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METAL MINING EFFLUENT QUALITY

CANADIAN ENVIRONMENTAL SUSTAINABILITY INDICATORS



Canada 

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CANADIAN ENVIRONMENTAL SUSTAINABILITY INDICATORS

METAL MINING EFFLUENT QUALITY

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Metal mining effluent quality

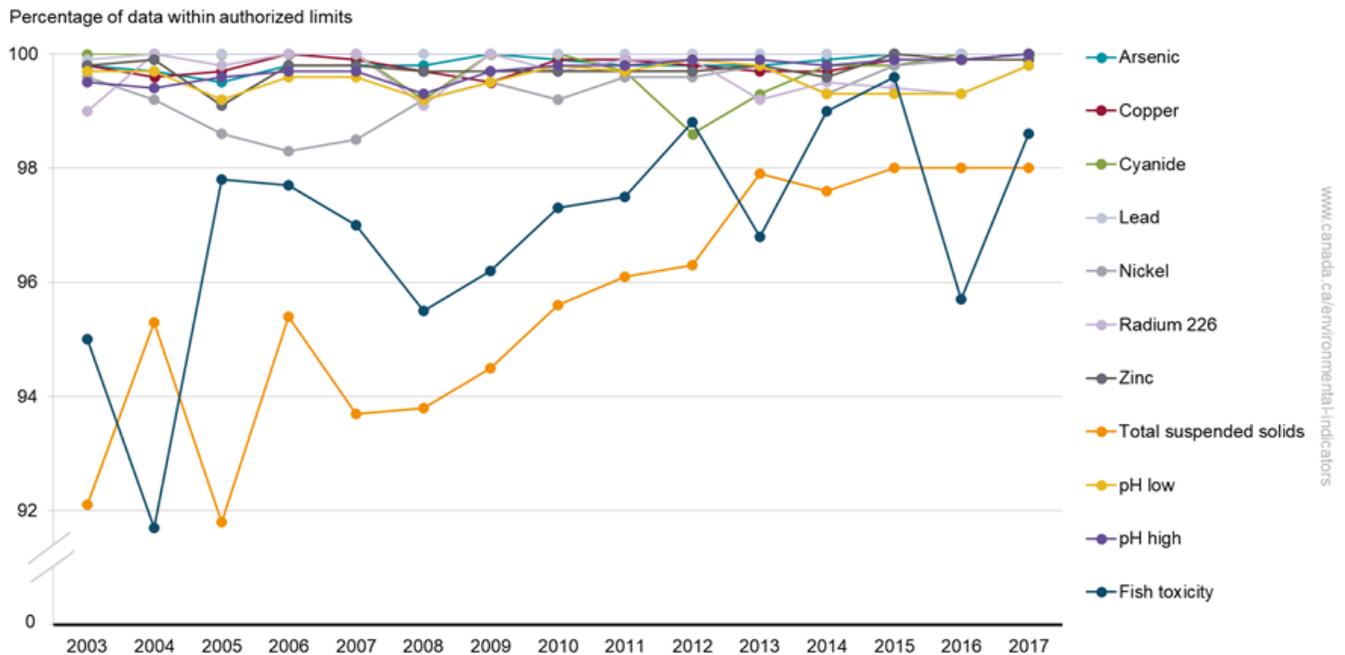
The effects of untreated mining effluent could be highly damaging to aquatic environments. The *Metal Mining Effluent Regulations* are designed to protect fish and fish habitat by governing the discharge of mining effluent into water frequented by fish. The indicator summarizes the test results observed since the regulations came into effect in 2002.

Key results

Between 2003 and 2017, for reported results

- fish toxicity test results varied and reached 98.6% compliance in 2017
- the percentage of mining operations meeting regulatory standards for total suspended solids increased from 92.1% to 98%
- test results for all other deleterious substances and pH levels ranged from 98.3% to 100% compliance

Figure 1. Percentage of regulatory data submitted by metal mines within authorized limits, Canada, 2003 to 2017



[Data for Figure 1](#)

Note: Deleterious substances listed in the *Metal Mining Effluent Regulations* include arsenic, copper, cyanide, lead, nickel, zinc, total suspended solids, and radium 226. The regulations set a minimum (pH low) and maximum (pH high) level for the pH of effluent released. Fish toxicity refers to tests of effluent on rainbow trout mortality rate.

Source: Environment and Climate Change Canada (2019) Mining and Processing Division.

In 2017, 137 metal mining facilities in Canada were subject to the *Metal Mining Effluent Regulations*. Compared to the previous year, the percentage of mining operations meeting regulatory standards for deleterious substances, pH levels and fish toxicity increased or remained at the same level. For deleterious substances, compliance was 100% for 4 substances and above 99% for the remaining substances, except for total suspended solids which had a compliance rate of 98%. However, the number of mines that did not report or reported incomplete information increased from 48 in 2016 to 52 in 2017.

About the indicator

What the indicator measures

The Metal mining effluent quality indicator presents the annual percentage of reported test results for all metal mines that are within authorized limits for deleterious substances, pH levels and fish toxicity from 2003 to 2017. The indicator helps Environment and Climate Change Canada evaluate the degree of compliance with the regulations and 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* came into effect in June 2002.

Why this indicator is important

Metal mining is an important sector for the Canadian economy. In 2017, the metal ore mining industry employed 38 825 persons,¹ and accounted for 0.96% (18 231 million dollars) of Canada's gross domestic product.² Canada ranks among the top 5 countries in terms of the production of a number of major metals.³

Without adequate regulations, metal mining could have harmful impacts on the environment. For example, the effects of untreated mining effluent could be highly damaging to aquatic environments, fish and fish habitat. Proper management regimes can mitigate these impacts. These regulations are designed to protect fish and fish habitat by setting standards for effluent released from metal mines into the environment. Specifically, the regulations prohibit discharge of effluent which is acutely lethal to fish and set limits for pH of effluent and concentrations of arsenic, copper, cyanide, lead, nickel, zinc, radium 226 and total suspended solids.



Pristine lakes and rivers

This indicator supports the measurement of progress towards the following [2019 to 2022 Federal Sustainable Development Strategy](#) long-term goal: Clean and healthy lakes and rivers support economic prosperity and the well-being of Canadians. It is used to assess progress towards the short-term milestone: Maintain high compliance rates with *Fisheries Act* regulations to reduce risks from metal mining and pulp and paper effluent.

In addition, the indicator contributes to the [Sustainable Development Goals of the 2030 Agenda for Sustainable Development](#). It is linked to the 2030 Agenda's Goal 6: Clean water and sanitation and Target 6.3: "By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally."

Related indicators

The [Pulp and paper effluent quality](#) indicator summarizes the degree of compliance achieved since 1985 under the *Pulp and Paper Effluent Regulations*.

¹ Statistics Canada, [Table 36-10-0489-01](#): Labour statistics consistent with the System of National Accounts, by job category and Industry, for the metal ore mining industry (NAICS 2122), annual (persons). Retrieved on May 23, 2019.

² Statistics Canada, [Table 36-10-0434-03](#): Gross domestic product at basic prices, by Industry, for the metal ore mining industry (NAICS 2122), annual average (2012 constant million dollars). Retrieved on August 1, 2019.

³ In 2017, Canada was the second-largest producer of uranium and the third-largest producer of nickel and platinum group metals. Mining Association of Canada (2019) [Facts and Figures of the Canadian Mining Industry 2018](#). Retrieved on August 8, 2019.

Data sources and methods

Data sources

This indicator uses compliance data provided by metal mines to Environment and Climate Change Canada under section 22 of the *Metal Mining Effluent Regulations* (the regulations).

More information

This indicator uses data from all metal mines subject to the regulations that came into effect on June 6, 2002. They apply to all Canadian metal mines that have an effluent flow rate exceeding 50 cubic metres per day, and that deposit a deleterious substance in any water or place defined in the regulations. The regulations define metal 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. The definition also includes smelters, pelletizing plants, sintering plants, refineries, acid plants and other facilities where any effluent is combined with the effluent from hydrometallurgy, milling or mining. Table 1 presents the number of such mines by province and territory from 2003 to 2017.

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

In 2018, the regulations were amended to cover diamond mines as well, becoming the *Metal and Diamond Mining Effluent Regulations*. The data submitted from 2003 to 2017 reflects the reporting obligations under the *Metal Mining Effluent Regulations*, prior to entry into force of the *Metal and Diamond Mining Effluent Regulations*.

Table 1. Number of metal mines subject to the regulations by jurisdiction, 2003 to 2017

Province or territory	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Newfoundland and Labrador	3	3	5	5	5	6	6	6	8	9	10	10	11	11	11
Prince Edward Island	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nova Scotia	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1
New Brunswick	1	1	1	1	3	3	3	3	3	3	3	3	3	3	3
Quebec	20	21	21	26	28	30	31	28	28	31	32	32	34	35	35
Ontario	21	21	22	25	28	29	31	34	37	38	40	40	45	46	46
Manitoba	9	9	9	8	9	10	10	10	11	10	10	10	10	10	10
Saskatchewan	8	8	8	8	8	8	8	7	7	9	9	9	8	8	8
Alberta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
British Columbia	5	5	5	5	6	6	8	9	10	8	8	12	11	13	13
Yukon	0	0	0	1	1	1	2	2	3	3	3	3	3	3	3
Northwest Territories	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3
Nunavut	3	3	3	3	2	1	1	2	2	2	2	2	3	4	4
Canada	73	74	77	85	94	98	104	105	112	117	121	125	132	137	137

Source: Environment and Climate Change Canada (2019) Mining and Processing Division.

Methods

The indicator is calculated by measuring the percentage of reported test results for all metal mines that are within authorized limits for deleterious substances, pH levels and fish toxicity. For each substance, this is done by dividing the number of monthly mean results that meet the authorized limits by the total number of monthly mean results reported in a given year. For pH, this is done by dividing the number of pH measurements that are within the allowable pH range by the total number of pH measurements reported in a given year. For fish toxicity, this is done by dividing the number of non lethal fish toxicity test results by the total number of fish toxicity test results reported in a given year.

More information

The regulations include provisions to allow the discharge of metal mine effluent into water frequented by fish, subject to certain requirements. Mines that are subject to the regulations may deposit an effluent that contains a deleterious substance if:

- the concentration of the deleterious substance in the effluent does not exceed the authorized limits
- the pH of the effluent is equal to, or greater than, 6.0 but is not greater than 9.5
- the effluent is not acutely lethal (an effluent is deemed non-acutely lethal if it kills less than or equal to 50% of the rainbow trout subjected to it at 100% concentration over a 96-hour period)

For deleterious substances, individual test results for each substance are compared with the maximum authorized concentration in a grab or composite sample set out in the regulations. All the test results in a month for each substance are used to calculate monthly mean concentrations for each final discharge point. These monthly means are compared to the maximum authorized monthly mean concentration limits set out in the regulations. Table 2 summarizes the maximum authorized monthly mean concentrations, in milligrams per litre or in becquerels per litre, for the deleterious substances listed in the regulations.

The frequency of test measurements varies depending on the individual mine and its performance. Under the regulations, operators are required to test the effluent at each discharge point weekly for deleterious substances and monthly for acute lethality (fish toxicity) and to record the results of all tests.

The frequency of testing can be reduced to once per quarter in the following instances:

- for arsenic, copper, cyanide, lead, nickel and zinc: if the concentration of the substance from a discharge point is less than 10% of the regulations monthly mean concentration limit for that substance over a period of 12 consecutive months
- for radium 226 from metal mines, other than uranium mines: if the concentration of radium 226 is less than 0.037 becquerel per litre in 10 consecutive weeks of testing
- for fish toxicity: if the effluent is determined not to be acutely lethal over a period of 12 consecutive months

Table 2. Authorized limits for deleterious substances

Substances	Maximum authorized monthly mean concentration
Arsenic	0.50 milligram per litre
Copper	0.30 milligram per litre
Cyanide	1.00 milligram per litre
Lead	0.20 milligram per litre
Nickel	0.50 milligram per litre
Zinc	0.50 milligram per litre
Total suspended solids	15.00 milligrams per litre
Radium 226	0.37 becquerel per litre

Note: Concentration limits are 1 of the 3 types of limits included in the regulations, the others being the maximum authorized concentration in a composite sample and the maximum authorized concentration in a grab sample. More information about these limits is available in [Schedule 4 of the regulations](#).

Source: *Metal Mining Effluent Regulations*.

Caveats and limitations

The data were compiled by staff of the Mining and Processing Division of Environment and Climate Change Canada using the 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 information that was missing or not properly reported by the owners or operators of some mines.

In 2017, it was determined that 52 mining facilities subject to the regulations (38%) provided incomplete effluent monitoring information. Of these 52 facilities, 7 did not report data at all and for the remaining 45 facilities, the vast majority of reporting issues were attributed to one or more missing acute lethality and radium-226 test results. The compliance statistics used for the indicator were compiled on the basis of the information provided in the quarterly and annual report submissions and do not include unreported data.

The indicator includes all Canadian metal mines subject to the *Metal Mining Effluent Regulations*, which came into effect on June 6, 2002. Mining operations that are not captured under the *Metal Mining Effluent Regulations* include placer mines,⁴ coal mines, diamond mines, quarries, and other non-metallic mineral mining facilities.

The indicator does not provide compliance information related to the newly amended regulations, the [Metal and Diamond Mining Effluent Regulations](#), which came into force on June 1, 2018. The new regulations will require diamond mines to start reporting their compliance results for the 2018 data year. The regulations will also strengthen effluent quality standards, improve the efficiency of environmental effects monitoring and include changes to clarify existing text.

⁴ Placer mines are mining operations that extract minerals or metals from stream sediments by gravity or magnetic separation.

Resources

References

Environment and Climate Change Canada (2019) Mining and Processing Division.

[*Metal Mining Effluent Regulations*](#), SOR/2002-222.

Related information

[Assessment of the Aquatic Effects of Mining in Canada: AQUAMIN Final Report](#)

[National assessment of phase 1 data from the Metal Mining Environmental Effects Monitoring Program](#)

[*Regulations Amending the Metal Mining Effluent Regulations*](#)

[Second national assessment of environmental effects monitoring data from metal mines](#)

[Third National Assessment of Environmental Effects Monitoring Information from Metal Mines Subject to the Metal Mining Effluent Regulations](#)

Annex

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 within authorized limits, Canada, 2003 to 2017

Year	Arsenic (percentage)	Copper (percentage)	Cyanide (percentage)	Lead (percentage)	Nickel (percentage)	Radium 226 (percentage)	Zinc (percentage)	Total suspended solids (percentage)	pH low (percentage)	pH high (percentage)	Fish toxicity (percentage)
2003	99.8	99.8	100.0	99.9	99.6	99.0	99.8	92.1	99.7	99.5	95.0
2004	99.7	99.6	100.0	100.0	99.2	100.0	99.9	95.3	99.7	99.4	91.7
2005	99.5	99.7	100.0	100.0	98.6	99.8	99.1	91.8	99.2	99.6	97.8
2006	99.8	100.0	100.0	100.0	98.3	100.0	99.8	95.4	99.6	99.7	97.7
2007	99.8	99.9	100.0	100.0	98.5	100.0	99.8	93.7	99.6	99.7	97.0
2008	99.8	99.7	99.2	100.0	99.2	99.1	99.7	93.8	99.2	99.3	95.5
2009	100.0	99.5	100.0	100.0	99.5	100.0	99.7	94.5	99.5	99.7	96.2
2010	99.9	99.9	100.0	100.0	99.2	99.7	99.7	95.6	99.8	99.8	97.3
2011	99.8	99.9	99.7	100.0	99.6	99.9	99.7	96.1	99.7	99.8	97.5
2012	99.8	99.8	98.6	100.0	99.6	99.9	99.7	96.3	99.9	99.9	98.8
2013	99.8	99.7	99.3	100.0	99.8	99.2	99.8	97.9	99.8	99.9	96.8
2014	99.9	99.7	99.8	100.0	99.3	99.5	99.6	97.6	99.3	99.8	99.0
2015	100.0	99.9	99.8	100.0	99.8	99.4	100.0	98.0	99.3	99.9	99.6
2016	100.0	99.9	100.0	100.0	99.9	99.3	99.9	98.0	99.3	99.9	95.7
2017	100.0	100.0	100.0	100.0	99.9	99.8	99.9	98.0	99.8	100.0	98.6

Note: Deleterious substances listed in the *Metal Mining Effluent Regulations* include arsenic, copper, cyanide, lead, nickel, zinc, total suspended solids, and radium 226. The regulations set a minimum (pH low) and maximum (pH high) level for the pH of effluent released. Fish toxicity refers to tests of effluent on rainbow trout mortality rate.

Source: Environment and Climate Change Canada (2019) Mining and Processing Division.

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