Environment and Climate Change Canada
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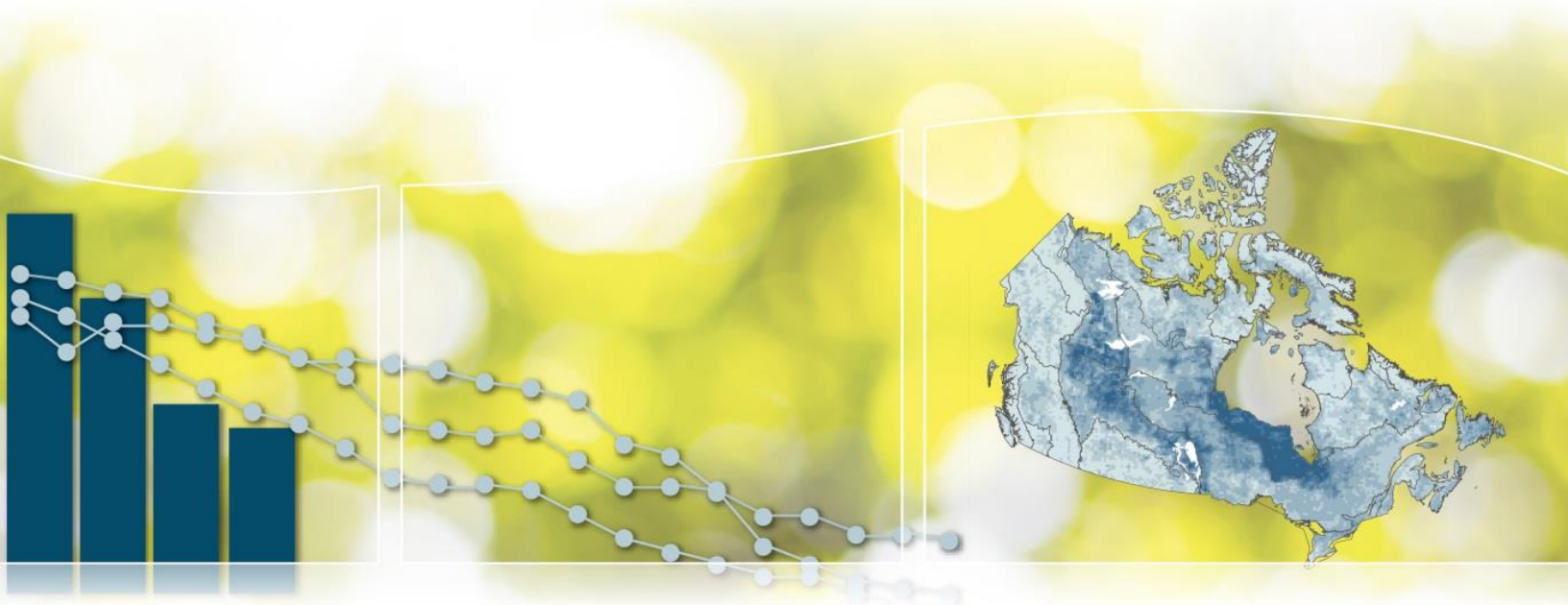
Canadian Environmental Sustainability Indicators

Managing Metal Mining Effluent Quality in Canada



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Suggested citation for this document: Environment and Climate Change Canada (2016) Canadian Environmental Sustainability Indicators: Managing Metal Mining Effluent Quality in Canada. Consulted on *day Month, year*.
Available at: www.ec.gc.ca/indicateurs-indicators/default.asp?lang=En&n=E6575C51-1.

Cat. No.: En4-144/62-1-2015E-PDF
ISBN: 978-0-660-03757-8

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Canadian Environmental Sustainability Indicators

Managing Metal Mining Effluent Quality in Canada

February 2016

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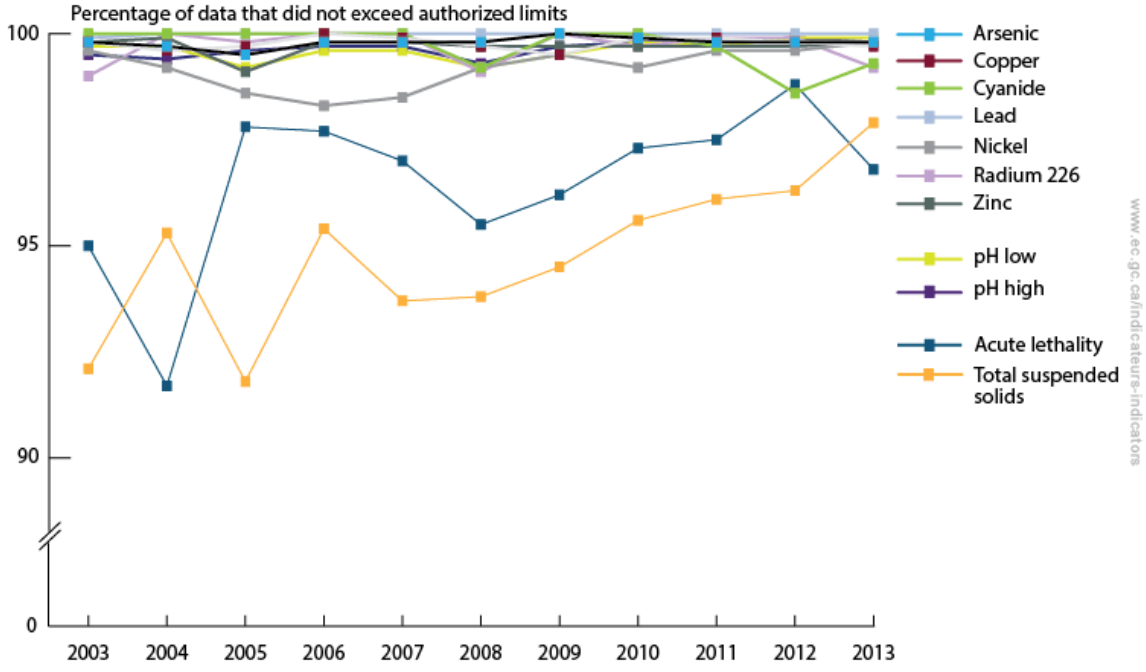
Part 1. Managing Metal Mining Effluent Quality in Canada Indicator

Promulgated under the Fisheries Act, the Metal Mining Effluent Regulations (MMER) came into force on December 6, 2002, replacing and expanding the scope of the 1977 Metal Mining Liquid Effluent Regulations. The MMER authorize the deposit of specific deleterious substances from metal mines, subject to certain conditions. They also impose limits on the pH level of the effluent, and prohibit the release of effluent that is acutely lethal.[1]

Overall, in 2013, the metal mining sector achieved over 99% compliance with the authorized limits for metals, cyanide and pH, and almost 98% for total suspended solids. These results have been mostly stable since 2003 – except for total suspended solids, for which compliance has increased. The percentage of test results that were not acutely lethal has remained above 95% since 2005.

Figure 1. Percentage of regulatory data submitted by metal mines that did not exceed authorized limits, Canada, 2003 to 2013



Data for Figure 1

Note: Deleterious substances listed on the MMER include arsenic (As), copper (Cu), cyanide (CN), lead (Pb), nickel (Ni), zinc (Zn), total suspended solids (TSS), and radium 226 (Ra-226). The MMER set a minimum (pH low) and maximum (pH high) level for the pH of effluent released. Acute lethality test refers to tests of effluent on rainbow trout in terms of mortality.
Source: Environment Canada (2015) Summary Review of Performance of Metal Mines Subject to the *Metal Mining Effluent Regulations* in 2013. A complete list of the annual summary reviews is available in the References section of this document.[2]

[1] An effluent is deemed non-acutely lethal if it kills less than 50% of the rainbow trout subjected to it at 100% concentration over a 96-hour period.

[2] The most recent versions of the Summary Review of Performance of Metal Mines Subject to the Metal Mining Effluent Regulations can be found online. The website is updated as new reports are published.

In the case of nickel and cyanide, the percentage of regulatory data that did not exceed authorized limits remained above 98% for the 2003–2013 period. For total suspended solids, the percentage of regulatory data that did not exceed authorized limits varied between 91.8% and 95.7% from 2003 to 2007. However, since 2007, this percentage has increased, with a high of 97.9% in 2013.

Finally, the percentage of test results that met regulatory standards for acute lethality varied between 91.7% and 98.8% from 2003 to 2013.

The MMER apply to all Canadian metal mines (except placer mines)[3] that exceeded an effluent flow rate of 50 cubic metres (m^3) per day at any time after June 6, 2002, and that deposit a deleterious substance in any water or place defined in the Regulations. Mining operations that are not captured under the MMER (such as coal mines, diamond mines, quarries, and other non-metallic mineral mining facilities) are still subject to the requirements of the *Fisheries Act*, including the general prohibition on the deposit of deleterious substances.

Metal mining is an important economic activity for the Canadian economy. In 2013, the metal mining industry employed 33 230 Canadians,[4] and contributed to 1.0% of Canada's gross domestic product.[5] Canada ranks among the top five countries in the mining of a number of major metals.[6,7] However, without adequate regulation, metal mining could have harmful impacts on the environment. For example, the effects of untreated mining effluent could be highly damaging to the receiving aquatic environment, including fish and fish habitat. Proper management regimes can mitigate these impacts.

This indicator is used to measure progress toward Target 3.11 Wastewater and Industrial Effluent: Reduce risks associated with effluent from wastewater (sewage) and industrial sectors by 2020 of the Federal Sustainable Development Strategy 2013–2016.

[3] The MMER define mines as hydrometallurgical, milling or mining facilities that are designed or used to produce a metal, a metal concentrate, or an ore from which a metal or metal concentrate may be produced, or any facilities, including smelters, pelletizing plants, sintering plants, refineries and acid plants, where any effluent from the facility is combined with the effluent from hydrometallurgy, milling or mining. Placer mines are mining operations that extract minerals or metals from stream sediments by gravity or magnetic separation.

[4] Statistics Canada (2013) Table 383-0031: Labour statistics consistent with the System of National Accounts, by province and territory, job category and North American Industry Classification System (NAICS 2122). Retrieved on 23 September, 2014.

[5] Statistics Canada (2014) Table 379-0031: Gross domestic product (GDP) at basic prices, for the metal ore mining industry (NAICS 2122) (2007 constant million dollars). Retrieved on 23 September, 2014.

[6] In 2012, Canada was the second-largest producer of uranium, the third-largest producer of cobalt, titanium and tungsten, the fourth-largest producer of cadmium and platinum group metals, and the fifth-largest producer of nickel.

[7] The Mining Association of Canada (2013) Facts and Figures of the Canadian Mining Industry 2013. Retrieved on 23 September, 2014.

Part 2. Data Sources and Methods for the Managing Metal Mining Effluent Quality in Canada Indicator

Introduction

The Managing Metal Mining Effluent Quality in Canada indicator is part of the Canadian Environmental Sustainability Indicators (CESI) program, which provides data and information to track Canada's performance on key environmental sustainability issues. This indicator is also used to measure progress towards the goals and targets of the Federal Sustainable Development Strategy.

Description and rationale of the Managing Metal Mining Effluent Quality in Canada indicator

Description

The Managing Metal Mining Effluent Quality in Canada indicator presents the percentage of reported monthly average monitoring results for deleterious substances, pH levels and acute lethality tests that did not exceed authorized limits from 2003 to 2013. The indicator helps Environment and Climate Change Canada evaluate the effectiveness of pollution prevention and control technologies, practices and programs within the metal mining sector. This indicator summarizes the results achieved since the *Metal Mining Effluent Regulations* (MMER) came into effect in 2002, replacing and expanding the scope of the 1977 *Metal Mining Liquid Effluent Regulations*.

Rationale

The *Metal Mining Effluent Regulations* (MMER) were promulgated on June 6, 2002 and came into force on December 6, 2002. The MMER include provisions to allow the discharge of metal mine effluent into fish-frequented water bodies, subject to certain requirements. Mines that are subject to the MMER may deposit an effluent that contains a deleterious substance if: (a) the concentration of the deleterious substance in the effluent does not exceed the authorized limits; (b) the pH of the effluent is equal to, or greater than, 6.0 but is not greater than 9.5; and (c) the effluent is not acutely lethal. An effluent is deemed non-acutely lethal if it kills less than 50% of the rainbow trout subjected to it at 100% concentration over a 96-hour period. Table 1 summarizes the monthly mean concentration limits for the deleterious substances listed in the MMER.

Table 1. Authorized limits for deleterious substances (monthly means)

Substances	Monthly mean concentration limits
Arsenic	0.50 mg/L
Copper	0.30 mg/L
Cyanide	1.00 mg/L
Lead	0.20 mg/L
Nickel	0.50 mg/L
Zinc	0.50 mg/L
Total suspended solids	15.00 mg/L
Radium 226	0.37 Bq/L

Note: mg/L = milligrams per litre. Bq/L = becquerel per litre. Monthly mean limits are one of three types of limits included in the MMER, the others being the maximum authorized concentration in a composite sample and the maximum authorized concentration in a grab sample. More information about these is available in Schedule 4 of the Regulations.

Data

Data source

This indicator uses monthly mean compliance data provided by metal mines to Environment and Climate Change Canada under section 22 of the *Metal Mining Effluent Regulations* (MMER). Starting in 2004, Environment and Climate Change Canada has made the data available through the annual release of the Summary Review of Performance of Metal Mines Subject to the *Metal Mining Effluent Regulations*. The most recent versions of the Summary Reviews can be found online. The website is updated as new reports are published.

The frequency of test measurement varies depending on the individual mine and its performance. Under the MMER, operators are required to test the effluent at each discharge point weekly, and record the results for all deleterious substances. However, this frequency can be reduced to once per quarter for certain substances (arsenic, copper, cyanide, lead, nickel and zinc) if the concentration of the substance from a discharge point is less than 10% of the MMER monthly mean concentration limit for that substance over a period of 12 consecutive months. The reporting frequency for radium-226 can also be reduced to once per quarter for metal mines, other than uranium mines, provided that the concentration of radium 226 is less than 0.037 Bq/L in 10 consecutive tests.

Spatial coverage

This indicator uses data from all metal mines subject to the MMER. Table 2 presents the number of such mines by province and territory for the 2003–2013 period.

Table 2. Number of metal mines subject to the MMER by jurisdiction, 2003 to 2013

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Newfoundland and Labrador	3	3	5	5	5	6	6	6	8	9	10
Prince Edward Island	0	0	0	0	0	0	0	0	0	0	0
Nova Scotia	0	0	0	0	1	1	1	1	1	1	1
New Brunswick	1	1	1	1	3	3	3	3	3	3	3
Quebec	20	21	21	26	28	30	31	28	28	31	32
Ontario	21	21	22	25	28	29	31	34	37	38	40
Manitoba	9	9	9	8	9	10	10	10	11	10	10
Saskatchewan	8	8	8	8	8	8	8	7	7	9	9
Alberta	0	0	0	0	0	0	0	0	0	0	0
British Columbia	5	5	5	5	6	6	8	9	10	8	8
Yukon	0	0	0	1	1	1	2	2	3	3	3
Northwest Territories	3	3	3	3	3	3	3	3	2	3	3
Nunavut	3	3	3	3	2	1	1	2	2	2	2
Canada	**73**	**74**	**77**	**85**	**94**	**98**	**104**	**105**	**112**	**117**	**121**

Temporal coverage

The indicator uses the quarterly and annual reports of metal mine effluent discharges submitted to Environment and Climate Change Canada under the MMER since the Regulations came into force on December 6, 2002.

Data completeness

The indicator includes all monthly mean compliance data derived from sampling results submitted to Environment and Climate Change Canada for the years reported in this indicator.

Data timeliness

The most recent data available at the time this indicator was produced are for 2013.

Methods

The indicator is calculated by measuring the percentage of tests for all metal mines that did not exceed authorized limits for the deleterious substances, pH levels and acute lethality. For each substance, this is done by dividing the number of monthly mean results that met authorized limits by the total number of monthly mean results reported.[8]

Caveats and limitations

The data were compiled by staff of the Mining Section of Environment and Climate Change Canada based on effluent quality information provided by the metal mines in their submitted annual reports. In some cases, Environment and Climate Change Canada staff used quarterly reports to complete missing information that was not properly reported by the owners or operators of some mines.

[8] For each substance, weekly test results reported by mines (the frequency of testing varies depending on regulatory conditions) are used to calculate a monthly mean concentration for each final discharge point.

Part 3. Annexes

Annex A. Data tables for the figures presented in this document

Table A.1. Data for Figure 1. Percentage of regulatory data submitted by metal mines that did not exceed authorized limits, Canada, 2003 to 2013

Type of test	2003 (%)	2004 (%)	2005 (%)	2006 (%)	2007 (%)	2008 (%)	2009 (%)	2010 (%)	2011 (%)	2012 (%)	2013 (%)
Arsenic (As)	99.8	99.7	99.5	99.8	99.8	99.8	100.0	99.9	99.8	99.8	99.8
Copper (Cu)	99.8	99.6	99.7	100.0	99.9	99.7	99.5	99.9	99.9	99.8	99.7
Cyanide (CN)	100.0	100.0	100.0	100.0	100.0	99.2	100.0	100.0	99.7	98.6	99.3
Lead (Pb)	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Nickel (Ni)	99.6	99.2	98.6	98.3	98.5	99.2	99.5	99.2	99.6	99.6	99.8
Radium 226 (Ra-226)	99.0	100.0	99.8	100.0	100.0	99.1	100.0	99.7	99.9	99.9	99.2
Zinc (Zn)	99.8	99.9	99.1	99.8	99.8	99.7	99.7	99.7	99.7	99.7	99.8
pH low	99.7	99.7	99.2	99.6	99.6	99.2	99.5	99.8	99.7	99.9	99.8
pH high	99.5	99.4	99.6	99.7	99.7	99.3	99.7	99.8	99.8	99.9	99.9
Rainbow trout acute lethality (toxicity)	95.0	91.7	97.8	97.7	97.0	95.5	96.2	97.3	97.5	98.8	96.8
Total suspended solids (TSS)	92.1	95.3	91.8	95.4	93.7	93.8	94.5	95.6	96.1	96.3	97.9

Note: Deleterious substances listed on the MMER include arsenic (As), copper (Cu), cyanide (CN), lead (Pb), nickel (Ni), zinc (Zn), total suspended solids (TSS), and radium 226 (Ra-226). The MMER set a minimum (pH low) and maximum (pH high) level for the pH of effluent released. Acute lethality test refers to tests of effluent on rainbow trout in terms of mortality.
Source: Environment Canada (2015) Summary Review of Performance of Metal Mines Subject to the *Metal Mining Effluent Regulations* in 2013. A complete list of the annual summary reviews is available in the References section of this document.[9]

[9] The most recent versions of the Summary Review of Performance of Metal Mines Subject to the Metal Mining Effluent Regulations can be found online. The website is updated as new reports are published.

Annex B. References and additional information

References and further reading

AQUAMIN Working Groups 7 and 8 (1996) Assessment of the Aquatic Effects of Mining in Canada: AQUAMIN Final Report. Environment Canada. Retrieved on 15 September, 2014.

Environment Canada (2007) National Assessment of Phase 1 Data from the Metal Mining Environmental Effects Monitoring Program. Retrieved on 15 September, 2014.

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Related information

Environmental Code of Practice for Metal Mines

Summary Review of Performance of Metal Mines Subject to the Metal Mining Effluent Regulations

www.ec.gc.ca

Additional information can be obtained at:

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