Chapter 4.8
Mercury Management

BACKGROUND

Mercury can occur in both inorganic and organic forms. An inorganic form, elemental mercury is a byproduct of some mining operations, due to the presence of mercury compounds in ore bodies such as gold, silver, copper and zinc deposits.

Mercury is a persistent, bio-accumulative pollutant. When released into the environment and deposited or carried by air and water to wetlands, streams or some other types of environments, mercury can be converted to methyl-mercury. Methyl-mercury can be transmitted up the food chain and accumulate in the tissues of animals.

Because of mercury's potentially significant health and environmental impacts, mining operations should work to restrict the release of point source mercury emissions to the atmosphere and surface and ground waters by adopting appropriate mercury reduction goals and by applying suitable mercury reduction technologies.

TERMS USED IN THIS CHAPTER

Affected Community ■ Artisanal and Small-Scale Mining ■ Consultation ■ Existing Mine ■ Facility ■ Indigenous Peoples ■ Mercury Emission Control System ■ Mercury Waste ■ Mining Project ■ Mine Waste Facility ■ New Mine ■ Operating Company ■ Stakeholder ■ Tailings ■ Waste Rock ■

These terms appear in the text with a dashed underline. For definitions see the Glossary of Terms at the end of the document.

OBJECTIVES/INTENT OF THIS CHAPTER

To protect human health and the environment through the responsible management of mercury.

SCOPE OF APPLICATION

RELEVANCE: This chapter applies to any mining project, new or existing, that utilizes an autoclave, roaster, carbon kiln, refining furnace, retort or other thermal process that could lead to significant emissions of mercury.

Mercury Management Requirements

4.8.1. Planning

4.8.1.1. A mining project with a mercury emission control system shall perform a mercury mass balance that assesses and documents the amount of mercury in waste rock and ore, and the amount of mercury during or after processing that is:[259]

a. Released to air and water;
b. Produced as by-product; and
c. Resident in tailings ponds, waste rock dumps and other mine waste facilities.

[259] Values may be estimated if measurements are not available.

4.8.2. Mercury Capture and Disposal

4.8.2.1. Any mine facility that uses a thermal process to treat material containing mercury (e.g., ore, concentrate) shall utilize best available techniques (BAT) and best environmental practices (BEP) to control and minimize the amount of mercury released to the atmosphere unless the operating company can demonstrate that mercury emissions from the mining project are unlikely to pose a significant risk to human health or the environment.[260]

[flag] **4.8.2.1 Issue in brief:** Mercury is a potent neurotoxin that negatively impacts human health and the environment around the world. Mercury is transported globally in the atmosphere and in water, so mercury emitted in one location may affect ecosystems and populations far removed from the source.

While global efforts such as the Minamata Convention aim to reduce emissions of mercury, there are very few national or global standards on what are acceptable mercury emission limits for the mining industry. One national example is the US Environmental Protection Agency's National Emission Standards for Hazardous Air Pollutants (NESHAP), which sets out mercury emission limits for industrial-scale gold mines.

During the Launch Phase, IRMA will not score this requirement, but will strive to collect information and test with companies and stakeholders whether there are effective approaches to responsibly manage mercury in addition to the requirements currently laid out in 4.8.2.1 that should be integrated in the IRMA Standard.

4.8.2.2. Mercury-containing wastes from mercury emission control systems:

a. Shall not be stored on-site or disposed with tailings after removal;
b. Shall not be sold or given away either directly or indirectly to an entity engaged in artisanal or small-scale mining; and
c. Shall be sold only for an end use listed in Annex A (Products) or Annex B (Processes) of the Minamata Convention on Mercury or sent to a regulated repository for mercury wastes.[261]

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[260] "thermal processes" may include: roasting operations and autoclaves that are used to pre-treat gold mine ore; carbon kilns; preg tanks; electrowinning cells; mercury retorts; and melt furnaces. Definitions for these processes can be found at: https://www.law.cornell.edu/cfr/text/40/63.11651

If gold mines in the US or elsewhere are meeting the mercury emissions limits set out in the U.S. National Emission Standards for Hazardous Air Pollutants (NESHAP) for Gold Mine Ore Processing and Production (Available at: https://www.law.cornell.edu/cfr/text/40/63.11645), then those mines would not be required to also demonstrate use of BAT/BEP.

If non-US gold mines are not meeting NESHAP limits, or if other types of mines such as iron, lead, copper, zinc, silver, tin, nickel, silico- and ferro-manganese, etc. are smelting, roasting or using other thermal processes on ores or concentrates that contain mercury, then those mines could:

Demonstrate that they use the NESHAP levels as their criteria for whether or not they need BAT/BEP, or demonstrate that they use a risk assessment process to establish whether or not they need BAT/BEP. If there are significant risks to human health or the environment, they should be able to demonstrate that BAT/BEP are being used (examples of BAT/BEP found at: http://eippcb.jrc.ec.europa.eu/reference/BREF/NFM/JRC107041_NFM_Bref_2017.pdf and https://www.unece.org/fileadmin/DAM/env/documents/2012/EB/ECE_EB.AIR_116_E.pdf).

During IRMA's Launch Phase IRMA will be collecting information on the risk assessments processes followed. At minimum, it is assumed that risk assessments would include quantitative analyses of mercury in ore/concentrate (as required in 4.8.2.1) , a modeling exercise to determine potential emissions of mercury to the atmosphere with and without BAT/BEP, and an analyses of the risks to human health or the environment posed by different options.

[261] Annex A and B also list phase out dates after which the manufacture, import or export of the product shall not be allowed. Companies are expected to comply with those phase out dates. The text and Annexes of the Minamata Convention are available at: www.mercuryconvention.org/Convention/tabid/3426/Default.aspx

"regulated" refers to the certification and regulation of a storage facility by a governmental authority.

4.8.2.3. As an exception to 4.8.2.2.a, mercury-containing wastes from mercury emission control systems may be stored or disposed of on-site only if:

a. A risk-based evaluation of the on-site storage or disposal of mercury waste demonstrates that the risk of long-term contamination is low; and
b. Disposal occurs in fully lined tailings storage facilities using synthetic liners that have a permeability of 10^{-9} cm/sec or less.

4.8.3. Monitoring

4.8.3.1. For each mining project with a source of mercury air emissions a mercury monitoring plan shall be developed in consultation with relevant stakeholders.

4.8.3.2. The mercury monitoring plan shall address:

a. Potential public health impacts (e.g., mercury levels in food sources and blood);
b. Environmental impacts monitoring (e.g., fish tissue and stream sediment mercury levels), including locations that are most likely to promote methylation, such as still waters, wetlands, and anaerobic sediment; and
c. Mercury air emission monitoring, which shall be conducted at least annually for direct releases to the atmosphere from an autoclave, roaster, carbon kiln, refining furnace, or other thermal process that has a mercury emission control system.

4.8.3.3. The mercury monitoring plan shall include the monitoring of:

a. The quantity of mercury released to air including fugitive emissions (to the extent technologically and economically feasible with air monitoring equipment);
b. The quantity of mercury released to water, including the forms of mercury;
c. The amount of mercury captured in mercury emission control systems; and
d. The amount of by-product mercury produced (including the mercury captured in mercury emission control systems); and
e. Methyl mercury and sulfate, if mines have a mercury emission control system. In such cases, sampling shall be regularly conducted in wetlands and water bodies on or near the mine site.

4.8.4. Reporting

4.8.4.1. The operating company shall report publicly, at least annually, a summary report of the findings from the implementation of the mercury monitoring plan, including the monitoring data.

NOTES

This chapter of the IRMA Standard seeks to reduce the costs to public health associated with mercury exposure, and the technical challenges of removing mercury once it is in the environment, by encouraging source control and preventing mercury from getting into the environment in the first place.

The United States Environmental Protection Agency's "National Emission Standards for Hazardous Air Pollutants: Gold Mine Ore Processing and Production Area Source Category" regulations, effective December 16, 2010, are the only existing national mercury emissions standards for mining. The EU regulates mercury emissions from major industrial sources, including from non-ferrous ore processing and smelting operations, through EU Directive 96/61/EC on Integrated Pollution Prevention and Control and EU Directive 2010/75/EU on Industrial Emissions.

These standards aim to reduce mercury pollution by prohibiting metallic mercury export and by-product sales, requiring safe metallic mercury storage, and reducing mercury emissions from non-ferrous metals using Best Available Techniques (BAT) and Best Environmental Practices (BEP).

IRMA recognizes both the paucity of existing regulations and the high cost of monitoring and collecting mercury from mine emission sources, and seeks to begin to develop better air monitoring though targeted approaches that use broad, less expensive testing protocols to determine if more testing is necessary.

Given the significant health risks associated with mercury, and the challenges and costs associated with reducing mercury once it enters environmental pathways, it is important that accurate information is available on all mercury emissions from mines certified by IRMA.

Researchers have documented fugitive mercury air emissions from non-thermal sources at mines, most notably heap leach facilities.[262] However, mercury air emission testing for fugitive mercury from non-thermal sources can be expensive. Further research is needed to assess the pervasiveness of these non-thermal sources, as well as to verify the reliability of the thermal-source measurements.[263] The IRMA Steering Committee is considering ways to incentivize companies to engage in research to help elucidate the scale and scope of these emissions.

CROSS REFERENCES TO OTHER CHAPTERS	
CHAPTER	**ISSUES**
1.1—Legal Compliance	As per Chapter 1.1, if there are host country laws governing mercury transport, storage, use, etc., the operating company is required to abide by those laws. If IRMA requirements are more stringent than host country law, the company is required to also meet the IRMA requirements, as long as complying with them would not require the company to violate host country law.
1.2—Community and Stakeholder Engagement	Requirement 4.8.3.1 shall conform with the stakeholder engagement requirements in Chapter 1.2. In particular, criterion 1.2.3 is important to ensure that stakeholders have the capacity to participate in mercury monitoring. Also, regarding reporting of data in 4.8.4, requirement 1.2.4 requires that communications be in formats and languages that are culturally appropriate, accessible and understandable to affected communities and stakeholders.
1.4—Complaints and Grievance Mechanism and Access to Remedy	Stakeholders who have complaints related to an operating company's use of mercury, can raise complaints through the company's operational-level grievance mechanism. As per Chapter 1.4, the operating company is required to have an operational-level grievance mechanism available to stakeholders, including procedures for filing complaints, and having complaints recorded, investigated and resolved in a timely manner.
2.1—Environmental and Social Impact Assessment and Management	If mercury is identified during ESIA as a key risk to human health or the environment, stakeholders shall be provided with the opportunity to propose independent experts to collaborate with the company on the design and implementation of its mercury monitoring program; and the company is required to facilitate the independent monitoring of key impact indicators where this would not interfere with the safe operation of the project.
2.5—Emergency Preparedness and Response	The protection of communities and workers during emergencies related to the transport and storage of hazardous substances, such as mercury, should be addressed in Emergency Response Planning if it is present in mercury wastes. Chapter 2.5 mandates emergency response planning for a spill, and requires coordination between the mine and emergency responders in potentially affected communities.

[262] See: Joyce, P. and Miller, G. January 2007. Mercury Air Concentrations in Northern Nevada: Monitoring Active Metals Mines as Sources of Mercury Pollution. University of Nevada, Reno, Department of Natural Resource & Environmental Science; and most recently: Miller, M. and Gustin, M. June 2013. "Testing and Modeling the Influence of Reclamation and Control Methods for Reducing Non-Point Mercury Emissions Associated with Industrial Open Pit Gold Mines," *Journal of the Air & Waste Management Association*. 63(6):681-93.

[263] Eckley, C.S., Gustin, M., Miller M.B., Marsik, F. 2011. "Nonpoint Source Hg Emissions from Active Industrial Gold Mines - Influential Variables and Annual Emission Estimates," *Environmental Science and Technology*. 45 (2) 392-399.

CROSS REFERENCES TO OTHER CHAPTERS	
3.2—Occupational Health and Safety	Mercury may present an occupational health and safety (OHS) hazard, and if so, should be included in the OHS risk assessment process.
3.3—Community Health and Safety	Mercury emissions may present health risks to communities, and if there are thermal mercury sources at a mine then risks from mercury exposure should be analyzed during the community health and safety risk and impact assessment process.
3.6—Artisanal and Small-Scale Mining	Requirement 4.8.2.2 mentions a prohibition on selling or giving away mercury to artisanal and small-scale mining (ASM) operations, however, the primary requirements related to interactions between the large-scale mines that apply for IRMA certification and ASM entities are addressed in Chapter 3.6.
4.1—Waste and Materials Management	If mercury wastes are generated and recovered from thermal processes, 4.8.2.3 requires a risk based evaluation before the operating company can store or dispose of those wastes on site (e.g., co-disposed in tailings facilities). This requirement may be met through the risk assessment process in Chapter 4.1, requirement 4.1.4.1. As per 4.1.4.1, if mercury is disposed of onsite the risk assessment should be updated if there is a potential that risks from such disposal may increase (e.g., more mercury waste is being produced than initially estimated). If mercury wastes are stored or disposed of on-site, relevant information should be included in the Operation, Maintenance and Surveillance plan as per 4.1.5.5.a.
4.2—Water Management	Mercury monitoring in water, as required in 4.8.3, may be incorporated into the water management program in Chapter 4.2 (see criteria 4.2.4). As per Chapter 4.2, if mercury is expected to be present in any effluent from the mine then monitoring for mercury would be required and concentrations in surface waters and groundwaters would be expected to meet IRMA Water Quality Criteria for relevant end uses of those waters (see Tables 4.2.a through h).
4.3—Air Quality	If mercury is identified as a potential air contaminant in Chapter 4.3 then Chapter 4.8 applies. Mercury monitoring in air, as required in 4.8.3, may be incorporated into the air quality management plan and monitoring program in Chapter 4.3 (see criteria 4.3.2 and 4.3.3).
4.6—Biodiversity, Ecosystem Services and Protected Areas	If there is the potential that mercury emissions from mining-related activities (e.g., thermal processes, effluent) may pose a threat to biodiversity (e.g., threatened or endangered species), ecosystem services or protected areas, then the potential impacts should be further assessed as per Chapter 4.6 (see 4.6.3).