

BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

HAT CREEK PROJECT

Pollution Control Board of British Columbia - Pollution Control Objectives for the Mining, Smelting and Related Industries of British Columbia - 1979

ENVIRONMENTAL IMPACT STATEMENT REFERENCE NUMBER: 50



MINISTRY OF ENVIRONMENT
VICTORIA, B.C.

Pollution Control Objectives
for
The Mining, Smelting, and
Related Industries
of
British Columbia

POLLUTION CONTROL BOARD
1979

FOREWORD

By Order-in-Council 3159, dated October 28, 1976, the Pollution Control Board was directed to enquire into and review the Pollution Control Objectives for the Mining, Mine-milling, and Smelting Industries of British Columbia, and to take such remedial action in respect of these Objectives as deemed necessary in the public interest. The Pollution Control Board has held a public inquiry. The following Objectives are published in accordance with Section 4, subsections (a) and (b) of the Pollution Control Act. In publishing these Objectives, the Board has considered all information provided by the public inquiry.

In these Pollution Control Objectives, the Board has not attempted to suggest methods by which these Objectives could be met, nor has it suggested what the "state of the art" can now achieve. The Board feels that it is the prerogative of the Director of Pollution Control to make such interpretations to Industry.

This is the first review of the Pollution Control Objectives for the Mining, Mine-milling, and Smelting Industries of British Columbia since the acceptance by the Board of the original Objectives in November, 1973. The Objectives as herein established are the Board's policy for pollution control in British Columbia for wastes from the Mining, Smelting, and Related Industries in British Columbia.

C. J. G. MACKENZIE, M.D.
Chairman, Pollution Control Board

February 22, 1979

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INTRODUCTION

Pursuant to Section 4, subsections (a) and (b) of the Pollution Control Act, the Pollution Control Board prescribes the following Objectives as policy and issues this report as policy advice to the Director of Pollution Control.

These Objectives are based on a review of Pollution Control Objectives for the Mining, Mine-milling, and Smelting Industries of British Columbia, experience gained in the application of the 1973 Objectives, and a review of other environmental and technical information developed since the previous Objectives were published. Publicly advertised meetings were held in Nelson, Vernon, Kamloops, Prince George, Courtenay and New Westminster. Subsequently, the Pollution Control Board held a public inquiry during January, 1978, in Victoria. This inquiry heard presentations from individuals, associations, industry, a Crown Corporation and divisions of both the Provincial and Federal Governments (Appendix 3). Transcripts may be examined at all Pollution Control Branch Regional Offices, the B.C. Research Library, and the Provincial Library, Parliament Buildings, Victoria.

The aim of these Objectives is to protect the quality of British Columbia's environment for the benefit of present and future citizens of this Province and Canada. The Objectives provide, firstly, for use of the environment's assimilative capacity within limits which do not lead to unacceptable conditions and, secondly, for adopting realistic cost-benefit pollution control strategies.

Good waste management practice involves a careful balancing of air and water pollution abatement as well as solid waste disposal with the overall goal of reducing the volume, concentration, and toxicity of waste discharge. While the Objectives focus on points of discharge as the most satisfactory regulatory tactic, the intent is to minimize the effects of known or potentially harmful physical, chemical, and biological changes in receiving environments. To achieve this aim a dual program is necessary: (1) regulation of discharge volumes and concentrations at levels consistent with public health and protection of the environment, and (2) effective monitoring programmes.

- (1) *Discharge regulation:* For the first time the Objectives provide for a wide range of possible discharge concentrations which take into account the needs of particular receiving environments. The more stringent values will apply to sensitive environmental situations, the less stringent where it can be shown that unacceptably deleterious changes will not follow. The Director may designate intermediate values. For specified industrial processes (Table III), discharge concentrations are based on the weight or volume of fuel input or production output. Where two or more discharges share the same receiving environment, the Director will normally limit total discharges so that Receiving Environment Objectives (Tables I and IV) are not exceeded. While the Objectives are intended to apply province-wide, in special circumstances the Director may apply more, or less stringent requirements.
- (2) *Monitoring Programmes:* Except as otherwise provided under the Pollution Control Act, environmental assessments will be undertaken at the discretion of and as specified by the Director of Pollution Control where the receiving environment may be impaired by an existing or proposed discharge. Prior to commencement of new discharges or changes to existing discharges, studies may be required to include a comprehensive examination of site suitability, baseline documentation of physical and chemical parameters, a biological resource inventory and detailed impact predictions. Long-term monitoring of parameters specified in discharge permits (legal standards) may be required. Responsibility for compliance and for provision of data supporting compliance rests with the permit holder.

Objectives are prescribed in the following categories:

Source	Section	Table
Discharges to air — ambient air emissions	A	I II. III
Discharges to water — receiving water effluent	B	IV V
Discharges to land	C	
Non-defined Objectives	D	
Discharges under existing permits	E	

A. DISCHARGES TO AIR

TABLE I. Ambient Air Control Objectives

Parameter (1)	Unit	Range	
1. Sulphur Dioxide			
Annual Arithmetic Mean	$\mu\text{g}/\text{m}^3$ (ppm _v)	25 (0.01)	75 (0.03)
24 hour conc.	$\mu\text{g}/\text{m}^3$ (ppm _v)	160 (0.06)	260 (0.10)
3 hour conc.	$\mu\text{g}/\text{m}^3$ (ppm _v)	375 (0.14)	665 (0.25)
1 hour conc.	$\mu\text{g}/\text{m}^3$ (ppm _v)	450 (0.17)	900 (0.34)
2. Asbestos (chrysotile)	fibres/cm ³ (2)	less than .04	
3. Dustfall	mg/(dm ² · d) (tons/mi ² /mo)	1.7 (15)	2.9 (25)
4. Elements (3)			
Antimony (Sb)	$\mu\text{g}/\text{m}^3$	0.1	0.5
Arsenic (As)	$\mu\text{g}/\text{m}^3$	0.1	1.0
Beryllium (Be)	$\mu\text{g}/\text{m}^3$	0.005	0.1
Cadmium (Cd)	$\mu\text{g}/\text{m}^3$	0.05	0.3
Chromium (Cr)	$\mu\text{g}/\text{m}^3$	0.05	0.1
Copper (Cu)	$\mu\text{g}/\text{m}^3$	0.25	2.5
Fluorine (F) (4)	$\mu\text{g}/\text{m}^3$	0.1	2.0
Lead (Pb)	$\mu\text{g}/\text{m}^3$	1.0	2.5
Mercury (Hg)	$\mu\text{g}/\text{m}^3$	0.1	1.0
Molybdenum (Mo)	$\mu\text{g}/\text{m}^3$	0.1	2.5
Nickel (Ni)	$\mu\text{g}/\text{m}^3$	0.01	0.1
Selenium (Se)	$\mu\text{g}/\text{m}^3$	0.1	0.5
Uranium (U) (5)	$\mu\text{g}/\text{m}^3$	0.01	6.0
Vanadium (V)	$\mu\text{g}/\text{m}^3$	0.05	1.0
Zinc (Zn)	$\mu\text{g}/\text{m}^3$	1.0	2.5
5. Suspended Particulate			
Annual geometric mean	$\mu\text{g}/\text{m}^3$	60	70
24 hour conc.	$\mu\text{g}/\text{m}^3$	150	200
6. Radon Daughter			
Concentration (5)	WL	less than 0.02	

NOTES APPLICABLE TO TABLE I

- (1) Sampling will be in a form and manner over periods of time specified by the Director of Pollution Control.
- (2) An asbestos fibre greater than 5 μm in length with a length to breadth ratio of 3:1 or greater.
- (3) Total gaseous and particulate.
- (4) Measured as total gaseous and particulate fluoride.
- (5) To apply to operations where the objective is not the mining of radioactive ores.

TABLE II Control Objectives for Gaseous and Particulate Emissions

Parameter	Unit	Range	
Total Particulate	mg/mol	1	8
	gr/SCF	0.02	0.15
Antimony as Sb	mg/mol	0.16	0.27
	gr/SCF	0.003	0.005
Arsenic as As	mg/mol	0.16	0.27
	gr/SCF	0.003	0.005
Asbestos	fibres/cm ³ (1)	less than 2	
Cadmium as Cd	mg/mol	0.05	0.27
	gr/SCF	0.001	0.005
Copper as Cu	mg/mol	0.16	0.27
	gr/SCF	0.003	0.005
Fluoride as HF	mg/mol	0.02	0.20
	ppm _v	1.0	10.0
Lead as Pb	mg/mol	0.16	0.27
	gr/SCF	0.003	0.005
Mercury as Hg	mg/mol	0.03	0.27
	gr/SCF	0.0005	0.005
Nitrogen Oxides as NO ₂	mg/mol	14	46
	ppm _v	300	1000
Opacity	percent	10	40
Sulphur Dioxide	mg/mol	16	64
	ppm _v	250	1000
Zinc as Zn	mg/mol	0.16	0.27
	gr/SCF	0.003	0.005

NOTE:

(1) An asbestos fibre greater than 5 μm in length with a length to breadth ratio of 3:1 or greater.

TABLE III Control Objectives for Gaseous and Particulate Emissions for Specific Processes

Industry	Parameter	Units	Range		Notes
1. Ammonium Phosphate Fertilizer Plants	Fluoride as HF	kg/tonne of P ₂ O ₅	0.05	0.15	
		lb/ton of P ₂ O ₅	0.1	0.3	
2. Aluminum Reduction	Total Particulate	kg/tonne of Al	2.5	7.5	(1)
		lb/ton of Al	5	15	
	Fluoride (gaseous plus particulate) as HF	kg/tonne of Al	1.0	2.5	(2)
		lb/ton of Al	2	5	
3. Coal Fired Power Boilers	Total Particulate	mg/kJ/heat input	0.01	0.04	
		lb/10 ⁶ BTU/heat input	0.02	0.09	
	Nitrogen Oxides as NO ₂	mg/kJ/heat input	0.15	0.30	
		lb/10 ⁶ BTU/heat input	0.35	0.70	
	Sulphur Dioxide	mg/kJ/heat input	0.09	0.34	
		lb/10 ⁶ BTU/heat input	0.2	0.8	
Opacity	percent	10	40		
Trace Elements	—	—	—	(3)	
4. Coke Plants	Total Particulate	kg/tonne of coke	0.1	0.2	
		lb/ton of coke	0.2	0.4	(4), (5)
	(a) Charging	mg/mol	1.1	5.5	
		gr/SCF	0.02	0.1	(4), (5)
	(b) Pushing	mg/mol	1.6	5.5	
		gr/SCF	0.03	0.1	
	(c) Battery Stacks	kg/tonne of coke	0.005	0.015	
		lb/ton of coke	0.01	0.03	
Opacity	percent	10	40	(6)	
Trace Elements	—	—	—	(3)	
5. Copper Smelting	Total Particulate	kg/tonne of Cu		1.5	
		lb/ton of Cu		3	
	Copper	kg/tonne of Cu		0.5	
		lb/ton of Cu		1	
Arsenic	kg/tonne of Cu		0.1		
	lb/ton of Cu		0.2		
6. Lead Smelting & Refining	Total Particulate	kg/tonne of Pb		4.5	
		lb/ton of Pb		9	
	Lead	kg/tonne of Pb		0.5	
		lb/ton of Pb		1	
	Zinc	kg/tonne of Pb		0.15	
		lb/ton of Pb		0.3	
Arsenic	kg/tonne of Pb		0.1		
	lb/ton of Pb		0.2		
Fluoride	kg/tonne of Pb		0.15		
	lb/ton of Pb		0.3		
7. Zinc Smelting	Total Particulate	kg/tonne of Zn		1.0	
		lb/ton of Zn		2	
	Zinc	kg/tonne of Zn		0.05	
lb/ton of Zn			0.1		

NOTES APPLICABLE TO TABLE III

- (1) Includes pot room emissions and facilities directly related thereto, but does not include external conveyor systems, raw material unloading facilities, coke calcining plants, shops or other similar installations.
- (2) Includes pot room vents and cell off gas scrubber discharges.
- (3) No ranges have been specified for polycyclic hydrocarbons or certain other reactive substances. Appropriate specifications will be established by the Director should such a need develop. The degree of control necessary may require a reduction of total particulate emissions.
- (4) To be measured in the discharge stream of the dust collecting equipment.
- (5) Where meaningful sampling cannot be carried out, the opacity objectives will apply.
- (6) Maximum allowable opacity for 90% of the time.

B. DISCHARGES TO WATER

TABLE IV Receiving Water Control Objectives (1)

Parameter	Level
Dissolved Oxygen	Not less than 90 percent of the seasonal natural value.
Temperature	To be within 1°C of the natural level.
Turbidity	Not more than 5 JTU above the natural value.
Floatable solids	None
pH	No change
Toxicity (96 hr static bioassay)	Below detectable limit
Colour	No change
Aesthetics	No decrease
Alkalinity (2)	Not less than 20% natural value
Chloride (2)	Not more than 25 mg/L
Fecal coliforms (3)	Not to exceed Ministry of Health standards.

(1) Applicable outside the initial dilution zone.

(2) Not applicable to marine discharge.

(3) Applicable only when sanitary discharge is mixed with effluent.

TABLE V Objectives for the Discharge of Final Effluents to Marine and Fresh Waters

Parameter	Range	
(mg/L dissolved in effluent unless otherwise stated) (5)		
Total suspended solids (1) (2)	25	75
Total dissolved solids	2500	5000
Toxicity (96-hour LC 50 static bioassay) (3)	100%	80%
pH (pH Units)	6.5 - 8.5	6.5 - 10
Radioactivity: (6)		
Gross Alpha pCi/L	10	100
Radium ²²⁶ pCi/L (dissolved in effluent passing through a 3 µm filter)		less than 10
Specific elements and compounds:		
Aluminum (Al)	0.5	1.0
Ammonia (as N)	1.0	10.0
Antimony (Sb)	0.25	1.0
Arsenic (as trivalent As)	0.05	0.25
Arsenic (total dissolved)	0.10	1.0
Cadmium (Cd)	0.01	0.1
Chromium (Cr)	0.05	0.3
Cobalt (Co)	0.5	1.0
Copper (Cu)	0.05	0.3
Cyanide (as CN)	0.1	0.5
Fluoride (F)	2.5	10.0
Iron (Fe)	0.3	1.0
Lead (Pb)	0.05	0.2
Manganese (Mn)	0.1	1.0
Mercury (Total) (Hg) (4)	Nil	0.005
Molybdenum (Mo)	0.5	5.0
Nickel (Ni)	0.2	1.0
Nitrite/Nitrate (as N)	10.0	25.0
Phosphate (Total P biologically available in effluent)	2.0	10.0
Selenium (Se)	0.05	0.5
Silver (Ag)	0.05	0.5
Uranyl (UO ₂)	2.0	5.0
Zinc (Zn)	0.2	1.0
Oil and Grease (Total)	10.0	15.0

- (1) Not applicable to approved direct discharge of tailing solids.
- (2) Variances may be allowed during periods of excess runoff.
- (3) Bioassay on salmonid species.
- (4) Natural background concentration will be assessed.
- (5) Analysis for Total Elements in tailings may be required prior to and during operations and the Director would give consideration to this information when issuing a permit.
- (6) To apply to operations where the objective is not the mining of radioactive ores.

C. DISCHARGES TO LAND

Putrescible and industrial refuse, including garbage and discarded solid materials resulting from an industrial process, including coal wash-plant refuse, but not including liquid-carried industrial and sanitary wastes (tailings and sewage), airborne solids in gaseous emissions and inert "waste rock" normally associated with the mining operation, are considered discharges to land and the following objectives apply generally:

1. The choice of site and disposal method must minimize potential fire nuisance and leachate pollution.
2. The frequency of covering is to be specified at each site.
3. Open burning is normally prohibited. However, controlled open burning may be allowed on a site specific basis.
4. The hazardous waste disposal method at each site will be designated by the Director.

D. NON-DEFINED OBJECTIVES

Objectives cannot be specified for certain toxic substances. Monitoring for these substances may be required and interim discharge levels established at the discretion of the Director.

E. DISCHARGES UNDER EXISTING PERMITS

The issuance of these Objectives does not invalidate existing permits. The terms and conditions of existing permits remain in force until amended by the Director.

APPENDIX I

Glossary of Terms

Characteristics — Physical and chemical contaminants which are listed and defined in the most recent editions of Laboratory And Source Testing Manuals* issued by the Environmental Laboratory, Ministry of Environment, Province of British Columbia, or of an alternate manual approved by the Director.

Dissolved — Any effluent material which passes through a 0.45 μ m membrane filter or its equivalent.

Dustfall — Airborne particulate matter which accumulates on a horizontal surface.

Effluent — Liquid industrial discharge with or without suspended solids, including cooling waters.

Emission — Gaseous industrial discharge to the atmosphere with or without particulate solids.

Fresh Water — Water containing no significant amounts of salts, such as water present in lakes, rivers and streams.

Hazardous Waste — Waste which because of its inherent nature and quantity requires special disposal techniques to avoid creating health hazards, nuisances, or environmental pollution. Hazardous wastes include toxins, corrosives, irritants, strong sensitizers, flammables, explosives or infectious wastes. Flammable wastes exclude plastics, paper, paper products and the like.

Initial Dilution Zone — That zone around a waste discharge in a receiving water that is not subject to receiving water guidelines. It is physically defined as follows:

- a) for point discharges in lakes, estuaries, and marine waters, the zone may extend up to 100 metres (330 feet) horizontally in all directions, but shall not exceed 50% of the width of the water body.
- b) for point discharges in rivers and streams, the zone may extend up to 100 metres (330 feet) downstream of the discharge point, but shall not exceed 50% of the width of the river or stream.
- c) for multiple point discharges, such as multipoint outfalls, the zone may extend up to 100 metres (330 feet) horizontally from all points of discharge but shall not exceed 50% of the width of the water body.

The Initial Dilution Zone extends from the point of discharge in the receiving water to the surface. The zone may not intrude on shellfish beds, restricted routes known to be followed by migrating salmon and trout and other significant biological resource or recreational area.

Leachate — Any liquid flowing from deposited solid materials which contains extracted dissolved or suspended solids.

LC 50 Static Bioassay — The percentage of an effluent by volume in which 50% of the test fish survive for a specified time.

Marine Waters — Oceanic, coastal and estuarine water having free connection to the sea and containing a measurable quantity of sea salt.

Parameters — See *Characteristics*.

Particulate Matter — Any material other than uncombined water which exists in a divided form as a liquid or solid.

Pollutant — see *Characteristics*.

Receiving Water — Any body of surface water into which a discharge of leachate or effluent may flow. Receiving water wholly contained within a permittee's property is not included in this definition, provided that pollutants in such waters cannot be transported outside the property.

Standard Cubic Foot — The volume of dry gas occupying one cubic foot at a temperature of 68°F (20°C) and a pressure of 29.92" of mercury (101.325 KPa).

Suspended Particulate — Particulate material in ambient air retained by a 0.3 µm membrane filter or its equivalent.

Suspended Solids — Particulate material in effluent retained by a 0.45 µm membrane filter or its equivalent.

Total Particulate — Particulate material in emissions retained by a 0.3 µm membrane filter or its equivalent.

Working Level — The amount of any combination of radon daughters in one litre of air that will release 1.3×10^5 mega electron volts of alpha particle energy during their radioactive decay to lead-210 (radium D).

***Laboratory and Source Testing Manuals:**

1. A Laboratory Manual for the Chemical Analysis of Ambient Air, Emissions, Soil and Vegetation.
2. Source Testing Manual for the Determination of Discharges to the Atmosphere.
3. A Laboratory Manual for Chemical Analysis of Waters, Wastewaters, Sediments and Biological Materials.

APPENDIX 2

Units of Measurement

°C	degree Celsius (Centigrade)
fibres/cm ³	fibres per cubic centimetre
gr/SCF	grains per Standard Cubic Foot
JTU	Jackson Turbidity Unit
kg/tonne	kilograms per 1000 kilograms
lb/ton	pounds per 2000 pounds
lb/10 ⁶ BTU	pounds per million British Thermal Units
µg/m ³	microgram per cubic metre
µm	micrometre (micron)
mg/(dm ² · d)	milligrams per square decimetre per day
mg/kJ	milligrams per 1000 Joules
mg/L	milligrams per Litre
mg/m ³	milligrams per cubic metre
mg/mol	milligrams per mole*
ppm _v	parts per million (volume)
pCi/L	pico Curies per Litre
SCF	Standard Cubic Foot (see glossary)
tons/mi ² /mo	short tons per square mile per month
WL	Working Level (see glossary)

*Mole is Volume of one molecular weight of substance or solvent.

APPENDIX 3

Notes on Public Inquiry

Public meetings were called in various centres throughout the Province to provide persons unable to attend the formal proceedings scheduled for Victoria the opportunity to learn of the issues under consideration and present their views. These meetings were advertised in advance, and copies of the Objectives under review and the formal submissions being made to the Inquiry were placed on file at Pollution Control Branch offices. A task force which included members of the Advisory Panel attended each public meeting.

At the Nelson, Kamloops and New Westminster meetings, input was received from persons who expressed their own views and others who spoke on behalf of groups.

No public input was offered at the Vernon, Prince George and Courtenay meetings.

Expressions of public concern at the meetings were conveyed to the Chairman of the Inquiry, and information judged to be relevant to the review was transmitted to the Inquiry.

Written submissions were made at the Nelson meeting by:

Mr. John Tomlinson, representing the Society of Friends in Argenta, B.C., and

at the New Westminster meeting by:

Mrs. A.M. Coppard and Mrs. Irene Abby, representing the B.C. Voice of Women.

The Public Inquiry held in Victoria in January, 1978, received presentations from the following organizations and individuals:

Mining Association of British Columbia

Cassiar Asbestos Corporation Limited

Canadian Coalition for Nuclear Responsibility

Canex Placer Limited

British Columbia Hydro and Power Authority

Alcan Smelters and Chemicals Limited

Canadian Association of Smelter and Allied Workers

B.C. Wildlife Federation

Derek V. Ellis, Ph.D.

Environment Canada

Ministry of Agriculture, Government of British Columbia

Ministry of Recreation and Conservation, Government of British Columbia, Fish and Wildlife Branch

West Coast Environmental Law Association

Union of B.C. Indian Chiefs

Briefs were also submitted by:

Canadian Association of Industrial, Mechanical and Allied Workers

The Canadian Scientific Pollution and Environmental Control Society (B.C.), (SPEC)

Chairman of the Inquiry

E. H. Vernon, Associate Deputy Minister, Conservation, Ministry of Recreation and Conservation; Member, Pollution Control Board.

Pollution Control Board Panel

B. D. Caine, Assistant Director, Environmental Engineering, Ministry of Health; Member, Pollution Control Board.

E. Knight, Manager, Special Services Division, Ministry of Forests; Member, Pollution Control Board.

Dr. J. E. McInerney, Director, Bamfield Marine Station; Member, Pollution Control Board.

Advisory Panel

Professor J. B. Evans, P.Eng., (Panel Co-ordinator), Head, Department of Mineral Engineering, Faculty of Applied Science, University of British Columbia.

F. P. Hodgson, P.Eng., Chief, Industrial Division, Pollution Control Branch.

Dr. J. L. Littlepage, Associate Professor, Dept. of Biology, University of Victoria.

W. C. Robinson, P.Eng., Chief Inspector of Mines, Ministry of Mines and Petroleum Resources.

R. M. Woodbridge, Mineral Economics Division, Dept. of Energy, Mines and Resources, Ottawa.

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