A Proposed Semi-Passive Treatment System At Remote AML Sites

by

Robert H. Lambeth, PE, PG, LHG & Gene Andrews, PE
Millennium Science & Engineering, Inc.
Spokane, Washington

EPA HARDROCK MINING CONFERENCE 2012
Denver, Colorado
April 3, 2012
Problem: ARD discharging into a popular Wild & Scenic River floodplain

Question: Can you build a minimal cost, walk-away treatment system that has no footprint, odor, maintenance, or power needs?

Answer: It would be difficult! Or more precisely – NO!
History & Description

- Volcanogenic Massive Sulfide deposit
- Active 1898-1942
- Most production 1908-1916
- 13 Adits
- 2 Shafts
- 4 Levels below River
- 10,000 feet of workings
Ground Level View of Site
Aerial View of Site

100 Yr. Flood Plain

River Level Adit
Floodplain Looking West
All Adits
Adit Discharge
Discharge Quality

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow</td>
<td>10 gpm</td>
</tr>
<tr>
<td>pH</td>
<td>2.9 su</td>
</tr>
<tr>
<td>Al</td>
<td>19 mg/L</td>
</tr>
<tr>
<td>As</td>
<td>0.016 mg/L</td>
</tr>
<tr>
<td>Cu</td>
<td>3.5 mg/L</td>
</tr>
<tr>
<td>Fe</td>
<td>93 mg/L</td>
</tr>
<tr>
<td>Pb</td>
<td>0.21 mg/L</td>
</tr>
<tr>
<td>Se</td>
<td>0.03 mg/L</td>
</tr>
<tr>
<td>Zn</td>
<td>18 mg/L</td>
</tr>
</tbody>
</table>
Treatment Design Considerations

- Limited access
- No power
- Adit frequently flooded
- Entire valley is a floodplain
- Visibility
- Vandalism
- No water availability
Basic Treatment Options

Neutralization (mandatory)

- Within wetlands?
- Caustic?
- Lime?

Sludge handling

- Direct discharge?
- Settlement basin w/removal?
- Filtration w/removal
Neutralization Discussion

Lime addition
- Denser sludge
- Lower cost
- Doesn’t freeze, but
- More maintenance
- Greater power requirements

Caustic addition (Preferred)
- Much easier and simpler to use
- Less power needs
- Lower maintenance
Bench & Field Tests

• Performed by Ionic Water Technologies, Inc., Reno, NV
• 8 gpd of 30% NaOH solution to pH 9
• All metals but Al declined to criteria in effluent
• Sludge passed TCLP, but leachate still exceeded some criteria
• Paint filter test was not performed

This Should Work!
Settlement Option Issues

Wetlands
- Would have to be in the floodplain
- Will 10 gpm sustain an adequate size system for the pH?
- Visible and subject to vandalism

Settlement basins
- Would have to be in the floodplain
- Visible and subject to vandalism

>> Sludge removal for both awkward and the disturbed sludge may not pass the Paint Filter Test<<
Potential Locations

100 Yr. Flood Plain

?? = Treatment plant
? = Basins
? = Pipeline

?? River Level Adit
Alternative Proposal!

1. Concrete plug in adit
   • Can create head!
   • Stops inundation!

2. Treatment system underground
   • Hides it!
   • Protects it!

3. Treated effluent to fabric filters
   • Contains sludge!
   • Protects sludge from flooding!

4. **Discharge to drainfield for polish and concealment!**
Sludge Disposal ?!? 

- Use multiple fabric filter tubes in series!
- Containerize filter tubes in large garbage dumpsters!
- Change out full filter tubes quickly!
- Dispose in local landfill!
  - The sludge passes TCLP!
  - The sludge should pass the Paint Filter Test!

>>The landfill can still reject it!!<<
In-Adit Design

Note: “V” indicates a bidirectional cleanout

Caustic Storage
Flocculant Storage
Pumps & Controls
In-Line Mixer

6” Discharge Line

520 LEVEL

0+45 ft crosscut

0+80

0+95 ft crosscut

PROPOSED PLUG 0+75

760 –
740 –
720 –
700 –
680 –

0+00 0+20 0+40 0+60 0+80 1+00 1+20 1+40

73.6' Depth
93.2' Depth

Top 1-4 ft of rock is weathered, weak

PILLAR 15'

58.5' 51.5'

3' 3/6'
Pipe Detail

520 ADIT PLAN VIEW

520 ADIT CROSS-SECTION VIEW

Note: Drawings are conceptual only and not to scale.
COSTS

Capital Cost = $1,900,000

Five Year Capital & Operating Cost = $2,828,000
Closing

1. More treatment/pilot tests are needed!
2. This can be phased in!
3. This is just one more wrench in the ARD remedial toolbox!
Comments?

Questions?

Sticker Shock?