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Chemical profile

Mercury and mercury compounds

Summary

- Mercury and mercury compounds are internationally recognised as environmental pollutants. These compounds are listed under the Minamata Convention to globally reduce and eliminate production and use.
- Mercury and its compounds have high chronic toxicity to aquatic life. In the environment, mercury and its compounds can be transformed into methylmercury which can persist in the environment and can bioaccumulate or concentrate in the tissues of aquatic organisms. Methylmercury is a highly toxic chemical which can biomagnify in ecological food-webs. Industrial emissions of these chemicals contribute to long-term adverse effects on ecological health.
- Mercury is used in lighting, electronics, dentistry, manufacturing processes, research and measuring instruments and devices (e.g. thermometers, gyrocompasses, sphygmomanometers). Mercury was previously used in Australia in gold refining and as an industrial catalyst.
- Mercury compounds are used in batteries, products including cosmetics, some vaccines, veterinary and therapeutic medicines, and as laboratory reagents, catalysts and frequency standards for research and educational activities. Mercury compounds were previously used in varnishes, textiles, fungicides and pesticides, dyes, latex paints, and photographic film.
- Mercury and mercury compounds are a priority for scheduling under the [Industrial Chemicals Environmental Management Standard \(IChEMS\)](#) to manage their long-term risks to the environment and to fulfill Australia's obligations to international obligations.

Introduction and use of mercury and mercury compounds in Australia

Mercury and mercury compounds have many commercial and industrial uses.

Mercury is used in the below:

- Floodlights, streetlights, powerful outdoor lights and general lighting (e.g. compact fluorescent light bulbs (CFLs), ultraviolet lamps, neon lights, High Pressure Mercury Vapour Lamp).
- Electronics (electrical switches, relays, consumer electronics, nanotechnology).
- Measurement and calibration instruments and devices (e.g. industrial thermometers, manometers and barometers, gyrocompasses).
- Electrodes and catalysts used in research.
- Manufacture of amalgams.

Mercury is commonly used in its liquid form in articles such as electrical switches, thermometers and lamps. The release of mercury to the environment can occur when the article is broken or damaged during disposal. Given the widespread use of mercury-containing articles and the time required to phase

them out and find alternatives, emissions from waste and disposal of mercury containing products may occur for many years to come.

In Australia, mercury is commonly introduced into the environment as a result of industrial emissions from metal refineries, coal fired electricity generators, petroleum refining, oil and gas extraction and cement production. Petroleum refining and manufacturing contribute nearly half of mercury emissions to land and water. Approximately 50% of these emissions are expected to be deposited in the vicinity of the emission source. The remainder will undergo long-range transport in the atmosphere before settling in terrestrial or aquatic environments.

Mercury compounds are used in the below:

- Batteries (e.g. alkaline button batteries, mercury batteries, zinc-air batteries, silver-oxide batteries, manganese dry-cell batteries, and alkaline dry-cell batteries).
- Pigments such as mercuric oxide red and vermilion (mercuric sulfide) in the paint and colour industry.
- Cosmetics (e.g. skin lightening creams, eye make-up).
- Laboratory reagents, chemical intermediates, catalysts and frequency standards.
- X-ray and gamma ray detection and imaging devices for material manufacturing.
- Production of mercury (from Cinnabar) or synthesis of other mercury compounds.

Many mercury compounds were historically used in latex paints, tattoo dyes, fireworks, herbicide and fungicides, adhesives, perfumes, germicidal soaps, taxidermy, varnishes, textiles and photography.

Controls under international conventions

The Minamata Convention on Mercury introduces controls to protect human health and the environment from human-caused releases of mercury and mercury-containing compounds.

Australia is a party to the convention and must reduce emissions and releases of mercury and mercury compounds to the environment by implementing controls on:

- Mercury supply sources and trade
- Use in products and processes
- Artisanal and small-scale gold mining where mercury is used
- Air emissions and releases to land and water
- Storage, waste and contaminated sites.

Under the convention, the following products are excluded from phase out obligations:

- Products essential for civil protection and military use.
- Products for research, calibration of instrumentation, for use as reference standard.
- Where no feasible mercury-free alternative for replacement is available, switches and relays, cold cathode fluorescent lamps and external electrode fluorescent lamps (CCFL and EEFL) for electronic displays and measuring devices.
- Products used in traditional or religious practices.
- Vaccines containing thiomersal as preservatives.

A number of mercury compounds are also included in Annex III of the [Rotterdam Convention](#) which prohibits the export of Rotterdam Convention-listed chemicals to parties without prior authorisation. Australia is a party to this convention.

Chemical identity

Mercury is a naturally occurring element with the chemical symbol Hg and atomic number 80. It is a dense, silver-coloured liquid metal. It will form alloys with most metals. It is not soluble in water or most other liquids but will dissolve in lipids (fats and oils). It is an excellent conductor of electricity. Inorganic mercury compounds are formed when mercury combines with chemical elements other than carbon, typically chlorine, sulfur, or oxygen. Organomercury compounds form when mercury combines with carbon.

Group name: Mercury and mercury compounds.

This group includes all of the following:

- Mercury (CAS RN 7439-97-6) and mercury alloys and amalgams.
- Any chemical compound that contains at least one mercury atom, such as:
 - inorganic monovalent and divalent ions (mercurous salts and mercuric salts) organomercury compounds (compounds in which mercury is attached covalently to at least one carbon atom).

CAS registry number (RN): 7439-97-6 and others (see indicative list).

Hazards and risks to the environment

Mercury cycles through all major environments from human-caused and natural processes.

Most mercury in the atmosphere is elemental mercury. It undergoes oxidation and deposits as mercuric salts in soil and aquatic environments. Reduction processes return mercury to the atmosphere as elemental mercury. All major environmental compartments are impacted from mercury emissions.

Bacteria in the environment can transform mercury and its compounds to methylmercury. This can occur in freshwater, marine and terrestrial environments. Organic forms of mercury, such as methylmercury, have a much higher biomagnification potential than inorganic mercury. Due to its high toxicity and biomagnification potential in terrestrial and aquatic organisms, methylmercury greatly increases the risk that mercury poses to the environment. Environmental organisms will primarily be exposed to methylmercury through dietary sources.

Terrestrial mammals and birds absorb mercury through the consumption of fish and other aquatic organisms. Methylmercury can pass through the blood-brain barrier and bioaccumulate in the central nervous system, where it can cause effects including ataxia, staggering, and hind-limb paralysis.

It was globally agreed through the Minamata Convention that mercury is likely to cause serious or irreversible harm to the environment and/or to human health.

Additional information: regulation of mercury in Australia

The National Industrial Chemicals Notification and Assessment Scheme (NICNAS), published an [IMAP Environment tier II assessment](#) for mercury in June 2020. It indicated that there are potential significant long-term risks to the environment from mercury emitted to the atmosphere from industrial processes such as non-ferrous metal refining, coal-fired electricity generation, the manufacture of cement and the disposal of mercury vapour lamps and mercury containing dental amalgam.

States and territories are responsible for managing and regulating mining; manufacturing; mercury storage and waste management; management of contaminated land; and processes that produce mercury emissions to air and releases to land and water.

Mercury emissions are required to be reported to the [National Pollutant Inventory](#) (NPI).

References

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More information

Email ichems.enquiry@dcceew.gov.au

Web www.dcceew.gov.au/environment/protection/chemicals-management/national-standard