



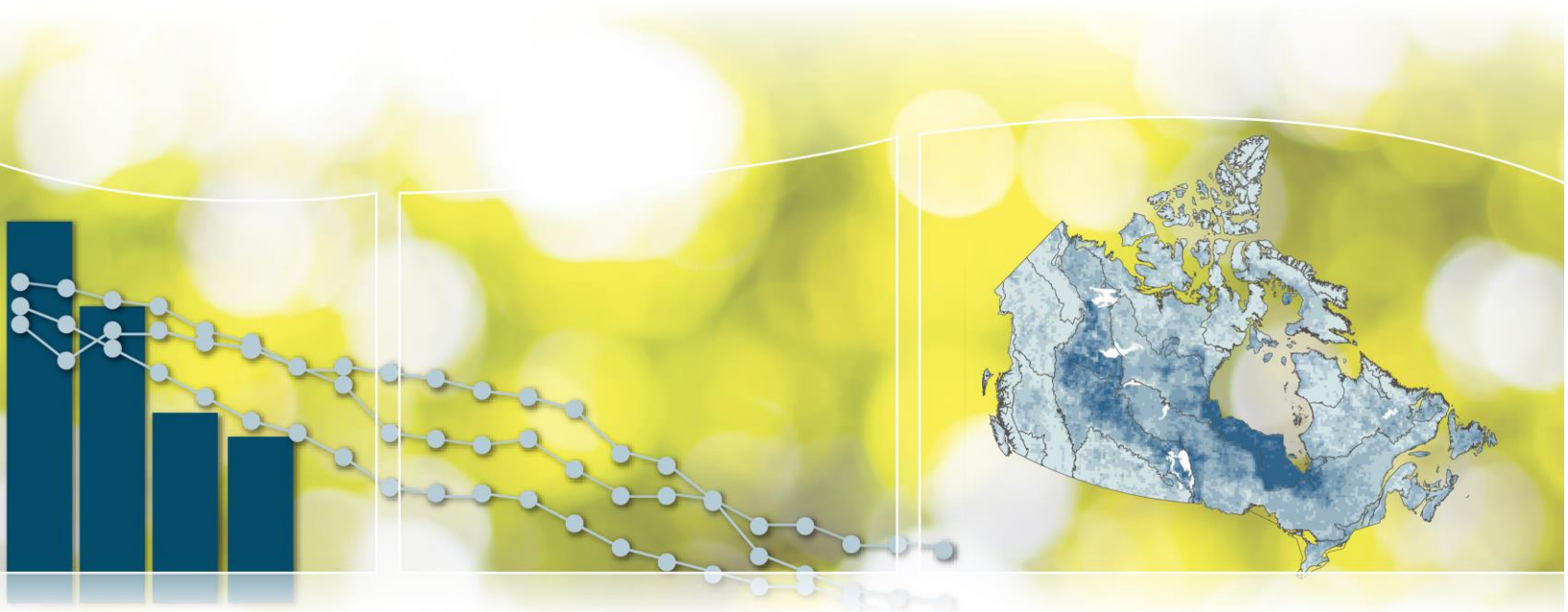
Environment and  
Climate Change Canada

Environnement et  
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# Canadian Environmental Sustainability Indicators

## Metal mining effluent quality



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# Canadian Environmental Sustainability Indicators

## Metal mining effluent quality

September 2018

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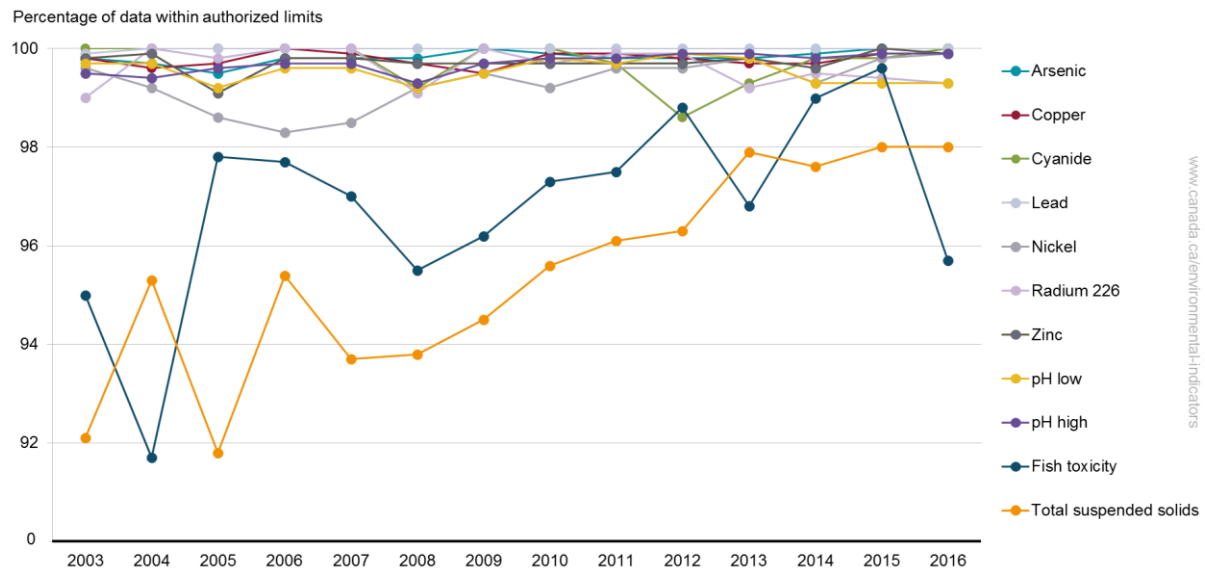
## Metal mining effluent quality

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 effluent into water frequented by fish. The indicator summarizes the test results observed since the regulations came into effect.

### Key results

- Between 2003 and 2016, the percentage of mining operations meeting regulatory standards for total suspended solids increased from 92.1% to 98%.
- The fish toxicity test results varied over the years but decreased to 95.7% in 2016.
- Test results for all other deleterious substances and pH levels ranged from 99.3% to 100% compliance over this time period.

**Figure 1. Percentage of regulatory data submitted by metal mines within authorized limits, Canada, 2003 to 2016**



[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 (2018) Status report on the performance of metal mines subject to the Metal Mining Effluent Regulations in 2016.

In 2016, 137 metal mining facilities in Canada were subject to the Metal Mining Effluent Regulations. Between 2003 and 2016, the percentage of mining operations meeting regulatory standards for deleterious substances and pH levels was above 99%, except for total suspended solids, which had a compliance rate of 98%.

The compliance with the regulations for fish toxicity decreased from 99.6% in 2015 to 95.7% in 2016. This decrease was due the reported test failures from one facility, Éléonore Mine, in Quebec.

## About the indicator

### What the indicator measures

The Metal mining effluent quality indicator presents the annual percentage of reported results for deleterious substances, pH levels and acute lethality tests within authorized limits from 2003 to 2016. 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 2016, the metal ore mining industry employed 31 510 persons,<sup>1</sup> and accounted for 1.21% of Canada's gross domestic product.<sup>2</sup> Canada ranks among the top 5 countries in terms of the production of a number of major metals.<sup>3,4</sup>

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.

### Related indicators

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



#### Pristine lakes and rivers

This indicator supports the measurement of progress towards the following [2016–2019 Federal Sustainable Development Strategy](#) long-term goal: Clean and healthy lakes and rivers support economic prosperity and the well-being of Canadians.

## Data sources and methods

### Data sources

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 (the regulations). Since 2004, Environment and Climate Change Canada has made the data available through the

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<sup>1</sup> Statistics Canada, [Table 36-10-0489-01](#) – Labour statistics consistent with the System of National Accounts (SNA), by job category and industry, for the metal ore mining industry (NAICS 2122). Retrieved on August 15, 2018.

<sup>2</sup> Statistics Canada, [Table 36-10-0434-03](#) – Gross domestic product (GDP) at basic prices, by industry, annual average (x1,000,000), for the metal ore mining industry (NAICS 2122) (2007 constant prices). Retrieved on August 15, 2018.

<sup>3</sup> In 2016, Canada was the third-largest producer of nickel, cobalt and platinum group metals.

<sup>4</sup> Mining Association of Canada (2018) [Facts and Figures of the Canadian Mining Industry 2017](#) (PDF; 4.58 mB). Retrieved on September 6, 2018.

annual release of the Status report on the performance of metal mines subject to the Metal Mining Effluent Regulations in 2016.

#### **More information**

This indicator uses data from all metal mines subject to the regulations which 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 2016.

The indicator uses the quarterly and annual reports of metal mine effluent discharges submitted to Environment and Climate Change Canada under the regulations since they came into force on June 6, 2002, replacing and expanding the scope of the 1977 Metal Mining Liquid Effluent Regulations. It includes all monthly mean compliance data derived from sampling results submitted to Environment and Climate Change Canada between 2003 and 2016.

**Table 1. Number of metal mines subject to the regulations by jurisdiction, 2003 to 2016**

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



## Methods

The indicator is calculated by measuring the percentage of 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 the 2016 report, it was determined that 48 mining facilities subject to the regulations (35%) provided incomplete effluent monitoring information. Of the remaining 40 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 and presented in the Status report on the performance of metal mines subject to the Metal Mining Effluent Regulations in 2016 were compiled on the basis of the information provided in the annual report submissions and do not include unreported data.

### 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 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 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 tests for fish toxicity: if the effluent is determined not to be acutely lethal over a period of 12 consecutive months
- 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
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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:** Fisheries and Oceans Canada (2018) Metal Mining Effluent Regulations.

## Recent changes

The indicator was updated to include data for the year 2016.

## Caveats and limitations

The data were compiled by staff of the Mining Section 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.

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,<sup>5</sup> coal mines, diamond mines, quarries, and other non-metallic mineral mining facilities.

On May 16, 2018, the Regulations Amending the Metal Mining Effluent Regulations came into force. The amendments strengthen effluent quality standards, improve the efficiency of environmental effects monitoring, make diamond mines subject to the regulations, change the long title of the regulations to the Metal and Diamond Mining Effluent Regulations and include changes to clarify the existing text.

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<sup>5</sup> 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 (2018) Status report on the performance of metal mines subject to the Metal Mining Effluent Regulations in 2016. Retrieved on August 15, 2018.

Fisheries and Oceans Canada (2012) [Regulations Amending the Metal Mining Effluent Regulations](#). Canada Gazette, Part II. March 2, 2012. Queen's Printer for Canada. Retrieved on August 15, 2018.

### Related information

[Assessment of the Aquatic Effects of Mining in Canada: AQUAMIN Final Report](#) (PDF; 459 kB)

[Metal and Diamond Mining Effluent Regulations](#)

[Metal Mining Effluent Regulations](#)

[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](#)

# 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 2016**

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

**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 (2018) Status report on the performance of metal mines subject to the Metal Mining Effluent Regulations in 2016.

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