

## Mercury exposure and health

### What is mercury?

Mercury is a naturally occurring metal found in air, water, and soil. It is distributed throughout the environment by both natural and human processes. Mercury exists in several forms (elemental or metallic, inorganic and organic) and is persistent in the environment. Metallic mercury is a shiny silver-white odourless liquid which readily releases a colourless vapour. It combines with other elements such as chlorine, sulphur and oxygen, to form inorganic mercury. It also combines with carbon to make organic mercury, mainly methyl and ethyl mercury.

### What are the main sources of mercury exposure?

The major human activities in Australia which release metallic and inorganic mercury into the atmosphere are gold production, coal fired power plants, and production of alumina from bauxite. Mercury also enters the air from bush fires and volcanic activity, mining of ore deposits, waste incineration, and from some manufacturing plants. It enters water and soil from natural deposits, disposal of wastes and from mercury present in the air. Once in the environment, mercury can be transformed by bacteria into methyl mercury. Methyl mercury bio-accumulates in fish and shellfish.

When exposure occurs above certain levels, mercury poisoning may occur. The amount of exposure required to cause poisoning depends on the form of the mercury, the amount and the way the mercury is taken into the body. As well, the developing embryo/fetus, infant and young child are more sensitive to the health effects of mercury than other age groups.

#### *Common background exposures*

**Dental amalgam** ('silver fillings') is an important source of mercury exposure in the general population, through the breathing in of mercury vapour from fillings. However, the use of mercury dental amalgams is declining.

Advice from Australian authorities on mercury in dental amalgam is available at [http://www.nhmrc.gov.au/files\\_nhmrc/publications/attachments/d18.pdf](http://www.nhmrc.gov.au/files_nhmrc/publications/attachments/d18.pdf)

Consumption of **fish and shellfish** is also a major source of intake of mercury, in the form of methyl mercury. While the levels of mercury in fish caught in Australian waters are generally low, pregnant or breast-feeding women and children under the age of 6 should limit the amount of fish or seafood they eat (see below).

#### *Accidental exposure*

Examples include spillage of **metallic mercury** in the home (eg from a broken mercury thermometer or barometer) with inappropriate cleaning up; accidental swallowing of batteries containing mercury; or exposure to vapour from a broken fluorescent light. Ingestion of soil contaminated with mercury as a result of previous industrial or mining activity is another avenue for exposure, particularly for young children who often put things into their mouths. Soil may also be brought into the house on the feet of occupants or their pets, whilst soil contaminated with metallic mercury may release mercury vapour.

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### *Occupational exposure*

Artisanal (cottage industry) and small-scale gold mining is one of the major sources of environmental mercury contamination, especially in developing countries. It leads to dangerous exposure of workers who burn the amalgam and of members of their households. Where there are poor industrial hygiene practices, occupational exposures to metallic mercury may also occur, for example in factories in which mercury is used in manufacture, such as in the production of thermometers or fluorescent lights, in the chemical industry including mercury cell chlor-alkali plants or in laboratories using mercury or mercury containing equipment.

### *Use of medicines and cosmetics*

Toxicity has also occurred from unregulated use of mercury compounds in both Western and traditional medicines, or in cosmetics such as skin lightening creams and soaps. In the first half of the last century, widespread use of mercury in 'teething powders' caused a form of infantile mercury poisoning called pink disease, marked by pink, swollen hands and feet, rash, lethargy, and hair and tooth loss.

Mercury in the form of thiomersal (which contains ethyl mercury) may be used as a preservative in vaccines; in Australia all childhood vaccines and most vaccines used in adults are mercury-free. Detailed information can be found at:

<http://ncirs.edu.au/immunisation/fact-sheets/thiomersal-fact-sheet.pdf>

### **How does mercury affect health?**

All humans are exposed to some level of mercury. Severity of health effects depend on the form of mercury, dose, developmental stage and age, duration and route of exposure.

#### *Inhalation of mercury vapour*

Mercury vapour is easily absorbed through the lungs, with about 70-80% entering the blood stream following inhalation. Prolonged inhalational exposure leads to central nervous system damage causing neurological symptoms such as irritability, memory loss, anxiety, depression, personality change and tremor. 'Mad Hatter's disease' caused by intense and prolonged exposure to the vapour of metallic mercury used to produce felt for hat making is a historical example.

At high doses, nausea and vomiting occur, whilst effects on the lungs are severe, leading to shortness of breath and eventually death due to respiratory failure.

#### *Ingestion (swallowing) of mercury or mercury containing foods and objects*

Metallic mercury is usually poorly absorbed into the body but will be absorbed if there is a delay during movement through the intestinal tract (for example, if an infant swallows a mercury battery). Some of the elemental mercury can turn into mercury compounds which are highly corrosive to the intestine. In acute exposure, the toxic effects usually occur within 10-15 minutes and can cause loss of appetite, abdominal pain, vomiting and bloody diarrhoea.

Methyl mercury found in contaminated seafood is readily absorbed and finds its way to almost every organ in the body, but particularly to the brain and kidneys. Effects on the brain and nervous system caused by eating fish heavily contaminated with methyl mercury, as happened in Minamata, Japan, include irritability, memory loss, anxiety, depression, personality change, tremor, unsteadiness, and visual and other sensory

disturbances. Kidney inflammation may occur, whilst in acute, high-level exposures, kidney failure has ensued within 24 hours.

### **Who are at most risk?**

Mercury can affect anybody, but there are certain groups who are higher risk.

#### *Pregnant women and the developing fetus*

In pregnant women mercury can pass through the placenta and affect the baby in the womb, potentially harming the development of a baby's central nervous system. Pregnant and lactating women are generally advised to reduce their consumption of certain types of fish (see below).

#### *Young children (< 6 years)*

Young children tend to put their hands or other objects into their mouths (e.g. soil). As their brains are still developing, they are more likely to be sensitive to mercury exposure. Effects observed in young children include behaviour, attention and learning problems, and difficulties thinking through tasks.

#### *People with pre-existing medical conditions*

The presence of central nervous system disorders or kidney disease may increase the impact of mercury toxicity. People sensitized to mercury and those with genetic susceptibility to mercury-induced hypersensitivity are also at higher risk.

### **Mercury poisoning is preventable**

#### *Limit consumption of fish and shellfish*

Although it is generally considered healthy to eat fish, mercury is concentrated through the food chain and may be present at high levels in the flesh of predatory fish, mainly shark (Flake), billfish (Broadbill, Swordfish and Marlin), Orange Roughy (Deep Sea Perch) and Catfish. Therefore it is advisable for at-risk groups to avoid or limit their ingestion of such fish in order to minimise exposure of methyl mercury.

All other fish species are safe to eat at the recommended level of 2 to 3 times per week.

Food Standards Australia and New Zealand provides guidance on fish consumption to minimise exposure to mercury, at:

<http://www.foodstandards.gov.au/consumer/chemicals/mercury/pages/default.aspx>

In waters where there is evidence that mercury contamination may lead to harmful levels of mercury in fish, authorities may ban the catching of fish.

#### *Other ways to reduce potential mercury exposure*

If there is concern regarding contamination of soil, frequently wash children's hands, and regularly wash or wet-mop floors, stairs, and window sills to reduce dust. Move play areas away from bare soil.

Products that contain mercury, such as thermometers, fluorescent light bulbs and older medications should be handled and disposed of carefully. Do not vacuum up spilled mercury or broken mercury-containing devices as it increases the level of mercury vapour in the air. For further information see:

<http://ee.ret.gov.au/energy-efficiency/lighting/energy-efficient-alternatives/disposing-used-and-broken-compact-fluorescent-lamps-cfl>

## **Are there Australian limits for human exposure to mercury?**

### *Drinking water*

The Australian National Health & Medical Research Council has set a health-related limit for total mercury in drinking water of 0.001mg/L.

<https://www.nhmrc.gov.au/guidelines/publications/eh52>

### *Air*

As a guideline for long-term exposure, NSW Health uses the World Health Organisation recommendation for a tolerable daily level in air of 1.0 µg/m<sup>3</sup> as an annual average.

### *Soil*

The current National Environment Protection (Assessment of Site Contamination) Measure, approved by the Council of Australian Governments Standing Council on Environment and Water, recommends health-based investigation levels for mercury in soil in different residential scenarios. The investigation level for residences with garden/accessible soil (also applicable to childcare centres, preschools and primary schools) is 10mg/kg for methyl mercury and 40mg/kg for inorganic mercury; for residences with minimal opportunity for soil access (includes dwellings with fully and permanently paved yard space) the level is 30mg/kg for methyl mercury and 120mg/kg for inorganic mercury.

It should be noted that where there is significant **metallic** mercury contamination of soil, the document recommends management on a case-by-case basis because assessment of human exposure may require measurement of mercury vapour released from soil.

Uptake of metallic or inorganic mercury by food plants is at a level of approximately 1 in 1000 to 3 in 1000 of the levels in the soil, so that food plants grown in residential gardens are very unlikely to accumulate harmful levels of mercury.

## **What to do if you are concerned about mercury exposure**

If you suspect you or your child's health has been affected by exposure to mercury, contact your doctor regarding the need for clinical assessment. Telephone advice may also be sought from the NSW Poisons Information Centre on 13 11 66.

If you need to clean up a mercury spill in your home, or if you are concerned about the likelihood of human mercury exposure from the environment, you may obtain advice from members of the environmental health team at the Public Health Unit on 9382 8333 for south eastern Sydney residents, or if you are elsewhere in NSW, by phoning the state-wide public health unit call number 1300 066 055.

Prepared by South Eastern Sydney Public Health Unit.

7 May 2013; reviewed 2 May 2014.