



ACID MINE DRAINAGE (AMD)

Fact Sheet

Acid Rock Drainage (ARD) is a natural process whereby sulphuric acid is produced when sulphides in rocks are exposed to air and water. Acid Mine Drainage (AMD) is essentially the same process, greatly magnified. When large quantities of rock containing sulphide minerals are excavated from an open pit or opened up in an underground mine, it reacts with water and oxygen to create sulphuric acid. Acid is carried off the mine site by rainwater or surface drainage and deposited into nearby streams, rivers, lakes and groundwater. AMD severely degrades water quality, and can kill aquatic life and make water virtually unusable.

ACID MINE DRAINAGE AND MINING

AMD has been called the mining industry's greatest environmental impact, especially to our waterways.

In gold mining, 99% of the rock material removed from the ground consists of tailings and waste rock, normally stored in ponds that may cover several hectares or waste rock piles (hills) that can reach as much as 100m in height.

The science of predicting AMD is still far from conclusive. The gap between the theoretical tests and the real world dynamics of AMD provides reason for caution when mines are assessed and permitted.

The causes of AMD can also include forestry road building, and any activity that disturbs mineralized materials.

SULPHURIC ACID AND ACID MINE DRAINAGE IN THE ENVIRONMENT

Sulphuric Acid is a clear, colorless, oily liquid that is very corrosive. It is also called sulphine acid, battery acid, and hydrogen sulfate.

Sulphuric Acid dissolves in water and air, and can remain suspended in air for varying periods of time. Sulphuric Acid is removed from air by rain.

Because of concentration levels, AMD can be 20 to 300 times more acidic than acid rain and

can burn human skin and kill fish and other aquatic life.

AMD also leaches toxic metals, including arsenic, cadmium, chromium, and lead from waste rock which can cause further pollution.

(See *Arsenic, Lead, and Cadmium* Factsheets)

Dissolved metals can be highly toxic, and become more readily absorbed by plants, animals and fish. Metals can also be *bioaccumulated* and *biomagnified* in the food chain.

(See also *Bioaccumulation of Contaminants* Factsheet)

PREDICTING AND MITIGATING ACID MINE DRAINAGE

In a recent study of mines in the United States, 89% of mines that developed acid drainage either underestimated or ignored the potential for AMD in their environmental impact statement.

64% of the mines in this study also had failures in the mitigation measures they claimed would prevent or limit AMD.

The study found that water quality impacts were closer to *potential* (pre-mitigation) rather than *predicted* (post-mitigation) impacts in the impact statements. There is no comparable study for Canadian mines.



HEALTH EFFECTS OF AMD

Government states that while there is no *direct* risk to public health from acid mine drainage, that the solubilization of various metals (aluminum, arsenic, cadmium, copper, lead, nickel, and zinc) makes it easier for them to enter streams and rivers. Contamination of streams and rivers by these metals can cause problems downstream in fish, wildlife, and drinking water.

(See *Arsenic, Lead, and Cadmium* Factsheets)

HEALTH EFFECTS OF SULPHURIC ACID

Sulphuric Acid does have health effects through direct exposure, which is supposed to be prevented through the mine's mitigation measures.

Sulphuric Acid is extremely corrosive and direct exposure can result in:

- ❖ Severe irritation and burns to the skin.
- ❖ Severe lung damage, life threatening accumulation of fluid (pulmonary edema).
- ❖ Irritation, permanent damage to eyes and possible blindness.
- ❖ If swallowed, can cause burns to mouth, throat, esophagus, and stomach.

Long-term exposure to low-levels can cause:

- ❖ Dermatitis: red, itchy, dry skin.
- ❖ Erosion of the teeth.
- ❖ Not a lot of study has been done on long-term exposure through air.

There is not enough information available on whether Sulphuric Acid affects fetuses, or whether it acts in a *synergistic manner* with other materials (will the effects be increased

when combined with exposure to other chemicals?)

Sulphuric Acid (in mist form) is absorbed through mucous membranes, ending up in the bloodstream. It is excreted in urine, and therefore is unlikely to accumulate in the body.

Testing for Sulphuric Acid in the Body

There is no medical test to determine whether you have been exposed to Sulphuric Acid. Breathing in acids will increase the acidity of your saliva, which can be measured through tests, but will not tell you which type of acid.

Does Sulphuric Acid Cause Cancer?

The International Agency for Research on Cancer (IARC) concludes that there is sufficient evidence that exposure in the workplace to strong inorganic acid mists containing sulphuric acid, is carcinogenic (cancer-causing) to humans.

ENVIRONMENTAL MANAGEMENT OF AMD

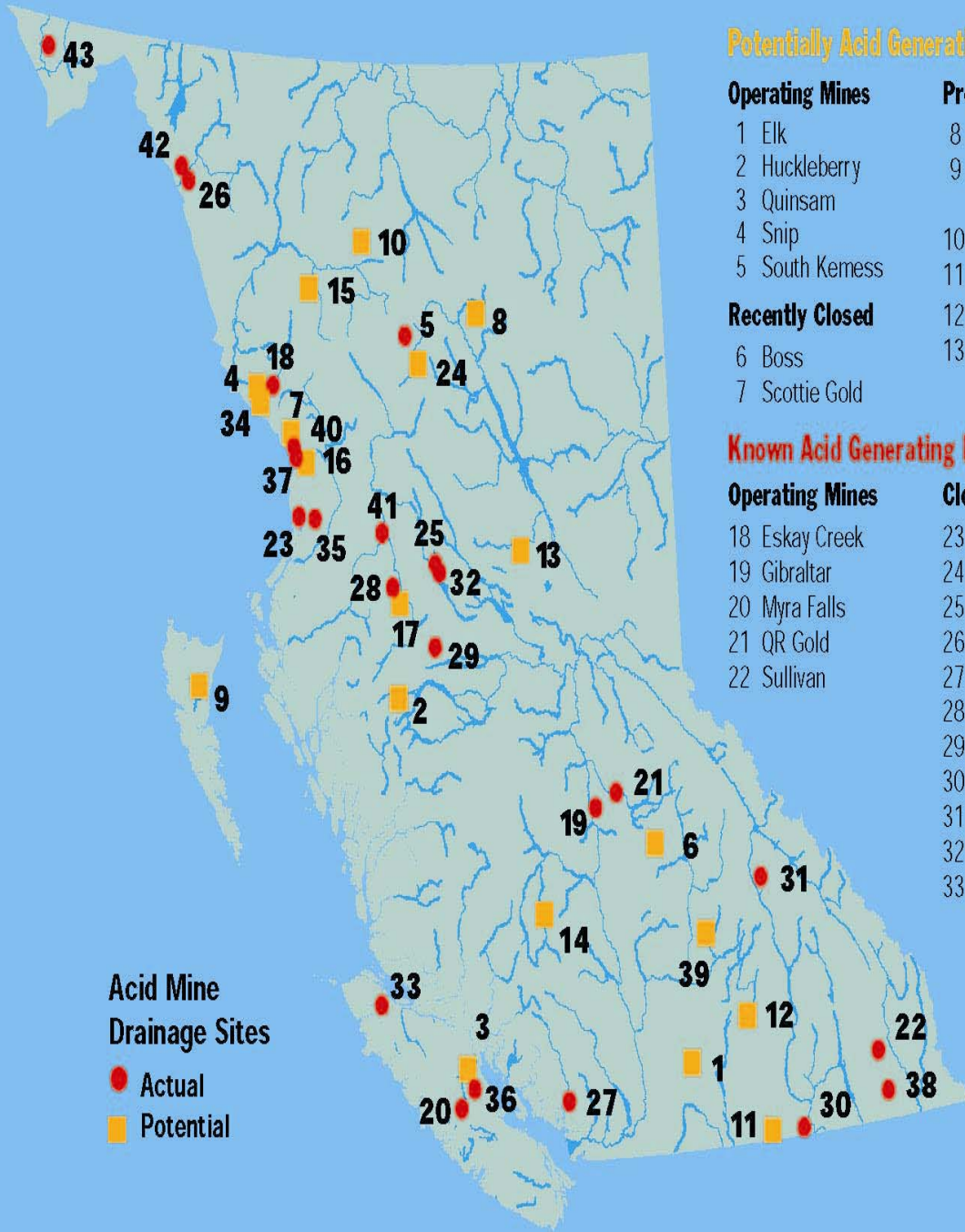
In British Columbia, regulations for managing mine wastes are included in the:

- ❖ *BC Waste Management Act* (BC Ministry of Environment)
- ❖ *BC Mines Act* (BC Ministry of Energy, Mines, and Petroleum Resources)
- ❖ *Fisheries Act* (Federal Department of Fisheries and Oceans)

The BC Ministry of Energy, Mines and Petroleum Resources requires that metal and coal mines predict the AMD potential of all wastes produced and, where necessary, provide reasonable assurance of environment protection and costs of future mitigation.



Acid Mine Drainage Sites – British Columbia



Acid Mine
Drainage Sites

- Actual
- Potential

Potentially Acid Generating Mines

Operating Mines

- 1 Elk
- 2 Huckleberry
- 3 Quinsam
- 4 Snip
- 5 South Kerness

Proposed Mines

- 8 Cirque
- 9 Harmony Gold (Cinola)
- 10 Kutcho Creek
- 11 Lexington

- 14 Prosperity (Fish Lake)
- 15 Red Chris
- 16 Red Mountain
- 17 Telkwa Coal
- 42 Tulsequah Chief (Redfern)

Recently Closed

- 6 Boss
- 7 Scottie Gold

- 12 Lumby Muscovite
- 13 Mount Milligan

Known Acid Generating Mines

Operating Mines

- 18 Eskay Creek
- 19 Gibraltar
- 20 Myra Falls
- 21 QR Gold
- 22 Sullivan

Closed/Abandoned

- 23 Anyox
- 24 Baker
- 25 Bell
- 26 Big Bull
- 27 Britannia
- 28 Duthie
- 29 Equity
- 30 Giant Nickel
- 31 Goldstream
- 32 Granisle
- 33 Island Copper

- 34 Johnny Mountain
- 35 Kitsault
- 36 Mount Washington
- 37 Premier
- 38 Saint Eugene
- 39 Samatsum
- 40 Silver Butte
- 41 Silver Standard
- 42 Tulsequah Chief (Cominco)

Exploration Site

- 43 Windy Craggy

Sources: MEI Acid Rock Drainage Policy, June 1997; Draft Guideline for Metal Leaching and ARD at Mine Sites in BC, BC Ministry of Employment and Investment, Reclamation Section; BC Minfile, BC Ministry of Employment and Investment, Geological Survey Branch



SOURCES/FOR MORE INFORMATION:

Health Canada

http://www.hc-sc.gc.ca/ewh-semt/pubs/eval/handbook-guide/vol_4/mining-miniere-eng.php

Agency for Toxic Substances and Disease Registry

<http://www.atsdr.cdc.gov/tfacts117.html>

Alaskans for Responsible Mining

http://www.miningwatch.ca/updir/ARM_Envr_Impacts_Fact_Sheet.pdf

Safe Drinking Water Foundation

<http://www.safewater.org/PDFS/resourcesknowthefacts/Mining+and+Water+Pollution.pdf>

BC Ministry of Water, Land and Air Protection (2002) Environmental Indicator: Mitigating Environmental Impacts in British Columbia

http://www.env.gov.bc.ca/soe/et02/10_mitigation/minesites.html

MiningWatch Canada

www.miningwatch.org

Comparison of Predicted and Actual Water Quality at Hardrock Mines: The reliability of predictions in Environmental Impact Statements

<http://www.mine-aid.org/predictions/ComparisonsReportFinal.pdf>

Nak'azdli Aboriginal Interests and Use Study on the Proposed Mt. Milligan Copper-Gold Mine at Shus Nadloh, June 2008 (available upon request).

Call us Toll-Free at 1-866-960-5223
for more environmental health resources

Production of this document has been made possible through a financial contribution from Health Canada. The views expressed herein do not necessarily represent the views of Health Canada. These factsheets are not intended to provide medical advice, nor do they constitute alerts on potential contamination in specific water, food, or air systems. For up to date information on public health emergencies across Canada please go to:

<http://www.phac-aspc.gc.ca/> (Public Health Agency of Canada).