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Preparation of a global legally binding instrument on mercury

Report on indicators to evaluate and track the health impacts of mercury and identify vulnerable populations

Note by the secretariat

1. At its first session, held from 7 to 11 June 2010, the intergovernmental negotiating committee to prepare a global legally binding instrument on mercury requested the secretariat to prepare a report on indicators to evaluate and track the health impacts of mercury and identify vulnerable populations, including the design of a sustainable awareness-raising and sensitization programme, to be developed in the context of pilot projects. The committee noted that the secretariat would invite relevant partners, as needed, to provide the information requested.

2. In recognition of the statements made by the World Health Organization (WHO) during the committee's first session and its stated willingness to provide Governments with technical support relating to the management of health risks posed by mercury, the secretariat invited WHO to take the lead in carrying out the work to provide the report requested.

3. The annex to the present note contains the report developed by WHO, which has been reproduced as submitted, without formal editing.

* UNEP(DTIE)/Hg/INC.2/1.

Annex

Report on indicators to evaluate and track the health impacts of mercury and identify vulnerable populations

Introduction

1. The present note, prepared by the World Health Organization, responds to the request of the intergovernmental negotiating committee at its first session to provide "(a) A report on indicators to evaluate and track the health impacts of mercury and identify vulnerable populations, including the design of a sustainable awareness-raising and sensitization programme, to be developed in the context of pilot projects".

2. Mercury exists in the environment in three forms: elemental, inorganic (e.g., mercuric oxide, mercuric chloride, etc.), and organic (e.g., methylmercury, thimerosal). The form of mercury affects its absorption and retention in the body.

3. The primary targets for toxicity of mercury and mercury compounds are the nervous system, kidneys, and the cardiovascular system. Other systems that may be affected include the respiratory, gastrointestinal, hematologic, immune, and reproductive systems. It is generally accepted that developing organ systems (such as the fetal nervous system) are most sensitive to the toxic effects of mercury.

Nervous System

4. Methylmercury's key target is the nervous system. Methylmercury is the most toxic and the most common form of mercury found in the environment. Exposure to methylmercury occurs from eating fresh or marine water fish and animals that feed on fish. Due to methylmercury's ability to cross the placental barrier, developing fetuses are particularly sensitive. Studies have shown that children exposed to 10 - 20% of the toxic level seen in adults can have cognitive deficits as early as ages 4 to 7. Effects on the nervous system are also the most sensitive toxicological end-point observed following exposure to elemental mercury. Inorganic mercury, however, has a limited capacity to cross the blood-brain barrier and thus exposure to inorganic mercury compounds is not associated with effects on the central nervous system.

Kidney

5. Kidney damage is the most sensitive endpoint of exposure to inorganic mercury compounds. Depending on the dose, inorganic mercury exposure can cause an abnormal amount of protein to be released into the urine, blood in the urine, a decreased production of urine, and acute kidney failure.

Cardiovascular

6. Methylmercury has been found to be associated with increased risks of heart attack and high blood pressure. It has been reported that increased mortality from cardiovascular effects may be due to even small increases in methylmercury exposure. Acute exposure to elemental and inorganic mercury has been associated with increased blood pressure, abnormal heart beat, and rapid heart rate. There are numerous risk factors to be considered when evaluating cardiovascular disease, however. Since developmental neurotoxicity and renal effects are considered the most sensitive effects of mercury toxicity, they may be more useful for monitoring of mercury related health effects.

7. A complete discussion on the health effects of mercury is beyond the scope of the present note. The health effects of mercury have been comprehensively described by several WHO documents, however, and the reader is urged to consult these sources for more detail. These documents include, but are not limited to, the following:

- JECFA. 2010. Seventy-second meeting. Rome, 16–25 February 2010. Summary and conclusions. Issued 16th March 2010
- UNEP and WHO. 2008. Guidance for Identifying Populations at Risk from Mercury Exposure. Geneva, Switzerland. [1]

1 Note from the secretariat – An executive synopsis of this guidance document is available to the committee as document UNEP(DTIE)/Hg/INC.2/19.

- WHO. 2008. Mercury: Assessing the Environmental Burden of Disease at National and Local Levels. Environmental Burden of Disease Series, No. 16. WHO. Geneva, Switzerland.
- UNEP and WHO. 2002. Global Mercury Assessment.
- WHO 2003. Elemental Mercury and Inorganic Mercury Compounds: Human Health Aspects. Concise International Chemical Assessment Document 50. Geneva, Switzerland.

8. Populations that may be particularly at risk from mercury exposure include the young and those with pre-existing disease, deficient diets, genetic predisposition, and/or physiologic limitations. Populations may also have an increased risk because of their consumption of fish, shellfish, and marine mammals; occupational exposure; and various consumer and "hot spot"exposures.

Susceptibility

9. ***Children.*** The fetus, the newborn and children are especially susceptible to mercury exposure because of the sensitivity of the developing nervous system. Levels of mercury not found to have an effect in adults or pregnant women, can have persistent adverse effects in children. Methylmercury from fish consumption may be 50% to 100% greater in a fetus' blood than in the mother's blood due to active transport across the placenta. Thus, new mothers, pregnant women, and women who might become pregnant should be particularly aware of the potential danger of methylmercury. In addition to *in utero* exposures, neonates can be further exposed by consuming contaminated breast milk. Nervous system development continues into adolescence; thus a child can be considered more susceptible to mercury exposure even years after birth.

10. ***Pre-existing disease.*** Individuals with diseases of the liver, kidneys, nervous system, and lungs have a higher risk of suffering the toxic effects of mercury than the general population.

11. ***Diet.*** Individuals with certain dietary deficiencies (e.g., zinc, selenium) and those who are malnourished may also be more sensitive.

12. ***Population variability.*** The inter-individual ability to eliminate methylmercury from the body, and the genetic predisposition to effects of mercury both have an effect on the risk of mercury-induced disease.

Exposure

13. ***Fish, shellfish, and marine mammal consumption.*** Some populations have greater exposure to methylmercury because of the quantity and type of fish, shellfish, and marine mammal consumed, and the location where the fish, shellfish and marine mammals are harvested. For example, subsistence fishers and recreational anglers who frequently consume fish from mercury-contaminated water bodies would have a higher exposure than the general population. Those who consume long-lived predatory species (such as shark and swordfish) would also have a higher exposure.

14. ***Consumer exposure***. Exposure to elemental or inorganic mercury may occur from dental amalgams; use of some skin-lightening creams and soaps; some traditional and ethnic medicines; and some cultural and religious practices.

15. ***Occupational.*** Occupational exposures of concern include chlor-alkali manufacturing; artisanal gold mining and processing; and dentistry. Highly exposed workers may take mercury home to family members on their clothing and persons.

16. ***Hot spot exposures.*** Hot spots may include artisanal gold mining (mercury is used to remove the gold from the ore), waste sites, and industrial emissions.

Pilot Studies: Health Impacts

17. The neurodevelopmental deficits caused by prenatal methylmercury exposure are well documented, and a correlation between neurodevelopmental deficits and hair mercury from the mothers has been established. A methodology to estimate the neurodevelopmental burden of disease based on hair mercury in women of child-bearing age has been developed (See: WHO. 2008. Mercury: Assessing the Environmental Burden of Disease at National and Local Levels. Environmental Burden of Disease Series, No. 16).

18. Hair sampling is minimally invasive, presents little risk of disease transmission, and does not require medical supervision. Hair samples provide an excellent indicator of methylmercury exposure since inorganic and elemental forms of mercury are not excreted to any significant amount in scalp hair. Among fish consumers, about 80% of the mercury in hair is from methylmercury.

19. Despite the relative ease of sample collection (hair), little information is available on hair mercury in the general population of countries with high fish consumption. Most studies which have examined hair mercury were of populations where there was a known source of mercury in the vicinity (e.g., artisanal gold mining) or the population was a select group (e.g., subsistence fishers) (see WHO 2008).

20. Pilot studies should focus on the collection and analysis of hair samples from women who are pregnant and of childbearing age in populations for whom fish, shellfish, and marine mammals are a major part of the diet. The purpose of the collection of hair samples is the evaluation of the most sensitive toxicological endpoint for mercury - cognitive deficits in infants. WHO (2008) describes how these results can be used to evaluate the burden of disease at the national or local level for this endpoint. The highest per capita fish consumption generally occurs in the island nations and countries with coastal areas. The highest per capita fish and shellfish consumption in the world is in the Maldives (170 kg per capita). Other countries or areas with high fish consumption include: Iceland (91 kg per capita), Greenland (84 kg per capita), Japan (69 kg per capita), Seychelles (65 kg per capita), Portugal (60 kg per capita), Malaysia (56 kg per capita), and South Korea (51 kg per capita). By comparison, Switzerland consumes 14 kg per capita, the U.S. 20 kg per capita, the United Kingdom 20 kg per capita, Australia 19 kg per capita[2]. Of particular interest would be the hair mercury levels in populations where there is large consumption of predator fish (e.g., shark, swordfish, yellowfin tuna) and marine mammals (e.g, whales, seals).

21. It is critical that the results from such studies be presented as distributions to allow health risk assessors to make optimum use of the information. Individuals potentially at risk of health impacts due to their estimated mercury level need to be referred for medical assessment. Finally, it is essential that studies be conducted in accordance with the Declaration of Helsinki. Participants must give their informed consent. Personal information must be handled and maintained confidentially.

Awareness-raising programmes: Introduction

22. Successful awareness-raising and communication programmes are based on a good understanding of the problems and of the communities where the programmes take place. They have definite aims and objectives, a clear message, directed to a specific target audience, and a planned strategy that is achievable with the human and other resources available. Effective communication is repeated and reinforced over time using different methods, is entertaining and attracts attention, uses clear simple language with local expressions, and emphasizes short-term benefits of action. Effective communication also provides opportunities for dialogue and encourages participation.

23. If communication materials are "imported" from outside the area and group being targeted, they need to be tested with a target group to ensure they are acceptable. Some communities may find a particular approach difficult to understand or unacceptable for cultural or religious reasons. Resource limitations may be handled by starting first with simple, cheap methods of communication to see whether these are effective, and only use more expensive methods where initial methods are not adequate.

24. Guidance on the education and communication for toxic exposures can be found in WHO 2004 IPCS Guidelines on the Prevention of Toxic Exposures: Education and Awareness-raising Activities. Additional guidance on risk communication for mercury is contained in UNEP WHO 2008: Guidance for Identifying Populations at Risk from Mercury Exposure.

Awareness-raising programmes: Pilot studies

25. Initially, a pilot study could evaluate the usefulness of a clearing house of communication resources on mercury. Such a pilot clearing house would contain existing materials that could be adapted to local circumstances, along with available guidance on how to communicate about toxic exposures. Study groups with common characteristics (language, similar population at risk) in different regions might choose a communication resource to trial and share their experiences.

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2 Source: Food and Agricultural Organization of the United Nations.