



Mercury in natural gas production and processing

During a maintenance shutdown at a natural gas processing facility in northeastern B.C., workers were exposed to mercury vapour when a number of vessels were opened. The site was shut down and workers were removed from the plant area. Mercury was identified in air samples collected from the vessels, and some of the exposed workers required treatment at a local hospital.

This document describes the health hazards posed by mercury and explains the presence of mercury in natural gas production and processing equipment. It also describes how to reduce the risk of exposure to mercury in natural gas facilities.

What is mercury?

Mercury is a heavy, dense metal that is liquid at room temperature. The freezing point of mercury is below minus 38 degrees Celsius. The liquid is so dense that a bowling ball would float in it.

Liquid mercury is quite volatile. When exposed to air, mercury metal vaporizes and can be inhaled. The warmer the temperature, the more quickly mercury vapour can get into the air.

Where is mercury used?

Mercury and its compounds have been used for a wide variety of purposes including:

- Switches (such as thermostats)
- Transmitters
- Paints and fungicides
- Thermometers and manometers
- Dental fillings
- Chlorine and caustic soda production (e.g., pulp mills)
- Extraction of gold from ore



A natural gas processing facility

Mercury in gas processing and production equipment

Mercury, in a number of chemical forms, is a natural component of oil and gas and may be present at high concentrations in some formations. Heat and pressure can liberate mercury from geological deposits. The mercury then migrates, as a vapour, to the oil and gas “traps.”

When these gas reservoirs are produced and the processed fluids are cooled, liquid mercury can condense within heat exchangers, separators, coolers, valves, and piping.

Mercury can form amalgams with a variety of metals in processing equipment, resulting in corrosion. When this equipment is taken apart for maintenance or repair, workers can be exposed to mercury vapour. Work activities that may carry a risk of exposure in gas processing facilities include:

- Vessel cleaning
- Welding
- Grinding, buffing, and polishing
- Machining
- Pipefitting
- Installation and removal of components or infrastructure
- Hydro excavating
- Electrical work

What are the health effects of mercury exposure?

Liquid mercury can affect human health through skin contact, by swallowing, and by breathing the vapour. Most worker exposure occurs through inhalation of mercury vapour.

Chronic (long-term) exposure to high concentrations of mercury vapour affects the central nervous system and can cause:

- Stupor
- Tremors
- Nervousness
- Personality changes
- Vision and hearing changes
- Hearing loss
- Reduction in fertility
- Kidney damage

Gum disease can also be an early sign of chronic mercury exposure. The brain and kidneys are particularly susceptible to damage from mercury.

Contact with mercury can also cause irritation and burns to the skin and eyes.

Occupational exposure limits

Employers must ensure workers are not exposed to mercury levels above the occupational exposure limits (OELs). The OELs for mercury in B.C. are very low—an 8-hour time-weighted average (TWA)

of 0.025 milligrams per cubic metre (mg/m³) for elemental mercury and inorganic compounds of mercury. *Mercury—Methyl, as Hg* has an OEL of 0.01 mg/m³.

Mercury is also an ALARA substance, meaning exposure must be kept **as low as reasonably achievable**, due to its potential for absorption through the skin and effects on the reproductive system.

Owner responsibilities

Owners must conduct a hazardous materials survey and a risk assessment for potentially hazardous contaminants (including mercury) at their facilities. This information must be kept on site and communicated to all contractors who will perform work at these locations.

Employer responsibilities

Employers must develop and implement an effective exposure control plan (ECP). An ECP explains the work procedures and other controls that will be used to reduce workers' risk of exposure to mercury.

An ECP for a workplace where workers may be exposed to mercury must include:

- A written policy that:
 - States the employer's commitment to health and safety
 - States the plan's objectives
 - Defines the responsibilities and roles of the employer, supervisors, and workers
- An assessment of the workplace hazards (for example, where workers are likely to be exposed to mercury)
- Controls used to reduce the hazards (for example, ventilation, barriers, or personal protective equipment); a respirator program must be developed if respirators are to be used
- Written safe work procedures and emergency response procedures (for example, rescue procedures)
- Training for supervisors and workers
- Records and statistics (for example, first aid records for workers who are exposed to mercury)

Worker responsibilities

To help reduce the risk of exposure to mercury, workers (including subcontractors) must:

- Attend education and training sessions provided by the employer
- Use controls and follow safe work practices outlined in the exposure control plan

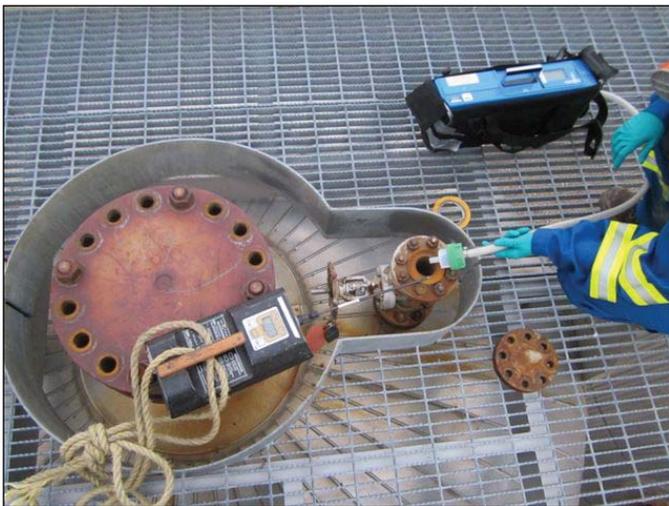
- Use available personal protective equipment (for example, respirators) as required
- Know how to report exposure incidents

Sampling for mercury

Choosing the correct sampling method for mercury can be difficult because each has its own potential problems (e.g., interferences).

Sampling methods currently available include:

- *Sorbent tube*—Air is passed through a solid (usually Hopcalite) sorbent tube and airborne mercury vapour adheres to the material in the tube. The tube is then sent to a laboratory for analysis.
- *Portable direct-read instruments*—These instruments can sample the air for mercury vapour and give an immediate reading. Instrument types include gold-film sensor and atomic absorption spectrometry technology. Please note that interferences with other contaminants, such as sulfur compounds (e.g., hydrogen sulfide and mercaptans), can result in false positive readings when using gold film instruments.



Monitoring for mercury vapour using direct-read instruments

Reducing the risk of exposure

The risk of worker exposure to mercury can be reduced by using the following controls:

- *Engineering controls*—Mercury removal units (usually a combination of a reactive chemical and an inert material forming a sorbent “bed”) should be employed to minimize the amount of mercury entering the process stream. The mercury binds to the reactive chemical and is trapped by the sorbent in the bed.

Ventilation can also be used to reduce worker exposure to mercury. Closed vessels and other process equipment should be ventilated before they are opened. The type of ventilation (for example, area or local exhaust) and the amount will depend upon the nature of the work.

- *Isolation controls*—Unprotected workers must be kept a safe distance from areas with potentially hazardous levels of mercury vapour.
- *Education*—Workers must be taught how to prevent exposure to mercury and how to use the appropriate personal protective equipment.
- *Monitoring*—Mercury levels in the air must be measured where there is a risk of exposure.
- *Personal protective equipment (PPE)*—The type of respiratory protection required will depend on the level of mercury detected. Skin must also be protected from mercury exposure. Examples of PPE are given below.

Personal protective equipment

The following PPE can be used, along with engineering and other controls, to protect workers from exposure to mercury:

- *Self-contained breathing apparatus (SCBA)*—This consists of an air cylinder, which is normally worn on the back, and a full-face mask to protect the eyes and face. A hose connects the face mask to the regulator and the air cylinder.
- *Supplied-air (airline) respirator*—This consists of an airline attached to:
 - A hood- or helmet-style respirator, or
 - A regulator and full-face mask
- *Air-purifying respirator (APR)*—This consists of an elastomeric facepiece (either full-face or half-face) equipped with a cartridge or cartridges specific for mercury (“combination” cartridges are also available). As APRs are not as protective as SCBA or airline respirators, they should only be used when the concentration of mercury is known and low. Cartridges should be changed following a regular schedule, as mercury has poor warning properties (e.g., no odour).

Workers who use respirators must be clean-shaven where the respirator seals with the face to ensure a good seal.

PPE should also include a chemical-resistant, fire-rated suit, goggles that seal to the face (if a full-face respirator is not worn), and gloves (preferably nitrile).



Workers wear respirators while testing for mercury

Personal hygiene

Workers should wash their hands before eating or smoking to minimize contact with mercury.

Employers should do the following:

- Provide washroom and changing facilities that have separate lockers for work clothes and street clothes.
- Provide a separate area for storing and eating food, away from the work area.

First aid

Washing and eyewash facilities must be available near areas where mercury contamination might be present. All workers must know how and when to use these facilities. Soap and water should be available at these facilities to treat contaminated skin.

Eye exposure

If mercury gets into the eyes, irrigate with tempered water for at least 15 minutes. Any affected workers should have an eye examination as soon as possible.

Skin exposure

If mercury gets on the skin, immediately wash the affected area(s) with soap and water. Remove any clothing or jewellery that might have been contaminated and store for cleaning or disposal.

Inhalation

If workers inhale mercury vapour, move them to fresh air and monitor for respiratory distress. Administer oxygen and assist with ventilation if required. Symptoms of pulmonary edema can be delayed up to 48 hours after exposure. Immediately transport workers to an emergency care facility.

Medical monitoring

Where workers are exposed to mercury, biological monitoring (e.g., the collection of blood and/or urine samples) may be necessary. Medical monitoring programs may involve both baseline and periodic examinations and should only be conducted by, or under the supervision of, a physician knowledgeable in occupational medicine.

If you think workers have been exposed to mercury, they should see a physician knowledgeable in work-related health problems.

Workers should report any suspected health effects to their employer and a physician. Workers should act on medical advice and comply with any medical instructions a doctor gives them.

For more information

For more information on mercury, refer to the following web pages:

U.S. Occupational Safety & Health Administration (OSHA), Safety and Health Topics—Mercury
<http://www.osha.gov/SLTC/mercury/index.html>

U.S. National Institute for Occupational Safety and Health (NIOSH), Workplace Safety and Health Topics—Mercury
<http://www.cdc.gov/niosh/topics/mercury>

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