

# **METAL LEACHING ISSUES IN THE CANADIAN MINING INDUSTRY: A Progress Report**

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# BACKGROUND

- Many “metals” (and other chemicals) affect water quality at neutral pH and require mitigation before discharge
- Neutral pH “metals” pose special challenges for mitigation and treatment
- “every mine with acid drainage issues has an issue with metals in neutral pH drainage” – Bill Price (2003)

# OBJECTIVES

- Identify the key issues and list of “metals” that can be problematic at neutral pH
- Where / what types of mines are affected?
- What are the drivers for mitigation (water quality objectives, environmental / receptor sensitivity, etc...)?
- How are mining operations addressing the issues?
- Do we have the answers yet?
- What are the cost implications?

# THE (LIKELY) CULPRITS

- Antimony
- Arsenic
- Cadmium
- Molybdenum
- Nickel
- Selenium
- Zinc

# Environmental Drivers / Objectives

Metal	MMER (mg/L)	Guide Aquatic (mg/L)	Environmental Issue ALSO Related to Environmental Effects Monitoring (EEM)
Arsenic	0.5	0.005	Toxicity to Green Algae
Molybdenum	NA	0.073	Toxicity to ruminants and other mammals
Nickel	0.5	0.025	Toxicity to invertebrates and fish
Selenium	NA	0.002	Toxicity to water fowl



# EXAMPLE

## MINE TYPES / REGIONS AFFECTED

Metal	Mine / Region	Primary Sources
Arsenic	Gold, Uranium, Nickel-copper	Arsenopyrite, Metal- arseno sulphides, nickel sulphides, arsenic sulphides
Molybdenum	Moly, Copper (BC), Uranium (SK)	Mo sulphide, Mo oxides
Nickel	Nickel (sulphide), Uranium	Ni sulphides, Ni arsenides
Selenium	Coal, porphyry- copper	Associated with sulphur



# TREATMENT ISSUES

- 1997 data suggest present value (5% disc) of treatment systems for gold and base metal mines is between \$120M and \$450M in Canada alone
- Traditional treatment;
  - pH adjustment with lime to remove metals
  - Cyanide destruction at gold mines
  - Ammonia removal (Mine water, CN byproduct)
  - Settling to remove TSS

# TREATMENT ISSUES

- Traditional treatment controls;
  - pH
  - Most heavy metals including; copper, lead, nickel, zinc
- Other treatment needed for
  - Antimony, Arsenic, Molybdenum, Selenium (and perhaps some other metals – eg Nickel at Raglan)
- Increasing number of non-traditional treatment systems are being developed



# EXAMPLES OF TREATMENT (ARSENIC)

- Ferric iron addition directly in ponds
- Ferric iron addition in plant followed by settling ponds
- In-Mill treatment;
  - Uranium mills have specific neutralization steps and target iron levels
- “Pilot” Systems;
  - Passive reactors and barriers
  - Wetlands
  - Nutrient-fed biologic reactors

# OUTSTANDING ISSUES

- Are the non-traditional systems effective?
- What do we do with the residual treatment solids?
- How do we manage “Legacy” facilities?
  - Arsenic trioxide wastes
  - Historic gold tailings (>100 mg/L arsenic in pore water)
- What are the full costs associated with complete cycle treatment and residual “sludge” management
- What do we do with unexpected EEM (toxic) results?

# PRELIMINARY RECOMMENDATIONS

- Re-evaluate status after preliminary EEM results have been assessed
- Develop Tech-Transfer events similar to the “Arsenic Workshop” to define common ground and better define needs for non-ARD issues affecting water quality
- Develop more specific guidelines (or description of experience) for the prevention and control of metals in neutral-pH drainage

# REPORT

- Draft report in January 2003
- Final report March 2004

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