Scientific Facts on

Mercury

Source document:
UNEP (2002)

Summary & Details:
GreenFacts

Context - Mercury is a heavy metal of which some forms are known to be highly toxic. Though mercury occurs naturally in the environment it is now mainly released by human activities.

Are these releases being controlled? Are humans and the environment at risk?

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This Digest is a faithful summary of the leading scientific consensus report produced in 2002 by the United Nations Environment Programme (UNEP):
"Executive Summary of the Global Mercury Assessment"

The full Digest is available at: http://www.greenfacts.org/en/mercury/

This PDF Document is the Level 1 of a GreenFacts Digest. GreenFacts Digests are published in several languages as questions and answers, in a copyrighted user-friendly Three-Level Structure of increasing detail:

- Each question is answered in Level 1 with a short summary.
- These answers are developed in more detail in Level 2.
- Level 3 consists of the Source document, the internationally recognised scientific consensus report which is faithfully summarised in Level 2 and further in Level 1.

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1. What is mercury?

1.1 Mercury is a heavy metal, sometimes known as quicksilver, that occurs naturally in the environment in different chemical forms. The pure form, elemental mercury, is liquid at room temperature and slowly forms a vapour in the air. Forms more commonly found in nature are inorganic mercury and organic mercury.

1.2 Natural events (e.g. volcanic activity, weathering of rocks) and human activities (e.g. mining, fuel use, products and processes) can cause mercury releases into the environment. Once released, it can move easily between air, water and land: natural processes can even change mercury from one form to another.

1.3 Mercury can have adverse effects on living organisms and the environment, though these depend on its form as well as dose, etc.

2. What are the impacts of mercury on human health?

2.1 Mercury and its compounds are highly toxic substances for humans. Methylmercury and elemental mercury are of the highest concern. They are poisonous to the nervous system. There is some evidence [see Annex 1, p. 5] at present that methylmercury can cause cancer in humans, but it is far from conclusive. However, there is no evidence at present that elemental mercury causes cancer in humans. Moreover, exposure to methylmercury during pregnancy may affect the unborn baby.

2.2 Humans are mainly exposed to methylmercury through their diet (particularly fish), and to elemental mercury vapours from tooth fillings and at certain workplaces.

2.3 Governmental bodies have set daily mercury intake levels that are considered safe, but some people take in more than these levels.

2.4 Risks vary from one place to another. The risk from diet mainly depends on how much contaminated fish is eaten: moderate consumption of fish with low levels of mercury is not a cause for concern.

3. What are the impacts of mercury on the environment?

3.1 Mercury can be particularly harmful for the environment because it can accumulate in organisms. The levels of methylmercury increase along the food chain and with age.

Methylmercury can accumulate along the food chain © Aurileide Alves

3.2 Mercury may harm bird reproduction and behaviour. Some seals and whales in the Arctic and some predatory marine mammals in warm waters may be at risk.

3.3 Some ecosystems, such as forest soils, may be affected by mercury.

4. Where is mercury found?

4.1 Mercury is released into the environment through both natural processes (e.g. volcanic activity, weathering of rocks) and human activities (e.g. mining, fuel use, products and processes). Once released, mercury enters air, water and soil, and moves from one to another until it comes to rest in sediments or landfills.

4.2 Mercury deposited from the atmosphere at any particular place comes from both local and global sources.

4.3 Human activity is now the main source of mercury being released into the environment. Much is released unintentionally from processes where mercury is an unwanted impurity. Emissions into the air, mainly from fossil fuel power plants and waste incinerators, are expected to increase unless other energy sources are used or emissions better controlled. However, mercury mining is decreasing and therefore releases from mining and mercury use may be in decline.

4.4 Weathering and evaporation from mercury-rich rocks and soils lead to natural mercury release, as do forest fires and volcanic activity. Although natural emissions are difficult to determine, current estimates suggest that less than 50% of total mercury releases come from natural sources.

5. Where do the world's supplies of mercury come from?

5.1 Mercury placed on the world market comes mainly from cinnabar mines in Spain, China, Kyrgyzstan and Algeria. It can also be recycled from industrial processes.

See also our summary on Dental amalgam [see http://copublications.greenfacts.org/en/dental-amalgam/index.htm]

5.2 Large amounts of recycled mercury will be available over the next decade and beyond and steps are being taken to manage the way it is used. Increased recycling will reduce the movement of new mercury onto the market and into the environment.

5.3 Because of its unique properties, mercury has been used for extracting gold and silver from ores, in chlor-alkali chemical manufacture, in thermometers and manometers, in lights and switches, and in dental amalgam fillings, among others. However, use of mercury and mercury compounds has been reduced for health and environmental reasons.

6. What can be done to reduce mercury releases?

6.1 Mercury releases from current human activity may be limited by either preventive measures or control measures.

Preventive measures include reducing the use of mercury-containing products and raw materials, and replacing products and processes that contain or use mercury with ones that do not.

Control measures include end-of-pipe techniques and effective waste management.

6.2 A suitable approach for reducing mercury emissions should involve both preventive and control measures.

6.3 There have been many national initiatives to manage the use and release of mercury. These include the setting of mercury emission limits, environmental standards and restrictions on use.

International initiatives include legally binding agreements, non-binding initiatives and voluntary private-sector initiatives.

7. What further research and information is needed?

7.1 Most countries need more information in order to manage mercury effectively. Some lack basic information about their own uses and releases of mercury, as well as levels in their local environment, while others want more advanced data in order to assess and manage the risks better.

7.2 Mercury is one of the best-studied environmental toxicants, but there are still some gaps in understanding a number of global issues. However, the information available is sufficient to address, without delay, the global adverse effects of mercury.

8. Conclusions

There should be international action to reduce the risks to human health and the environment arising from mercury release into the environment.

While more data will help, the adverse impacts of mercury need to be addressed at the global, regional, national and local levels. Various options for doing this have been identified, and areas for immediate action have been proposed.

Annex

Annex 1:
Standard IARC degrees of evidence of carcinogenicity

- in humans
- in experimental animals

which are the basis for the Standard IARC Classification

Carcinogenicity in humans

Sufficient evidence of carcinogenicity:

The Working Group considers that a causal relationship has been established between exposure to the agent, mixture or exposure circumstance and human cancer. That is, a positive relationship has been observed between the exposure and cancer in studies in which chance, bias and confounding could be ruled out with reasonable confidence.

Limited evidence of carcinogenicity:

A positive association has been observed between exposure to the agent, mixture or exposure circumstance and cancer for which a causal interpretation is considered by the Working Group to be credible, but chance, bias or confounding could not be ruled out with reasonable confidence.

Inadequate evidence of carcinogenicity:

The available studies are of insufficient quality, consistency or statistical power to permit a conclusion regarding the presence or absence of a causal association between exposure and cancer, or no data on cancer in humans are available.

Evidence suggesting lack of carcinogenicity:

There are several adequate studies covering the full range of levels of exposure that human beings are known to encounter, which are mutually consistent in not showing a positive association between exposure to the agent, mixture or exposure circumstance and any studied cancer at any observed level of exposure. A conclusion of 'evidence suggesting lack of carcinogenicity' is inevitably limited to the cancer sites, conditions and levels of exposure and length of observation covered by the available studies. In addition, the possibility of a very small risk at the levels of exposure studied can never be excluded.

In some instances, the above categories may be used to classify the degree of evidence related to carcinogenicity in specific organs or tissues.

Carcinogenicity in experimental animals

Sufficient evidence of carcinogenicity:

The Working Group considers that a causal relationship has been established between the agent or mixture and an increased incidence of malignant neoplasms or of an appropriate combination of benign and malignant neoplasms in (a) two or more species of animals or (b) in two or more independent studies in one species carried out at different times or in different laboratories or under different protocols.

Exceptionally, a single study in one species might be considered to provide sufficient evidence of carcinogenicity when malignant neoplasms occur to an unusual degree with regard to incidence, site, type of tumour or age at onset.

Limited evidence of carcinogenicity:

The data suggest a carcinogenic effect but are limited for making a definitive evaluation because, e.g. (a) the evidence of carcinogenicity is restricted to a single experiment; or (b) there are unresolved questions regarding the adequacy of the design, conduct or interpretation of the study; or (c) the agent or mixture increases the incidence only of benign neoplasms or lesions of uncertain neoplastic potential, or of certain neoplasms which may occur spontaneously in high incidences in certain strains.

Inadequate evidence of carcinogenicity:

The studies cannot be interpreted as showing either the presence or absence of a carcinogenic effect because of major qualitative or quantitative limitations, or no data on cancer in experimental animals are available.

Evidence suggesting lack of carcinogenicity:

Adequate studies involving at least two species are available which show that, within the limits of the tests used, the agent or mixture is not carcinogenic. A conclusion of evidence suggesting lack of carcinogenicity is inevitably limited to the species, tumour sites and levels of exposure studied.

Source & © IARC Chapter 12 (evaluation) of the Preamble to the IARC Monographs [see http://monographs.iarc.fr/ENG/Preamble/eval.php]