Molybdenum Removal In Constructed Anerobic Wetlands

Mark Freberg
Highland Valley Copper
Highmont Tailings Pond
Highmont Tailings Seepage Chemistry

- pH          7.2 to 8.6
- Molybdenum  2.5 to 9.9 mg/l
- Copper      0.002 to 0.007 mg/l
- Sulphate    330 to 560 mg/l
- Manganese   0.01 to 0.36 mg/l
- Alkalinity  220 to 250
History of Passive Treatment

- 1994 to 1996 Pilot Test Tank
- 1998 Full Scale Installation at S5 Pond
- 2002 Full Scale Installation at S8 Pond
Tank Scale Testwork

- Operated between 1994 and 1996.
- Both internal and external nutrient sources tested.
Tank Scale Testwork

- Molybdenum removals as high as 99% obtained but system was very temperature sensitive.

- Internal nutrient source gave the best overall results.
S5 Installation - 1998
S5 Installation
Collection of Bacterial Innoculant
S5 Final Discharge Point

S5 Pond

Final Discharge at Culvert
S5 Flow Rates

- Flows range between 60 and 80 litres/min. for most of the year.
- During freshet flow rates can exceed 500 litres/min.
S5 Performance To Date
Molybdenum

Inflow
Outflow
Culvert
S5 Performance To Date

Molybdenum Removal
<table>
<thead>
<tr>
<th></th>
<th>Seepage</th>
<th>Discharge</th>
<th>Culvert</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molybdenum</td>
<td>4.56</td>
<td>0.58</td>
<td>0.48</td>
</tr>
<tr>
<td>Copper</td>
<td>0.0033</td>
<td>0.0029</td>
<td>0.0026</td>
</tr>
<tr>
<td>Iron</td>
<td>0.052</td>
<td>0.267</td>
<td>0.057</td>
</tr>
<tr>
<td>Sulphate</td>
<td>291</td>
<td>173</td>
<td>116</td>
</tr>
<tr>
<td></td>
<td>(mg/l)</td>
<td>Seepage</td>
<td>Discharge</td>
</tr>
<tr>
<td>-----------------------</td>
<td>--------</td>
<td>---------</td>
<td>-----------</td>
</tr>
<tr>
<td><strong>Total Nitrogen</strong></td>
<td>0.24</td>
<td>1.32</td>
<td>0.43</td>
</tr>
<tr>
<td><strong>Ammonia</strong></td>
<td>0.015</td>
<td>0.627</td>
<td>0.027</td>
</tr>
<tr>
<td><strong>Total Phosphate</strong></td>
<td>0.023</td>
<td>1.09</td>
<td>0.158</td>
</tr>
<tr>
<td><strong>Manganese</strong></td>
<td>0.14</td>
<td>0.55</td>
<td>0.12</td>
</tr>
</tbody>
</table>
### S5 Performance

#### 2001 Average Results

<table>
<thead>
<tr>
<th></th>
<th>Range</th>
<th>Average</th>
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</thead>
<tbody>
<tr>
<td><strong>Redox (mv)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seepage</td>
<td>+60 to +165</td>
<td>+131</td>
</tr>
<tr>
<td>Discharge</td>
<td>-530 to -555</td>
<td>-546</td>
</tr>
<tr>
<td><strong>pH</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seepage</td>
<td>7.28 to 8.42</td>
<td>8.04</td>
</tr>
<tr>
<td>Discharge</td>
<td>7.28 to 8.25</td>
<td>7.76</td>
</tr>
</tbody>
</table>
S5 Performance To Date

Temperature

Temperature (Degrees C.)

Jul-98 Nov-98 Feb-99 May-99 Aug-99 Dec-99 Mar-00 Jun-00 Oct-00 Jan-01
S5 Performance To Date
Sulphide

Graph showing sulphide levels from Feb-99 to Dec-02, with peaks in Apr-01, Nov-01, and May-02.
S5 Performance To Date

Limiting Factors

- Molybdenum Removal
  - Low water temperature
  - Availability of simple carbon

- Volumetric Throughput
  - Bed permeability
Highmont Tailings Pond
S8 Installation

S8 North/South cross-section

S8 East/West cross-section containing all planes of reference

**LEGEND**
- **SHORT CIRCUIT PREVENTION PLYWOOD**
- **SHORT CIRCUIT PREVENTION CURBS**
- **GEOTEXTILE AND PVC LINER**
- **PERFORATED PIPE**
- **FILTER MEDIA**

Drawn By: Rudolf Zdravije
Date: Aug 10th, 2002
Scale: N.T.S.
S8 Installation
S8 Pond Installation
S8 Pond Installation
S8 Pond Installation
Acknowledgement

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