Sea to Sky Parkway ARD/ML Assessment

Cheryl Ross, Valérie Bertrand, Rens Verburg - Golder Associates
Al Brown - B.C. Ministry of Transportation
Objective

Characterize the *bulk* acid rock drainage (ARD) and metal leaching (ML) potential of rocks along the Sea to Skyway corridor.
Overview

• Data Collection - Rationale and Results
  - Geologic Mapping
  - Static Testing
  - Kinetic Testing

• Impact Assessment Approach

• Ongoing Work
Geologic Mapping
WATER SAMPLING

- 23 creeks
- Exceedances of aquatic freshwater criteria identified
  - pH < 6.5
  - Aluminum
  - Copper
Static Testing

- Acid Base Accounting (ABA)
- Mineralogy (XRD)
- Whole Rock Analysis
- Shake Flask Extraction (SFE)
- Wall Washing
Shake Flask Extraction (SFE)

- Crushed sample
  - 2 size fractions
- 3:1 liquid to solid ratio
- Lixiviant
  - Deionized water
  - Salt water
- 24-hour bottle roll
SFE Copper Results

Coarse Fraction (mg/L) vs. Fine Fraction (mg/L)

Data points for CP, PJT, and IKG are plotted on the graph.
Salt Water Vs. Fresh Water SFE Copper

Howe Sound Cu = 0.011 mg/L
Wall Washing

- Conducted in early October - prior to start of wet season
- Area - 1 m²
- Leachate volume recorded
Results Summary

- ARD Potential
  - Coast Plutonics - None
  - Twin Island Group - None
  - Gambier Group - Likely to Possible

- ML Potential
  - Copper and aluminum from all rock types
Impact Assessment
Metal Leaching Rate (SFE)

COARSE

FINE

SFE

SFE

Rates (kg/m²)

Rates (kg/m²)

Rates (kg/m²)

Rates (kg/m²)
Wall Washing vs. SFE Rates

Copper Leaching Rate (kg/m²)

Wall Washing - Solid
SFE Test - Stripe
Metal Loading

RATE (kg/m²)

LOAD (kg of Cu)

Concentration (mg/L of Cu)
# Predicted Concentrations

<table>
<thead>
<tr>
<th>Drainage</th>
<th>Background</th>
<th>CEQG</th>
<th>Rock Cut Drainage (mg/l)</th>
<th>Stream</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sclufield</td>
<td>0.002</td>
<td>0.002</td>
<td>0.029</td>
<td>0.0021</td>
</tr>
<tr>
<td>Loggers</td>
<td>0.001</td>
<td>0.002</td>
<td>&lt;0.001</td>
<td>0.00099</td>
</tr>
<tr>
<td>Britannia</td>
<td>0.044</td>
<td></td>
<td>0.021</td>
<td>0.0439</td>
</tr>
</tbody>
</table>

**CEQG - Federal freshwater aquatic standard**
Gambier Group Cuts

Approximate Distance = 5 km

Total Sulphur (wt. %)

0.3 wt. %
Kinetic Testing

- **pH (s.u.)**
- **Sulphate (mg/L)**
- **Week**

The graph shows the relationship between pH and sulphate levels over a period of weeks.
Conclusions

- Metal leaching may result in Cu and Al exceedances in rock cut runoff; however, resultant stream concentrations are predicted to remain below standards.
- Metal loading to Howe Sound is predicted to be small:
  - 2 g to 9 g in Rundle drainage compared to 5.7 kg loading from Britannia drainage.
- Gambier Group andesites have potential to generate ARD.
Conclusions

Potential environmental effects from ARD/ML perspective are anticipated to be small, provided suitable re-use and disposal options are chosen for the excavated material.
Acknowledgements

B.C. Ministry of Transportation
Al Brown

B.C. Ministry of Energy and Mines
Kim Bellefontaine