
Mercury Threat Awareness Training

E-Learning Course Program

BSTC

Learning Outcomes

- Explain the properties of mercury
- Explain the forms that mercury can take
- Understand mercury in oil & gas industry
- Identify the hazards that mercury can present to personnel, plant and equipment
- Identify the effects of mercury
- Identify the Mercury Risk Management procedure
- Explain the mercury emergency response
- Explain the first aid action for mercury exposure

What is Mercury?

Mercury is a naturally-occurring chemical element found in rock in the earth's crust, including in deposits of coal with the symbol Hg and atomic number 80. It is commonly known as quicksilver and was formerly named hydrargyrum.

Note: Mercury in its elemental (pure) form, that is, as a metal; hence the synonym metallic mercury. A shiny, silver-gray metal that is a liquid at room temperature



What Forms Can Mercury Take ?

It exists in several forms:

- Elemental (metallic) mercury
- Inorganic mercury compounds
- Methylmercury and other organic compounds

Mercury occurs naturally in the environment and exists in a large number of forms;

- Like lead or cadmium, mercury is a constituent element of the earth, a heavy metal.
- In pure form, it is known alternatively as "elemental" or "metallic" mercury (also expressed as $\text{Hg}(0)$ or Hg^0).

What Forms Can Mercury Take ?*contd.*

- Mercury is rarely found in nature as the pure, liquid metal, but rather within compounds and inorganic salts. (Inorganic mercury compounds are formed when mercury (symbol Hg) combines with elements other than carbon, such as chlorine, sulfur, or oxygen.)

Where Can Mercury Be Found ?

- Natural sources - could be present in various stages of oil and natural gas exploration, production and processing, as volcanic activity and weathering of rocks;
- Associated with human activity - such as fossil fuels – particularly coal, and to a lesser extent gas and oil – and other extracted, treated and recycled minerals;
- From mercury used intentionally in products and processes, due to releases during manufacturing, leaks, disposal or incineration of spent products or other releases;
- From mercury releases previously deposited in soils, sediments, water bodies, landfills and waste/tailings piles

Note: A general term for buried combustible geologic deposits of organic materials, formed from decayed plants and animals that have been converted to crude oil, coal, natural gas, or heavy oils by exposure to heat and pressure in the Earth's crust over hundreds of millions of years.

Mercury in Oils & Gas Industry

- Mercury is a natural occurring element and could be present in various stages of oil and natural gas exploration, production and processing. Mercury is not only hazardous to human health and the environment but could also attack process equipment components that have mercury reactive materials, leading to potential catastrophic failure to the plant or installation.
- The mercury associated with petroleum and natural gas production and processing enters the environment primarily via wastewater, solid waste streams, and air emissions

Mercury in Oils & Gas Industry *Contd.*

- The solid wastes are also generated in production (e.g. drilling muds), transportation (e.g. sludge), and refining operations (e.g. spent mercury adsorbent).
- The mercury emissions to atmosphere originate from gas processing plant, flared gas refineries, and fuel burning for process utilities.
- In the plant operation, mercury needs to be removed from oil and gas streams especially from natural gas, in order to get pure product as well as to protect the process equipment and catalyst used in the downstream processes.

Mercury in Oils & Gas Industry

Contd.

- In the plant operation, mercury needs to be removed from oil and gas streams especially from natural gas, in order to get pure product as well as to protect the process equipment and catalyst used in the downstream processes.
- Sludge is a semi-solid material tends to aggregate with mixture of one and more liquids and suspended solids. In hydrocarbon processing facilities, sludges are removed from tanks and vessels during maintenance and inspection. Mercury in hydrocarbon sludge is usually higher than the process fluid in the process stream.

Use of Mercury

Consumer Products that Traditionally Contain Mercury

- Some batteries
- Fluorescent light bulbs, including compact fluorescents (CFLs)
- To make liquid mirror
- Many types of thermometers
- Thermostats
- Amalgam in dental fillings
- Medicine
- Thimerosal in vaccines
- Automotive switches



Common Exposures to Mercury

Exposures to Methylmercury

Nearly all methylmercury exposures occur through eating fish and shellfish that contain higher levels of methylmercury.

Exposures to Elemental (Metallic) Mercury

Common exposures: When most exposures to metallic mercury occur, they occur because mercury is released from a container, or from a product or device that breaks.

Note: If the mercury is not immediately contained or cleaned up, it can evaporate, becoming an invisible, odorless, toxic vapor.

Common Exposures to Mercury *Contd.*

Exposures to Other Mercury Compounds

- used as fungicides, preservatives, antiseptics (e.g., Mercurochrome) or disinfectants.
- used in skin lighteners and anti-aging products for the skin.

What Are the Effects of Mercury Contamination?

Health Effect

- This liquid form of mercury is especially dangerous because it vaporizes at room temperature. If mercury vapor is inhaled, it is easily absorbed by the body, where it first gets into the lungs and from there into the blood and the brain. The nerve poison can cause sleep disorders, agitation, and paralysis
- Can harm the brain, heart, kidneys, lungs, and immune system of people of all age.

What Are the Effects of Mercury Contamination? *Contd.*

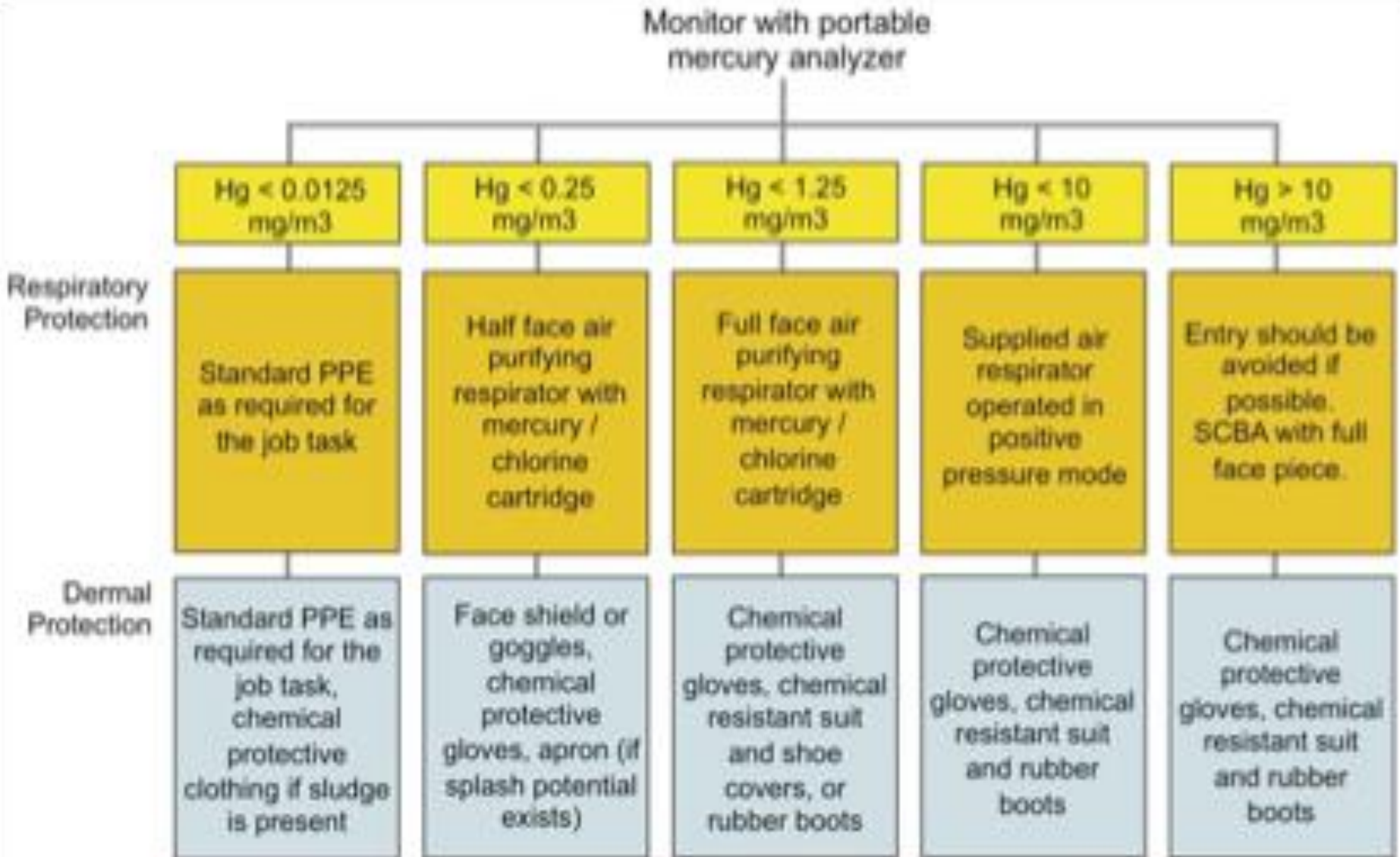
Ecological Effect

- Birds and mammals that eat fish have more exposures to methylmercury than other animals in water ecosystems. Predators that eat these birds and mammals are also at risk. Methylmercury has been found in eagles, otters.

Mercury Risk Management Procedures

- Reducing consumption of raw materials and products generating mercury releases.
- Substitution by non-mercury alternatives.
- End-of-pipe techniques - Methods used to remove already formed contaminants from a stream of air, water, waste, product or similar. These techniques are normally implemented as a last stage of a process before the stream is disposed of.
- Proper waste management.
- To reduce emissions.

PPE Requirements



PPE Requirements *Contd.*

Eye/Face Protection:

- Wear a face shield (with safety goggles) may also be necessary.

Skin Protection:

- Wear chemical protective clothing e.g. gloves, aprons, boots. In some operations, it may be necessary to wear a chemical protective, full-body encapsulating suit and self-contained breathing apparatus (SCBA).

PPE Requirements - *Contd.*

Respiratory Protection:

Up to 1 mg/m³:

- (*APF = 10) Any chemical cartridge respirator with cartridge(s) providing protection against mercury compounds; or
- Any supplied-air respirator.
- SCBA

*APF = Assigned Protection Factor

Waste Management

Mercury wastes, including those residues recovered by end-of-pipe technologies, constitute a special category of mercury releases, with the potential to affect populations far from the initial source of the mercury

Emergency Response

Personal Precautions:

- Keep unnecessary and unprotected personnel out of spill area.
- Use personal protective equipment as required.
- Ventilate area.

Methods for Containment and Clean-up:

- Do not touch spilled material.
- Dike spilled product to prevent runoff.
- Stop or reduce leak if safe to do so.
- Small spills or leaks:
 - use material or equipment specific for mercury.
- Large spills or leaks:
 - contact emergency services and manufacturer/supplier for advice.

Continued First-Aid Measures

Inhalation:

- Take precautions to ensure your own safety before attempting rescue (e.g. wear appropriate protective equipment).
- Move victim to fresh air. If breathing is difficult, administer emergency oxygen.
- DO NOT allow victim to move about unnecessarily.
- If breathing has stopped, trained personnel should begin artificial respiration (AR). If the heart has stopped, trained personnel should start cardiopulmonary resuscitation (CPR) or automated external defibrillation (AED). Avoid mouth-to-mouth contact by using mouth guards or shields.
- Transport to a hospital.

Continued First-Aid Measures – *Contd.*

Skin Contact:

- Avoid direct contact.
- Wear chemical protective clothing if necessary.
- Quickly take off contaminated clothing.
- Quickly and gently blot or brush away excess chemical. Wash gently and thoroughly with lukewarm, gently flowing water and non-abrasive soap for 5 minutes.
- Call a doctor.
- Thoroughly clean clothing, shoes and leather goods before reuse or dispose of safely.

Continued First-Aid Measures - *Contd.*

Eye Contact:

- Avoid direct contact.
- Wear chemical protective gloves if necessary. Quickly and gently blot or brush chemical off the face.
- Immediately flush the contaminated eye(s) with lukewarm, gently flowing water for 5 minutes, while holding the eyelid(s) open.
- If irritation or pain persists, see a doctor.

Ingestion:

- Have victim rinse mouth with water.
- Immediately call a doctor.