for automated chemical dosing
• Temporary holding basins for phased treatment
• Reduces operator involvement
High Reliability

• Stayed with Hydrated Lime for primary Neutralization/Precipitation Process
• Redundant Primary Process (2 Parallel Treatment Trains)
• Redundant Pumps throughout
• Backup Power Supply for Seep Collection/Lift Stations and EW
Reduce O&M Requirements
Current Sludge Drying Process Labor Intensive

- Pumped via Dredge from Settling Pit to Drying Pads
- Precipitated hydroxide sludge is fine-grained and holds water
- Sludge “stirred” and air dried
- Long drying times, rain impacts drying time (>50” per year)
- Current process requires significant operator involvement

Current sludge dewatering/drying method
Proposed Sludge Dewatering Process

- Sludge automatically pumped from clarifiers to Lined Settling Basin
- Sludge pumped from basin to geotextile dewatering tubes at operator’s convenience
- Inline addition of polymer coagulant
- Drying time unaffected by rain

Geotextile fabric filter tube dewatering reduces O&M
Incorporating PBC Into Design (Selenium)

• Multiple Competing Technologies and approaches (proprietary, unreliable cost and performance data)

• Bench and Pilot Studies Preferred – BV selected one for Bench, will provide report to bidders

• System and performance criteria incorporated in Engineering Design Specifications
  • Specifies Influent Water Quality and Discharge Requirements
  • Specifies opportunity for treatability and/or pilot testing
  • Provides chemical data from existing system and jar tests
  • Specifies PBC contractor design, procure, install, & commission equipment, and prove-out period for full operation
FS versus RD Cost Estimates

RD Estimated Cost ~ 3 Times Higher Than FS

Factors
- Redundancy, Extra Water Storage Basins, Back up Power Supplies, Input from Stakeholders (State), More existing Comp. Required Replacement than Anticipated
- Selenium Treatment Requirements / Processes / Costs not well understood at the time
- Complex Systems - Inadequate Conceptual Design During FS

Lessons Learned
- Complex Systems - Involve more key stakeholders in conceptual design development, including O&M staff if available during the FS
- Provide more detailed conceptual design during the FS
- Include more contingency for uncertainty related to treating emerging COC’s
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THANK YOU

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2017 Design and Construction Issues at Hazardous Waste Sites