Treating British Columbia's Acid Mine Drainage (AMD)

THE UNIVERSITY OF BRITISH COLUMBIA

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INTRODUCTION

This project proposes an acid mine drainage (AMD) treatment facility for acidic outflow from the Gibraltar Mine in South-Central British Columbia. The treatment process is mainly designed to tackle the environmental issues rather than to generate profit. This is done by minimizing the concentration of heavy metals in the final discharge and neutralizing the pH using CO_2 gas. The final effluent will be discharged to the Fraser River and/or recycled back into the process.

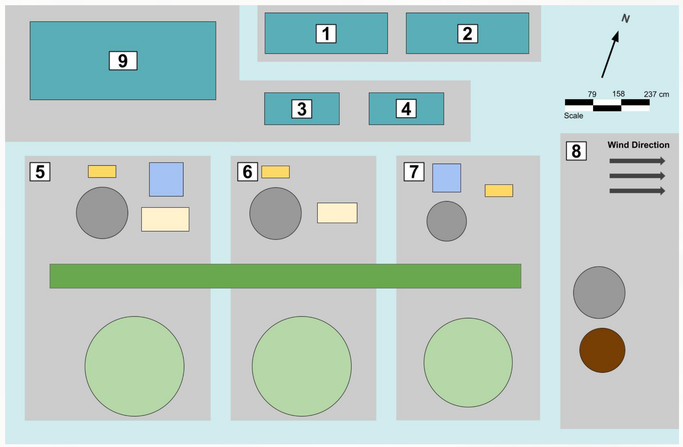
SOCIETAL NEEDS

10,000+ Abandoned Mines across Canada

BC's Projected Spending on Site Reclamation: CAD $2.8 billion

Proposed Treatment Plant Capacity: 1 million L/day of AMD

PLANT LAYOUT



1	Receiving Facility	6	Stage 2 Treatment
2	Warehouse	7	Stage 3 Treatment
3	Administration	8	Stage 4 Treatment
4	Control Room	9	Parking Lot
5	Stage 1 Treatment		

Clarifier	Solid Feeders
Reactors	CO_2 Tank
Flocculant Tanks	Designated Pump Area
Holding Tanks	

PROCESS DESCRIPTION

AMD & Magnesite
1,000,000 L/d of AMD and magnesite enter a stirred tank reactor.

STAGE 1

Metal Hydroxide Sludge
Hydroxide metals precipitate out and are dewatered to be disposed.

Lime
Hydrated lime is added to the magnesite treated AMD in a stirred tank reactor.

STAGE 2

Gypsum
Gypsum sludge at a purity of 50% is dewatered and disposed.

Soda Ash
Soda ash is added to the lime treated AMD in a reactor to reduce the hardness of AMD and precipitate out limestone.

STAGE 3

Limestone
Limestone precipitates out and is dewatered to be sold at a purity of 99%.

CO_2 Gas
CO_2 gas is added to a bubble column reactor to neutralize. The unreacted CO_2 is recycled back to be bubbled through again.

STAGE 4

Final Effluent
The final effluent with a pH of ~7.3 will be discharged to the Fraser River at a rate of 952,000 L /day.

ENVIRONMENTAL ANALYSIS

Air Pollution

No significant source of pollutants since combustion and use of toxic volatile chemicals are not involved.

Solid Disposal

Metal hydroxide and gypsum waste sludge are produced at 17% solids, which is lower than the conventional high density sludge (HDS) treatment.

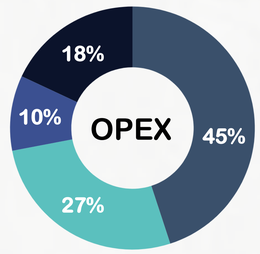
Liquid Discharge

Final effluent concentration complies with all discharge standards.

Dissolved Metals	Concentration in Final Stream (µg/L)	Max. Allowable Concentration (µg/L)
Cu^{2+}	2	30
Ca^{+}	1,108	1,000,000
Fe^{3+}	21	350
Zn^{2+}	1.1	7.5
SO_4^{2-}	147,000	1,000,000

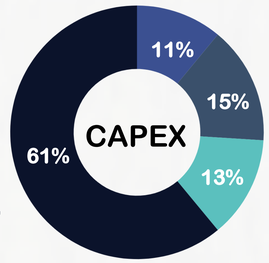
ECONOMIC ASSESSMENT

Cost of Treatment per m^3 of AMD	Limestone Sales per tonne	Plant Lifetime
USD 38.61	USD 67.90	30 years



- Total Direct Production Costs
- General Expenses
- Plant Overhead Costs
- Total Fixed Charges

Total OPEX Value: USD 12.87M



- Total Direct Costs
- Working Capital
- Total Indirect Costs
- Fees and Contingency

Total CAPEX Value: USD 20.35M

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