# HALTING THE CHILD BRAIN DRAIN

## Why we need to tackle global mercury contamination

STAY HEALTHY! STOP MERCURY

*A joint campaign by:*

Health Care Without Harm

Health & Environment Alliance

## **"Stay Healthy, Stop Mercury"** campaign

Health and Environment Alliance (HEAL) and Health Care Without Harm Europe (HCWH) are joining forces to mobilise the health community in Europe for a global ban on mercury. The activities are focused on raising awareness of the risks to health, especially for babies and pregnant women, and on working with women and health care professionals on how they can protect themselves and the environment from mercury exposure. The development of the protocol, quality assurance and data analysis of a small-scale survey of mercury levels in hair samples from women throughout Europe was undertaken and made possible through the support of Hygiène Publique en Hainaut and the Institut Provincial d'Hygiène et de Bactériologie du Hainaut, Belgium.


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**Armenian Women for Health and Healthy Environment**, Armenia

**Arnika**, Czech Republic

**Bund fur Umwelt und Naturschutz**, Germany

**Centre National d'Information Indépendante sur les Déchets**, France

**Earth Forever Foundation**, Bulgaria

**European Public Health Alliance**, Belgium

**Family Medicine Department, Wroclaw Medical University**, Poland

**Foundation for Realisation of Ideas**, Belarus

**Groundwork**, South Africa

**Health Care Without Harm**, Phillippines

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**Irish Doctors Environmental Association – IDEA**, Ireland

**La Leche League**, Belgium

**Macedonian Doctors for the Environment**, Macedonia

**Non au Mercure Dentaire – NAMD**, France

**PIN for Health**, Croatia

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## Why we need to tackle global mercury contamination


*A report by HEAL and HCWH*


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# Preface

**Frédérique Ries, Member of the European Parliament (MEP), Liberal/ALDE, Belgium**

*Member of the Committee on the Environment, Public Health and Food Safety*

It is with great pleasure that I welcome the launch of the "Stay healthy, Stop mercury" report entitled "Stopping the child brain drain: Why we need to tackle global mercury contamination".

Continued use of mercury is highly worrying for human health. A recent report from the European Commission showed that large numbers of people living in Mediterranean and Artic fishing communities have mercury in their bodies at levels that produce clear neurological damage in their offspring.

Fortunately, the European Union has already demonstrated a strong track record on the issue. It has committed to passing a law banning the export of mercury by 2011; it has also banned the use of mercury in non-reusable batteries in Europe. In recent months, a regulation was introduced for co-decision to ban the sale of mercury-containing thermometers and other measuring devices. In addition, the European Food Safety Authority (EFSA) has published guidelines on safety in fish consumption though these could be improved given the need to act with precaution in the face of the child brain drain.

Two European strategies have been developed that are key to further progress. One is the European Action Plan for Environment and Health (2004-2010). My report on this plan, approved by the European Parliament with a large majority in January 2005, recommends a ban on mercury in dental amalgams and in electronic medical measuring devices.

The second is the EU Mercury Strategy published in February 2005. It sets out multiple parallel approaches to the control of mercury emissions and prioritises educational and other measures to protect those groups that are most vulnerable to health damage from mercury.

To increase the sense of urgency about this public health concern, I proposed four amendments to the Parliamentary Report on the European mercury strategy earlier this year. One has already been accepted. The monitoring of mercury levels in vulnerable populations will be included the European Union's bio monitoring programme, which starts in 2007.

The other three proposals include a request for a mercury risk assessment for vulnerable groups to be undertaken by the Scientific Committee on Health and Environmental Risks. So far, the magnitude of the risk from mercury contamination in Europe remains uncertain in its extent and severity. A second proposal recommends that the costs from mercury contamination be assessed, including the reduced intellectual capacity of European children arising from the damaging mercury exposure.

Finally, to further stimulate information about human mercury levels, I have proposed an investigation be made into the option of Member States reporting mercury dietary intake data for vulnerable groups to the European Food Safety Authority.

Legislation also needs to be formulated. A general restriction on all remaining uses of mercury in public and professional products is urgently needed. This should include medical products and should be phased in over a short period of time. Time-limited exemptions should only be permitted in cases where no mercury-free alternatives exist.

At the global level, the key challenge is to achieve a global ban. The European Union is aware that it will not be able to protect its own citizens if it does not play a leading role in the international arena. A United Nations Environment Programme (UNEP) meeting in Nairobi, Kenya in February 2007 provides an excellent opportunity to show leadership in pushing for a global mercury ban.

The contents of this report – produced by two leading non-governmental organisations - will contribute substantially to European advocacy efforts on reducing human exposure to mercury. The hair sample survey has already caused debate among women in several Brussels offices and in groups throughout Europe and beyond. The report's scientific and medical evidence provides concise and important arguments for policy makers seeking to make a difference at both the European and global levels.

# Executive summary

Recently, the foremost scientific authority on the development of children's brains warned of a "chemical braindrain" from low level mercury exposure. Professor Philippe Grandjean, from Harvard University and the University of Southern Denmark, says that our society is losing its intelligence - IQ points in our population are being chemically destroyed. The damage to developing brains, much of which is neurologically irreversible, arises from exposure to methylmercury as well as other neurodevelopmental toxicants during early foetal development. These toxicants cause brain injury at doses much lower than have been previously recognised, as they are much lower than those affecting adult brain function, and much lower than those levels involved in acute mercury poisoning disasters in recent history.

The most vulnerable populations are babies and young children, and by extension, the women who bear them. Because mercury is most toxic to the developing brain; because mercury is stored in the human body and transmitted to the baby during pregnancy; and because many women are unaware of the problem and the sources of exposure; pregnant women or women who have yet to bear children can unknowingly expose their foetus to the risk of serious neurological disorders. Mercury is highly toxic, especially when metabolised into methyl mercury, which accumulates in fish, travels up the food chain and poses risks to humans who consume fish on a regular basis. The main sources of exposure are firstly, through consumption of fish, especially certain kinds of fish – those highest in the aquatic food chain; secondly, through exposure to mercury via contact at work; or thirdly, from industrial sources in the community.

To tackle this public health problem, governments and international bodies have been setting recommended safety levels that aim to protect people. Meanwhile, it is still unclear at what precise level there will be no toxic effects on the foetal brain. Over time, the scientific assessments of safe levels have been constantly revised downwards towards lower levels. Some scientists believe that there may be no level of mercury in the body which is safe. The current estimates of levels of exposure, therefore, both within and outside of Europe, are a cause for great concern. A large percentage of the world's population consume fish regularly, and so far, regulation has not reduced this health threat to future generations.

Over the past year, Health Care Without Harm and the Health & Environment Alliance have undertaken a campaign to raise awareness about the silent braindrain, and to mobilise the health community to advocate for a swift reduction of mercury pollution in the EU and across the globe. Our Stay Healthy Stop Mercury Campaign has conducted an illustrative survey of mercury levels in hair from over 250 women in 21 countries. This survey demonstrates that more than 95% of the women tested had detectable levels in their bodies. The levels which people ingest directly are often estimated from the levels found in hair, and so certain 'hair levels' are considered to correspond with so-called 'intake' doses. Fifteen per cent were above the most protective "Reference Dose" of 1 µg/g set by the United States National Research Council, a level which should not be exceeded in women of child-bearing age. However, all women were below the Benchmark dose limit of 10 µg/g set in 1990 by the World Health Organisation. This is the level at which it is accepted that there are clear neurological effects. Our survey suggested a link between fish consumption and raised mercury levels.

At an individual level, the risk from low doses of mercury may be less alarming, because an increased mercury level in the mother does not automatically lead to brain damage in the child, and because small effects may not be noticeable. However, the implications of widespread low levels of mercury in all childbearing women for our society are enormous. Due to widespread mercury pollution, our current and future children are at greater risk of suffering from lower intelligence, learning disabilities, sensory deficits, and delays in normal development.

It is very difficult and yet vital for public health officials and other public decision-makers to take low-level mercury contamination seriously. Because mercury is a global pollutant with no respect for national or regional boundaries, its release anywhere in the world can contribute to the chemical braindrain anywhere else. Ultimately global action is necessary to eliminate intentional mercury use – and thereby its subsequent release; clean up mercury contamination; and reduce unintentional releases such as those from major air sources like incinerators, coal-fired power plants and cement kilns. Substitute products and technologies are widely available for the majority of mercury uses which would prevent mercury releases and emissions. These should be pursued as fast as possible at any and all levels of authority, whether governmental, public interest or commercial. However, even if all uses of mercury were stopped immediately, the mercury already in the environment and the food chain would continue to pose a serious risk to health. Therefore, it is also imperative that governments, private and public interest entities enable us to take immediate measures to protect our children's health before a concerted, comprehensive solution is achieved. It is essential to identify the populations most at risk through biomonitoring and ensure that people are better informed about how to avoid mercury exposure.

Healthcare professionals can play a leading role in achieving a world free of mercury contamination. The health care sector, including dentistry, is a significant contributor to health care waste, and can thus promote mercury free alternative devices, leading the way for other industries. Moreover, the health care sector is an important trusted source of information, and thereby has a special role in raising public awareness on risks for specific populations.

### THE *"STAY HEALTHY, STOP MERCURY"* CAMPAIGN CALLS FOR:

- *Policy changes to speed up reductions in the use of mercury, through a global ban with community involvement to ensure effective implementation. This ban must tackle the mercury problem on all fronts, from production, to use, to disposal – and in all parts of the world, so that the burden does not migrate from one region to another. Europe is a leader in these efforts but there is still a lot to be achieved.*
- *Education of the population about the current risks and provision of tools which show how to minimise the risk of exposing babies and children to mercury. Biomonitoring of actual exposure which involves the public and the health community is key to properly targeting these educational measures, as well as informing policy measures.*
- *Promotion of alternative technology transfer and financial assistance to Global South countries, to ensure that they can also implement the protective measures which Europe and other developed countries are undertaking.*

# 1. How does mercury affect our health?

## *Introduction*

The Spanish have known for 2,000 years that slaves in the mercury mines gradually got sick and died. In the 1960s and '70s, acute and widespread poisonings such as those in Minamata, Japan, made mercury notorious as a nervous system toxicant and as a cause of birth defects. More recently, studies in the Faroe Islands and elsewhere have shown that low doses of mercury in mothers during pregnancy can have a negative impact on the development of their child's brain.

Ongoing scientific research gives us a more sophisticated understanding of the toxicity of mercury and its complex health effects. This is reflected by the fact that the 'safe' levels are regularly reduced. Alongside the substantial evidence and concern about effects on neurological development, other recent studies show that low doses of mercury can also have other health impacts, such as effects on the cardiovascular system. The health effects of small doses of mercury may not be apparent in individual children, but at the level of the wider population they have far more significance, with reduced numbers of 'gifted' children and greater numbers with low IQ scores.

The emerging scientific recognition about the destructive impacts of low doses raises urgent questions about the health risks that have already been and are currently being incurred under the existing safety levels. Given the downward trend of safety levels, precautionary public policy requires that we anticipate the need to build in further safety margins. At the same time, the need to address the source of the mercury problem is therefore becoming more pressing.

## *What is mercury?*

Mercury has no positive role in the human body[1]; in fact a safe level of mercury exposure is very difficult to determine. It can be present in the environment in several different forms, and while all forms of mercury are toxic to humans, the pattern of toxicity varies with its chemical form, the route of exposure, the amount, the duration and timing of exposure[2], and the vulnerability of the person exposed[3].

For example, pure elemental mercury (also known as quicksilver or Hg ) is liquid at room temperature. If ingested, quicksilver has very low toxicity because it is not absorbed by the gastrointestinal tract and is eliminated completely in the stool. If quicksilver is agitated or heated, however, the liquid mercury becomes a vapour which is readily absorbed by inhalation and is highly toxic to the lungs and central nervous system. The nervous system is the primary target of mercury toxicity, but, depending upon the specific exposure, the kidneys, liver and lungs are also important targets. Table 1 (Page 21) gives an overview of the different forms of mercury, their uses, routes of exposure and their toxicity.

The two biggest sources of exposure to mercury for the general population are through our consumption of fish, and associated with medical and dental practices.[a] People in developed countries have significant exposure from the mercury in their dental fillings[4]. However, our environmental exposure to methyl mercury, a highly toxic form of organic mercury found in ocean and freshwater fish and marine mammals, is a cause of great concern. The impact on public health as a result of exposure to methyl mercury is therefore the major emphasis of this chapter.

## *Human health effects of mercury*

High doses of mercury can be fatal to humans, but even relatively low doses of mercury containing compounds can have serious adverse impacts on the developing nervous system, and have recently been linked with possible harmful effects on the cardiovascular, immune and reproductive systems[5].

Mercury and its compounds affect the central nervous system, kidneys, and liver and can disturb immune processes; cause tremors, impaired vision and hearing, paralysis, insomnia and emotional instability. During pregnancy, mercury compounds cross the placental barrier and can interfere with the development of the foetus, and cause attention deficit and developmental delays during childhood[6].

The effects of low dose mercury exposure are discussed in more detail on Pages 10-12.

[a] Medical exposures occur when mercury containing preservatives like thimerosal are used in certain vaccines and pharmaceutical agents. Exposure to mercury vapour can occur during placement and removal of mercury containing dental amalgams, as well as during normal chewing when mercury amalgams are present. Please read our fact sheet series on Mercury and Health for more details.

HEALTH EFFECTS OF MERCURY AT A GLANCE

*Nervous system –*
developmental delays, impaired vision and hearing, motor function, brain function, IQ

*Cardiovascular system –*
High blood pressure, altered heart rate, increase heart attack risk

*Effects on the immune and reproductive systems, liver and kidneys*

## *History of poisonings*

The effects of acute exposure to mercury, as a result of accidental contact with high amounts of mercury following isolated incidents, are well documented and understood. The best known of these incidents were in Japan and Iraq (see box).

Individuals exposed to mercury spills in the workplace, home or school may be exposed to dangerous or even fatal levels of mercury.

MINAMATA DISEASE

Methylmercury poisoning was first recognised in Minamata, Japan around 1960[7]. Hundreds of fishermen and their families were severely poisoned during the 1950s by methyl mercury that bioaccumulated in fish as a result of the release of mercury to the bay from a local chemical plant. Many severe effects were observed including parasthesia (abnormal physical sensations such as numbness), gait disturbances, sensory disturbances, tremors, hearing impairment and many mortalities[8]. By 1960 the serious and mysterious affliction, affecting both adults and infants, was recognised as methyl mercury poisoning, a hitherto unrecognised disease. High level exposure produced serious neurological disease in adults, but the most dramatic manifestation was congenital Minamata disease in infants born to mothers with high mercury levels. These babies were born with severe cerebral palsy, blindness and profound mental retardation[9]. Some severely affected children were born to mothers who themselves showed no evidence of mercury-related impacts.

**Iraq.** Epidemics of organic mercury poisoning from consumption of grain treated with organomercurial fungicides have also occurred in Iraq and Guatemala. In Iraq, children exposed during foetal development were severely affected, consistent with the Minamata findings[10]. By the time the severe Iraq outbreak occurred in 1971, epidemiologists and toxicologists were alert and analytical results (mainly hair mercury) were obtained and used in risk assessment. This resulted in calculation by the US National Research Council of an intake 'reference dose' of 0.3 ug/kg/day for adults, recently revised to 0.1 ug/kg/day, sufficient to protect the neurobehavioural development of the foetus[11].

*"Mercury has long been recognised as a major source of toxicity in children causing reduced cognitive functioning, including reduced I.Q. However, we are now seeing that even 'low' exposure levels can cause damage to the developing brain of the foetus and infant. These are mercury levels that are not known to cause acute poisoning or ill health in adults. We also know that mercury is 'stored up' in women even before pregnancy. Therefore, preventing exposure to future children means reducing everyday exposure today."*

Hg Gavin ten Tusscher, M.D., Ph.D., paediatrician, Department of Paediatrics and Neonatology, Westfries Gasthuis, Hoorn, the Netherlands

## *Levels of mercury and biomonitoring*

Levels of pollutants in people's bodies can be estimated through biological monitoring, or biomonitoring. Scientists can analyse samples of urine, serum, saliva, blood, breast milk and other tissues (such as hair, body fat and teeth) to measure the levels of various chemicals in the body. The most common way of measuring mercury is in hair, blood and urine.

Biomonitoring can show whether and how much an individual or a population has been exposed to a chemical. However, because some people are more sensitive than others, it is hard to predict how much someone will be affected by a given concentration of mercury in their bodies.

Exposure to methyl mercury can also be estimated at the population level by measuring the amount found in a sample of fish species and calculating exposure from average consumption patterns. However, this will not protect people whose fish consumption differs significantly from the average.

**TABLE 1. Comparison of methyl mercury limits**

| | | levels corresponding to the intake dose | |
|---|---|---|---|
| | INTAKE DOSE | HAIR | BLOOD |
| FAO/WHO Joint Expert Committee on Food Additives (JECFA) | 1.6 µg/kg body weight Provisional Tolerable Weekly Intake (PTWI)[i] | 14 mg/kg[ii]<br><br>*2 µg/ gram corresponds approximately to the PTWI* | |
| US EPA reference dose<br>US National Research Council (NRC) | 0.1 µg/kg body weight per day.[iii]<br>OR<br>0.7 µg/kg body weight per week | *1 µg/ gram of hair*[iv] | *5.8 µg/L*[v] |

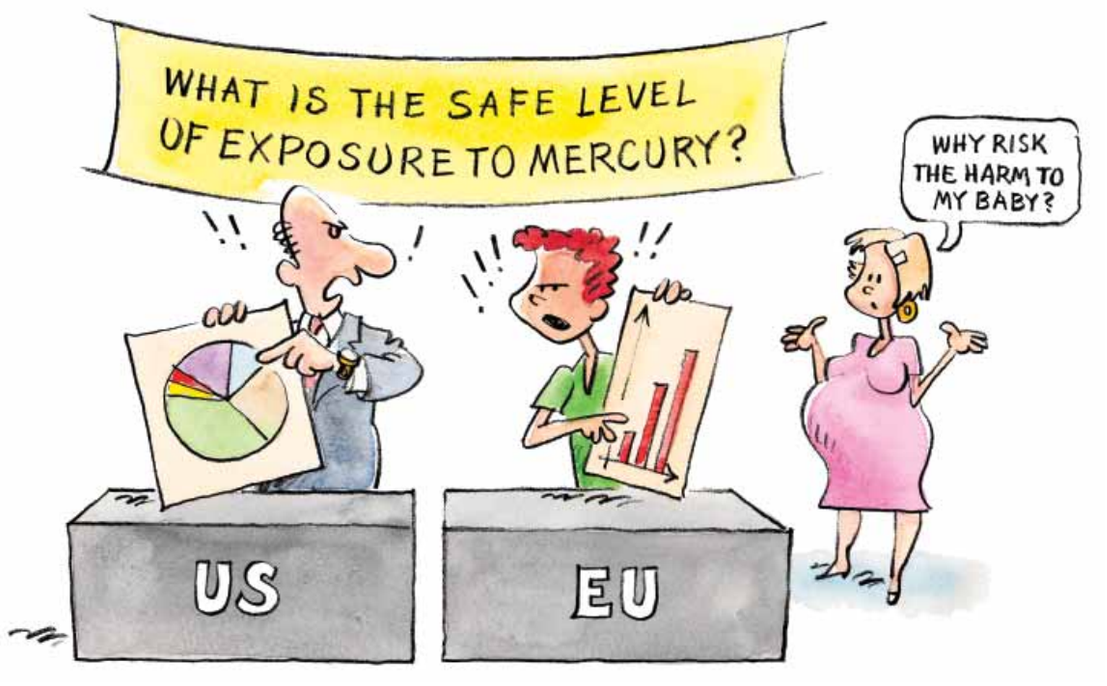
[i] FAO/WHO Joint Expert Committee on Food Additives (JECFA), Summary & Conclusions. 61st Meeting, Rome, 10-19 June 2003. See www.chem.unep.ch/mercury/Report/JECFA-PTWI.htm

[ii] Taking the average from the two studies in the **Seychelles and Faroe Islands**, the committee established this level in maternal hair reflecting exposures that would be without appreciable adverse effects in the offspring in these two study populations.

[iii] United States Environmental Protection Agency (1997) Mercury Study Report to Congress, Volume VII: Characterization of Human Health and Wildlife Risks from Mercury Exposure in the United States. p. 19 http://www.epa.gov/ttn/oarpg/t3/reports/volume7.pdf accessed 8 November 2006

[iv] United States Environmental Protection Agency (1997a), Mercury Study Report to Congress Volume IV: An Assessment of Exposure to Mercury in the United States. http://www.epa.gov/ttn/oarpg/t3/reports/volume4.pdf

[v] United States Environmental Protection Agency (1997a), op.cit.




## *Setting a 'safe' level of mercury*

In 1990, WHO concluded that a safe level of mercury exposure is very difficult to determine due to lack of information on a dose-response relationship between methyl-mercury exposures in mothers and the neurological effects on their offspring[12].

Nevertheless, various national, European and international authorities have established limits for intake of mercury. They have done this by identifying a 'Benchmark' dose: the lowest level at which adverse health effects, such as impacts on the developing brain functions of the foetus, are known to occur (the Lowest Observed Adverse Effect Level - LOAEL). The authorities then calculate a safety margin and set a tolerable intake dose or 'reference' dose just below this safety margin – a level at which there is not likely to be an impact.

The WHO concluded in 1990 that: 'A prudent interpretation of the Iraqi data implies that a 5% risk may be associated with a peak mercury level of 10-20 µg/g in maternal hair"[13], and subsequently calculated a [benchmark dose] limit of 10 µg/g in hair[14].

Since then, lower intake limits have been set by the Joint Expert Committee of the WHO and the FAO (JECFA); and the US National Research Council. These limits are those most commonly referred to. Both have set advisable doses for weekly intake and the levels in hair which correspond to these doses have then been determined. So, for example the WHO/JECFA has set a Provisional Tolerable Weekly Intake (PTWI) of 1.6 µg/kg body weight, which corresponds to a level in hair of 2 µg/gram[15].

A lower intake 'Reference Dose' has been established by the US National Research Council (NRC), for methyl-mercury of 0.7 µg/kg body weight per week, which the US EPA calculated would correspond to a level in hair of 1 µg/gram[16]. The NRC used a greater safety margin from the 'Benchmark Dose Limit' to calculate their intake 'reference' dose.

While these differences may not seem significant, in light of the continuing downward trend for safety levels, in this case, the US level has the advantage of being more precautionary or protective of public health. The US reference dose is the one which the European Commission refers to in its Extended Impact Assessment[17]. It is also the limit we refer to in this report.

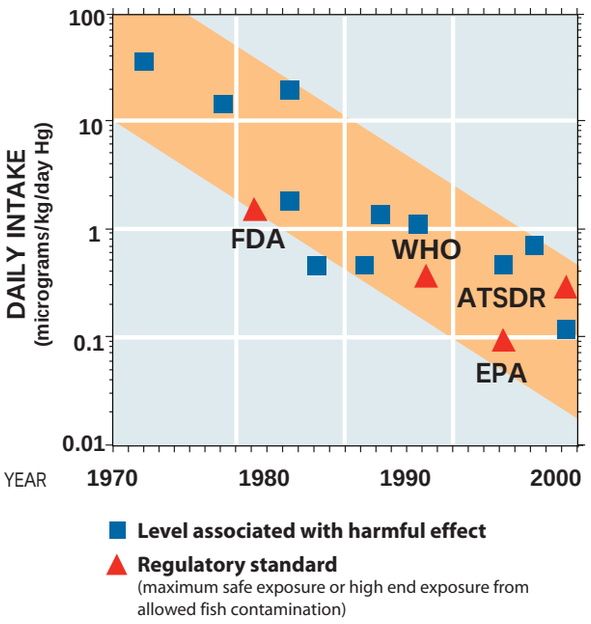
*"The evidence that a mother's exposure to methyl mercury can affect the neurodevelopment of her unborn child is not disputed. What is still debated is the level of environmental mercury contamination which causes documented harm. Over time, our techniques have improved and we have been able to identify harm to humans at lower and lower levels. In time, it is likely that the scientific consensus will conclude that there is no safe level of foetal exposure."*

Peter Orris, MD, MPH, FACP, FACOEM, Professor at University of Illinois at Chicago School of Public Health

As knowledge about the health effects from low levels of mercury exposure has increased over the years, there is a trend for the 'safe' limits set by regulatory authorities to get progressively lower, as shown in Figure 1[18].

**FIGURE 1.**
**Declining threshold of safety from harm**

*This graph displays the apparent toxic threshold for mercury as it was identified at various points in time over the past three decades. It illustrates the tendency for apparent toxic thresholds to decline with advancing knowledge.*




The estimates of dose–response relationships at low exposure levels are subject to considerable uncertainty but all prenatal effects to date have been found to be neurologically irreversible[19].

## *Most vulnerable populations – most vulnerable, most exposed*

The full extent of exposure to mercury in children and adults in Europe or globally is still unknown. A recent EU assessment[20] suggested that as many as one in 20 people may be affected. The study estimates that between 1-5% of the general population in Central and Northern Europe (3 to 15 million people), and people in coastal areas of Mediterranean countries have levels that are around the US NRC reference dose. Even more worrying is the fact that a percentage of this population, notably Mediterranean fishing communities and the Arctic population, have levels ten times as high as the recommended norm - that is, benchmark levels where definite adverse impacts to babies can be expected. Children and foetuses appear to be more affected than the population as a whole. For example, the EU assessment estimates that 44% of 3-6 year old children in France may have mercury levels above the US NRC reference dose.

> *"One of the priorities of the Children's Environment and Health Action Plan for Europe, CEHAPE, adopted by WHO Member States across Europe, is specifically to reduce children's chemical exposures: the global effort working towards eliminating mercury is part of that. There is a growing understanding of the terrible damage that mercury does to the health of children and future generations."*
>
> Dr Roberto Bertollini, WHO Regional Office for Europe

The US National Academy of Sciences identified that 'the population at highest risk is the children of women who consumed large amounts of fish and seafood during pregnancy'[21]. Infants and young children are also susceptible to damage from methyl mercury exposure. This is because the human brain and body develops at a dramatic rate *in utero* and during the first few years of life. In addition, infants and young children may have higher exposures, because they consume more food in relation to their body weight than older children and adults[22].

## *Illustrative mercury sampling survey – 250 women*

As part of our campaign to raise awareness about our exposure to mercury and its dangers to our health, Health and Environment Alliance and Health Care Without Harm Europe commissioned chemical analysis of hair samples to assess the levels of mercury in volunteer women of childbearing age. The combined results of testing in many different countries provide a unique, small scale survey on exposure of women of childbearing age to mercury across a number of countries. This study is an illustrative survey; it is not based on the wider population and was not designed to make predictions about it. The purpose is to help provide a snapshot that can be used to raise awareness, particularly among women, who can take personal precautions (see box on fish consumption, Page 16) to reduce exposure in the most vulnerable group – their unborn children. It also gives an indication of some of the problems that might be uncovered by the planned European Union biomonitoring (see Page 31). Non-EU governments should also follow their lead.

*"As one of the national coordinators in this project, I learnt how worried many women are about exposure to mercury. Some were worried about what fish to eat, others about their dental fillings or exposure at work. They felt they did not have enough information. We were overwhelmed by the number of women wanting to participate in this survey. Women have the right to be informed so that they can protect themselves and prevent any effects on the foetus during pregnancy."*

Sascha Gabizon, national coordinator in Germany and international director of Women in Europe for a Common Future (WECF), the Netherlands

## *Why hair sampling?*

Hair sampling was chosen because it is not an invasive technique and provides information about exposure to mercury over time, making it preferable to blood analysis. Depending upon the length of the hair sample, it is possible to ascertain exposure to mercury over several months. Mercury is incorporated into hair as it grows and remains in hair for a long time. The level of mercury in human hair can provide valuable information about exposure to mercury in the diet. Women were involved in this sampling exercise as the developing foetus is more sensitive to mercury pollution than adults or even children; and can suffer irreversible brain damage at even low exposure levels. A woman's body can store mercury before pregnancy which is later bioconcentrated across the placenta to the foetus. Also, a woman exposed to methylmercury during pregnancy will pass it on to her developing child and to a much lesser extent, through breast milk once the child is born. It should nevertheless be noted that breastfeeding is beneficial to the growing child and the amount of mercury in breast milk is not a problem under normal circumstances. The WHO advises all women to continue to breastfeed for six months and continue breastfeeding along with adequate complementary feeding for 2 years or more.

## *Results and interpretation*

We received over 260 samples from 21 different countries, most of them within Europe (EU and non-EU countries), plus South Africa, the Philippines, India and Argentina. Both hair samples and completed questionnaires were sent to the Provincial Institute of Hygiene and Bacteriology of the Hainaut, Belgium, for laboratory analysis and interpretation. Quality control and quality assurance procedures are outlined in the testing protocol in Annex 1. The results are consistent with results found in the scientific literature, and show the distribution illustrated in Figure 2.

*"Women, particularly those who may become pregnant or are pregnant, don't have enough information on what they need to know about mercury in their body and how to protect themselves and their babies. As a leader of a breastfeeding support group I participated in the "Stay Healthy, Stop Mercury" campaign to find out more and share this with others. In my work I often meet mothers who are breastfeeding young babies who are concerned about this issue."*

Erin Meyer is a La Leche League leader in Belgium

91% of volunteers submitting samples were women between 18 and 45 years old[b] These women were concerned with the issue in some way; as members of health, environment or women's organisations, as doctors, nurses, dentists or other health-related positions, or in positions of leadership, such as MPs.

All testing samples were cut individually or by a national coordinator (a member of collaborating NGO), placed in the small plastic bag provided and sent by courier to HEAL, where they were given reference numbers. Strict ethical and confidentiality rules were followed. The laboratory collected the samples anonymously and an informed consent was obtained from all volunteers.

The exposure values ranged from not detectable to 4.96 µg/g or ppm (parts per million) of total mercury in hair.[c] 95% of volunteers had detectable levels of mercury in their hair[d]. The lowest detectable level in the hair samples was 0.05 µg/g.

[b] Out of 266 samples, 23 did not fall into the criteria defined in the protocol, ie women between the ages of 18-45.

[c] The lab measured the total level of mercury in hair including organic and inorganic mercury. See the Testing Protocol in Annex 1

[d] Out of the 243 volunteers of child bearing age, 232 had detectable levels.

*"I wanted to take part in the hair sample testing because I work in a chemical lab where we handle mercury. I have been worried for a long time that this contact may not be good for my health."*

Maria Toneva works in a chemical lab in Bulgaria

As illustrated in Figure 2, all of the 266 participants tested were below the WHO benchmark value, 10 µg/g in hair[23], adopted in 1990. The US National Research Council has set the most protective limit, or 'reference dose', of 0.7 µg/kg body weight per week, which the US EPA calculated would correspond to a level in hair of 1 µg/gram (see Page 10, Setting a 'safe' level of mercury). In our survey, 42 hair samples (16 %) had results above 1 µg/gram. The mean mercury hair level was 0.53 µg /gram.

**FIGURE 2. Mercury levels in survey of hair samples**

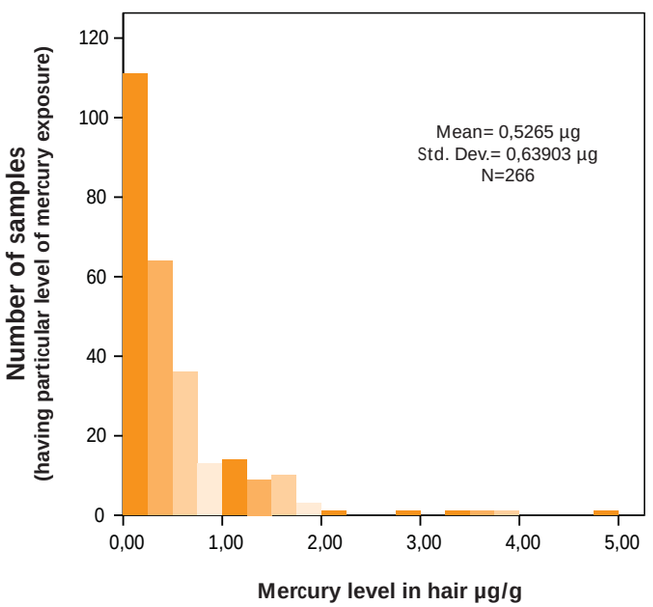
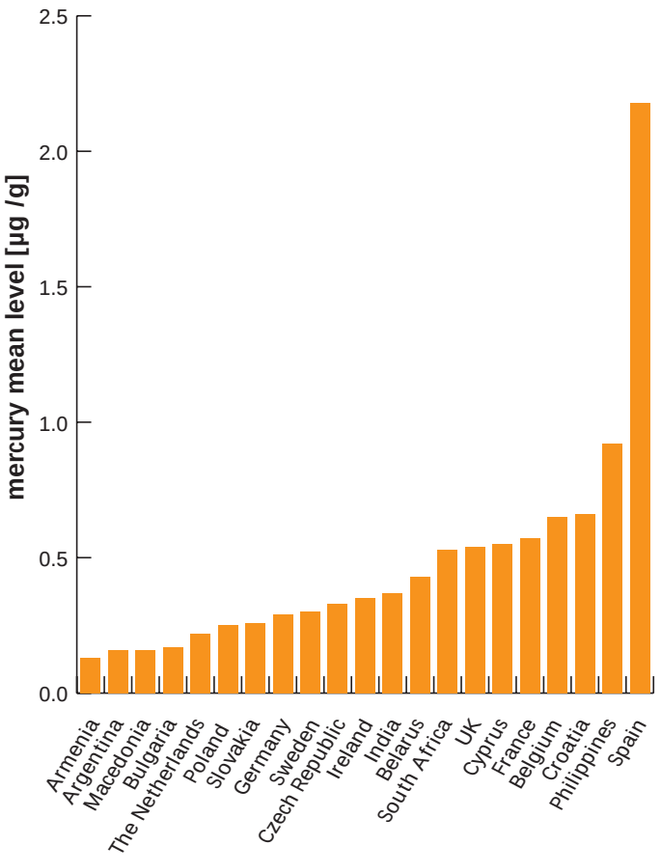



**FIGURE 3. Mean values of mercury in hair samples**




See Annex 2 for figures on mean values of Hg in hair per country.

For the interpretation of the data, 252 samples were used for a statistical analysis of the results in relation to the country of origin, including 9 samples from Spain that showed comparatively high levels of mercury exposure (mean levels were 2.18 µg/g for Spanish samples).

*"The results of the samples taken from Czech women did not show high levels of mercury. This is probably because the country is landlocked and fish consumption is low. However, this does not mean that the Czech government should not take a responsible attitude and play its part in EU efforts to stop this pollution. Mercury pollution is a global problem and we must tackle it with global instruments and policies."*

Jana Hybaskova MEP, European People's Party (EPP), Czech Republic

## Elevated levels in Spain

Increased values in Spanish volunteers are consistent with conclusions of the EU Mercury Extended Impact Assessment that states: "most people in coastal areas of Mediterranean countries… are around the Reference Dose (RfD)" which corresponds to 1 µg /g of mercury in maternal hair. This is a dose below which there is not likely to be a neurological impact on their children. The European Commission further notes that some Mediterranean and Arctic communities who frequently consume lots of fish have mercury levels in hair above the National Research Council (NRC) US "Benchmark Dose Limit" (BMDL); the equivalent figure for hair is 10 µg/g. This is the level at which there is a significant detectable impact on brain function in the developing foetus.[24]

More specifically, several studies of communities consuming large amounts of fish have found elevated levels of mercury. For example, concentrations of mercury in maternal hair in Madeira, Portugal ranged from 1.1 to 54.4 µg/g, with a median of 9.64 µg/g[25]. Median hair mercury concentrations 9.6 µg/g have also been measured among a sample of 8 regular consumers of large tuna in Sardinia[26]. The levels of mercury in the Spanish hair samples were lower than the Benchmark Dose Limit (the highest sample was 5 µg /g) but indicate elevated levels which might be due to higher fish consumption.

There could also be other sources of mercury exposure. The most recent study from Spain found that children living near a chlor-alkali plant had median mercury values in the hair nearly twice as high as children living on Menorca Island (0.631 µg/g vs. 0.370 µg/g).[27]

More research would be needed to discover the reason why the levels in the Spanish women in our survey were so much higher than those from other countries. Two possible causes are: the amount and contamination of fish in their diets and possible exposure at work, since all the women work in the same hospital where they come into contact with mercury.

In the case of occupational exposure, i.e. inhalation of mercury vapours, the hair might be externally contaminated. Our analysis did not distinguish between methyl mercury contamination and other types of mercury in hair.

## Trends in the survey

There were limitations to the study due to the size of the survey and self-identification of the volunteers. In individual countries the sample size varied and selection was not representative at all regarding region, age or other population characteristics. However, despite these limitations, the following trends were observed.

## The link with fish

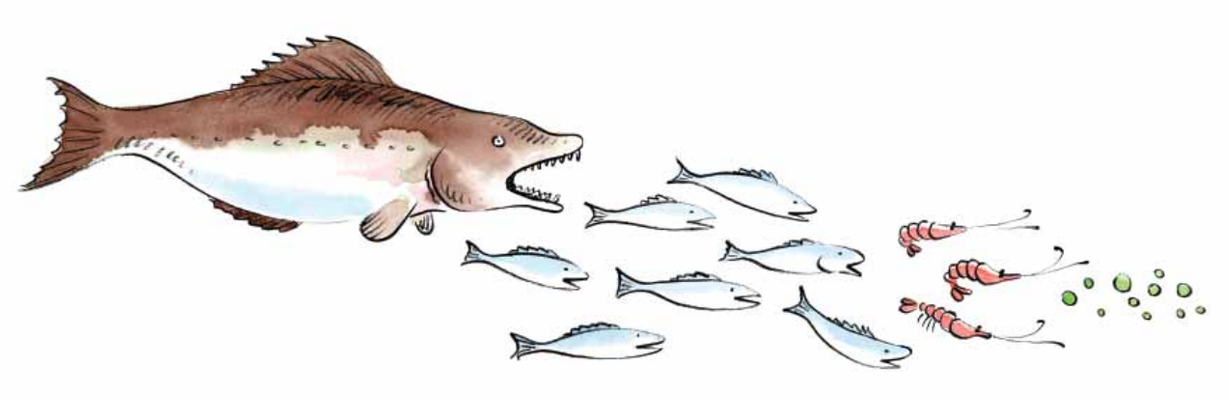
***In the more detailed examination, we found that women who regularly eat various kinds of fish tend to have higher levels of mercury levels in hair. Those women who eat various types of locally purchased and commercially traded fish more frequently showed increased mercury exposure.***

This finding is consistent with the many scientific studies in the literature. In Germany, the Robert Koch Institute measured mercury levels in adults' blood. They found significant increases in mercury levels related to more frequent fish consumption.[28]

The mean mercury hair levels in our survey for Swedish participants were 0.3 µg/g. A scientific study from 2003 found mercury levels in hair of pregnant Swedish women ranging from 0.07-1.5 µg/g with mean of 0.35 µg/g. Again, the authors reported increased mercury hair levels for women who consumed seafood and fish more frequently[29].

Similar conclusions from a recent US study are also consistent with our findings. The mean maternal hair mercury levels in a U.S. cohort were 0.55 µg/g, in the range of 0.02–2.38 µg/g[30].

Finally, in the Czech Republic, the State Health Institute biomonitors blood mercury levels in adults and reports slightly increased mercury blood levels for women in 2004 and 2005. Children's hair is also examined to monitor levels of heavy metals, and mercury levels are comparable with those we found in our survey; the highest values were reported in 2003 with a maximum of 1.98 µg/g of mercury in hair. Czech women from our survey show mean levels 0.33 µg/g, while the highest level of mercury exposure was 1.58 µg/g[31].



*Methylmercury bioaccumulates in larger predatory fish, which contain much higher levels than non-predatory fish*

## *Fish consumption*

Eating contaminated fish is the major source of human exposure to methylmercury. The populations most sensitive to the compound are foetuses, infants, and young children. Consequently, fish consumption by pregnant women, young children and women of childbearing age is a particular cause for concern because of the likelihood of mercury exposure. Methylmercury bioaccumulates in larger predatory fish, which contain much higher levels than non-predatory fish[32].

EUROPEAN RECOMMENDATIONS

The European Food Safety Authority (EFSA) recommends that "women of childbearing age (in particular, those intending to become pregnant), pregnant and breastfeeding women as well as young children select fish from a wide range of species, without giving undue preference to large predatory fish such as swordfish and tuna".[33]

Following this recommendation, the European Commission released an "Information Note" based on the need to give more specific advice to vulnerable groups and to provide them with concrete information[e]. It suggests that women who might become pregnant, women who are pregnant or are breastfeeding and young children should not eat more than one small portion (less than 100 g) per week of large predatory fish, such as swordfish, shark, marlin and pike. If they do eat a portion of this fish, they should not eat any other fish during the same week. Nor should they eat tuna more than twice per week[34].

The EU member states vary widely in their recommendations on fish consumption. Some have no recommendations for vulnerable groups whereas other countries have recommendations that are stricter than those of the European Food Safety Authority (EFSA) above, most notably Sweden.

It is important to consider that fish is an excellent source of essential nutrition. Smaller fish, which are lower in the food chain and therefore accumulate less mercury, are also excellent sources of protein and provide omega 3 fatty acids that are important to neurodevelopment, cardiac function and good health. In contrast, just one serving of fish that is high in mercury may fill an advised mercury quota for several days or even weeks.

For details of national recommendations relating to different species of fish and further advice on fish consumption, see: *HCWH/HEAL Fact sheet on Mercury and Fish Consumption.*

[e] The Commission made a rough calculation, based upon levels of methylmercury in fish compared with the "Provisional Tolerable Weekly Intake" (PTWI) established by the Joint FAO/WHO Expert Committee on Food Additives, to make recommendations more tangible to the public. The PTWI is a tolerable intake based on a weekly level, to emphasize that long-term exposure is important because contaminants accumulate in the body. Joint FAO/WHO Expert Committee on Food Additives. (2003) Summary & Conclusions. 61st Meeting, Rome, 10-19 June 2003. See: www.chem.unep.ch/mercury/Report/JECFA-PTWI.htm

## Link with occupation

***This survey was too small to detect any link between professional contact with mercury (for example via mercury containing products used by nurses or dentists) and the levels of mercury in hair. However, it remains a possibility that workers in the healthcare sector need to be aware of.***

A number of the volunteers for this survey came from the healthcare sector and reported that they are in daily contact with mercury, which can lead to increased mercury exposure. Some of the volunteers lived or worked at industrial complexes where mercury emissions are reported. Other sources of exposure are living or working close to industrial sources of mercury emissions such as coal burning power stations, chlor-alkali plants using mercury cell technology or, in countries outside of Europe, living in small-scale gold mining communities.

> *"Health professionals in some countries of Asia, including India, are phasing out mercury in hospitals. My organisation has helped encourage these initiatives and five hospitals in New Delhi have switched over to digital products. Our message to the EU is that it should stop all exports of mercury. We would like to see Europe playing a leadership role in efforts to achieve a global ban."*
>
> Ratna Singh was national coordinator to the participants in the hair sample testing and survey in India. She works with Toxics Link, which is a member of Health Care Without Harm

> *"I eat a lot of fish and was surprised and concerned to learn that this might present a risk during pregnancy. I think my government should be providing more information about mercury in fish."*
>
> Violeta Krstevska is a nurse in Macedonia

## Conclusions from the mercury sampling survey

Our small snapshot survey has shown that mercury levels are being detected in the majority of women tested and that consumption of fish is linked to the level of mercury in hair. These findings are comparable to numerous studies and other human biomonitoring projects that have been carried out in Europe and the United States. The fact that mercury was found in almost all of the samples and that low doses can matter highlights the need for an immediate action from policy makers to reduce our exposure to mercury.

The concerns raised in this survey also need further investigation through detailed biomonitoring at a wider population level with a specific focus on regions where higher exposure has been identified and sites of possible workplace exposure.

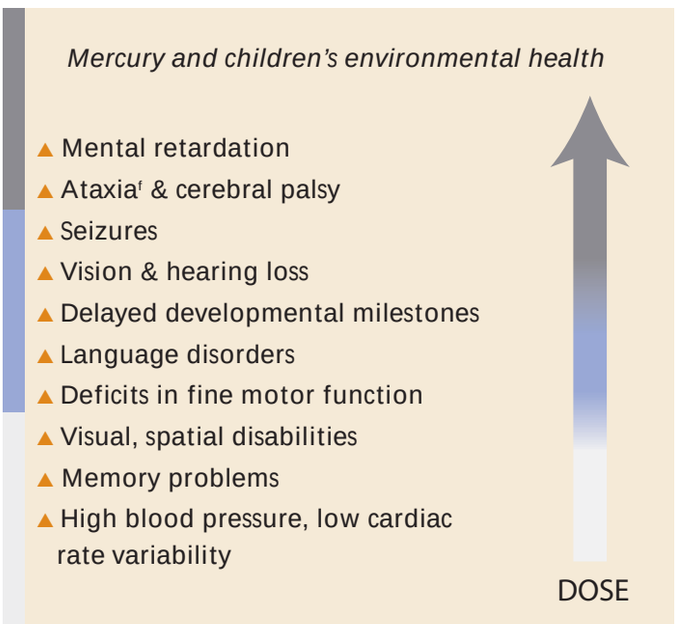
## *Why we should be concerned about low dose mercury exposure*

There is extensive evidence of effects on the development of the brain from high dose poisoning episodes such as those in Japan and Iraq. Ongoing, or chronic, exposure to low levels of mercury in the environment is less well understood than acute toxicity. It is now one of the most critical areas of mercury health research, since many people are exposed to methyl mercury levels at low levels, not high enough to cause obvious signs of poisoning[35].

## *Effects on the developing foetus*

Foetuses and young children are actively developing and therefore most at risk from health effects including neurological damage, resulting in behavioural problems and learning disabilities[36].

**FIGURE 4. Effects of prenatal exposure**[37]




**Neurological effects:** Low doses of methyl mercury in pregnant women have been shown to have impacts on the foetus[38]. In a major review of mercury health studies the US National Academy of Sciences stated:

'*Chronic, low-dose prenatal methylmercury exposure from maternal consumption of fish has been associated with …poor performance on neurobehavioural tests, particularly on tests of attention, fine-motor function, language, visual-spatial abilities (e.g. drawing) and verbal memory.*'

The review looks at three large epidemiological studies. Two of these, one in the Faroe Islands and one in New Zealand, found these associations; those effects were not seen in the other study, in the Seychelles Islands. In all the studies the methyl mercury exposure resulted from the mother's consumption of fish[39].

- In a study which assessed neurobehavioural effects in 878 children at ages 7 and 14 from the Faroe Islands, prenatal methyl mercury exposure was 'significantly associated with deficits in motor, attention and verbal tests'; post-natal exposure had no discernible effect. The study concluded that 'the effects on brain function associated with prenatal methyl mercury exposure therefore appear to be multi-focal and permanent'[40].

**Cardiovascular effects:** Two recent epidemiological studies found associations between exposure to low levels of methyl mercury and adverse cardiovascular effects[41]. The US National Academy of Sciences concludes that additional studies are needed to better characterise the effect of methyl mercury exposure on blood pressure and cardiovascular function at various stages of life. The European Commission also notes recent evidence suggesting that mercury from fish and seafood may promote or predispose the development of heart disease[42].

[f] Ataxia is unsteadiness due to the brain's failure to regulate the body

## *Effects at the wider population level*

It is important to distinguish individual risk from population risk. Subtle neurological effects from low doses of mercury that may be too small to be clinically significant for the individual child might be quite important when the population as a whole is considered[43].

- A recent analysis of three epidemiological studies found that prenatal mercury exposure sufficient to increase the concentration of mercury in maternal hair at childbirth by 1 ug/g decreases IQ by 0.7 points[44].

- In a recent US study, levels of maternal hair mercury at delivery were correlated with 6-month infant cognition. Offspring of mothers with hair mercury above 1.2 µg/g had lower scores for cognition tests than those with hair mercury below 1.2 µg/g. Higher scores for cognition abilities appeared highest among infants of mothers with high fish intake and low mercury levels, whereas scores appeared lowest in infants of mothers with low fish intake and high mercury[45]. The authors recommend that 'women should continue to eat fish during pregnancy but choose varieties with lower mercury contamination'.

- Exposure to neurotoxic chemicals such as lead and methyl mercury could reduce the number of children with far above average intelligence (IQ scores above 130 points), and might likewise have increased the number with IQ scores below 70[46].

- For example, a study from 2005[47] states that between 316,588 and 637,233 children in the US have cord blood mercury levels greater than 5.8ug/l (although subsequent levels were not as high), a level reported to be associated with loss of IQ[48]; other neurodevelopmental effects may also occur at that level with similar implications. One way to measure the cost of methyl mercury toxicity is by lost productivity, which the study estimates at $8.7 billion annually (range $2.2 – 43.8 billion).

These seemingly small impacts on brain development can therefore have a profound effect at the level of the wider population.

The results of our survey on exposure of women of childbearing age show that women are carrying too much mercury. Other studies show that the population as a whole is exposed to mercury. Therefore the population at risk from sub-clinicial neurotoxicity from mercury could be very large.

The most recent data[49] suggest that the neurotoxic effects of methylmercury exposure may yet extend significantly below even the US 'safe' dose (RfD). In its Impact Assessment, the European Commission supports the possible benefits of decreasing exposures further, even for those who are below the present 'safe' levels;

- *'although effects at such levels would be likely to be less important than those occurring at higher exposures, this nevertheless suggests there may be benefits of decreasing exposures even for populations who are below the present RfD/PTWI levels[50].'*

The trend for health effects to become apparent at ever decreasing doses indicates that we need to anticipate potential problems, rather than react in retrospect; there is an urgent need for action, based on **'new, precautionary approaches that recognise the unique vulnerability of the developing brain'[51].**

# 2. Mercury pollution – where does it come from?

The largest source of emissions to the atmosphere is currently coal fired power stations, however, the widespread use of mercury in dental amalgam means that in the future, crematoria could become the most significant source. Hospitals with medical waste incinerators are also a major contributor to the mercury problem, and although emissions are decreasing as the number of medical waste incinerators is reduced, there is concern within the health community that the use of mercury in healthcare products is exposing patients and other vulnerable groups. The chlor-alkali industry, the biggest single user of mercury in Europe, has released many tonnes of mercury to the aquatic environment over the years, and contributed to fish contamination[52].

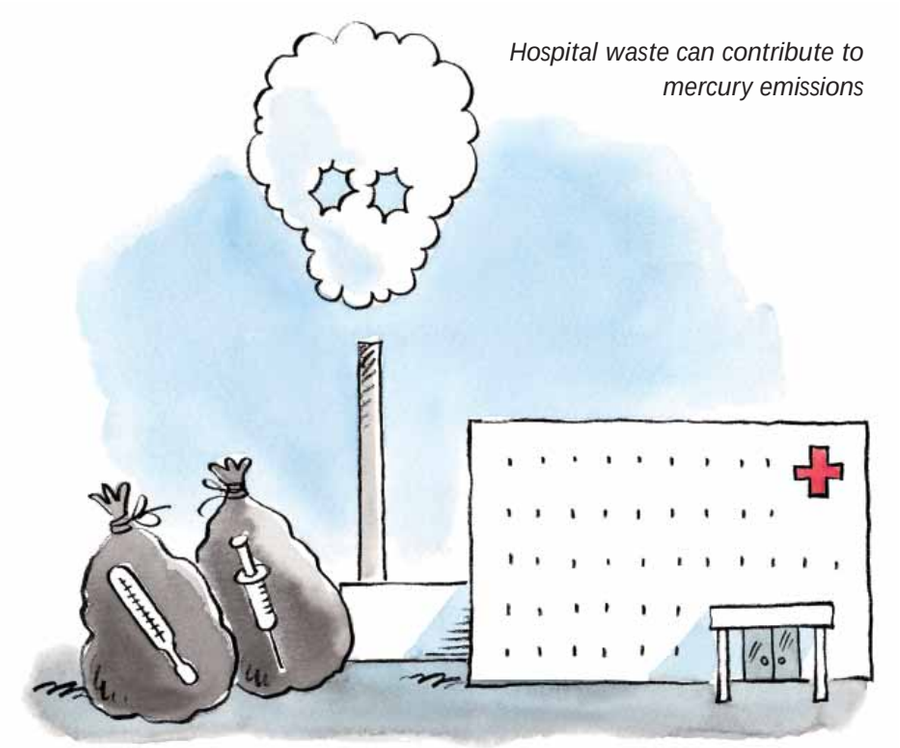
Approximately 70% of environmental mercury now comes from human activities including a variety of industrial processes; coal burning, incineration or disposal of mercury-containing products, the use of mercury for chlorine production in the chlor-alkali industry, production of zinc, steel and other metals; cement production, mining and product recycling.

Mercury is used in a variety of industrial, consumer and medical products.

It is also released into the environment through natural phenomena (volcanoes, degradation of minerals or evaporation from soils) and manmade processes.

PRODUCT EXAMPLES AT A GLANCE[g]:

- fluorescent light bulbs and batteries,
- medical devices: thermometers, blood pressure instruments (sphygmomanometers),
- laboratory chemicals, preservatives in some vaccines and pharmaceuticals, and in dental amalgams[53].
- various temperature and moisture measurement and sensing devices (barometers, hydrometers, flame sensors).



*Hospital waste can contribute to mercury emissions*

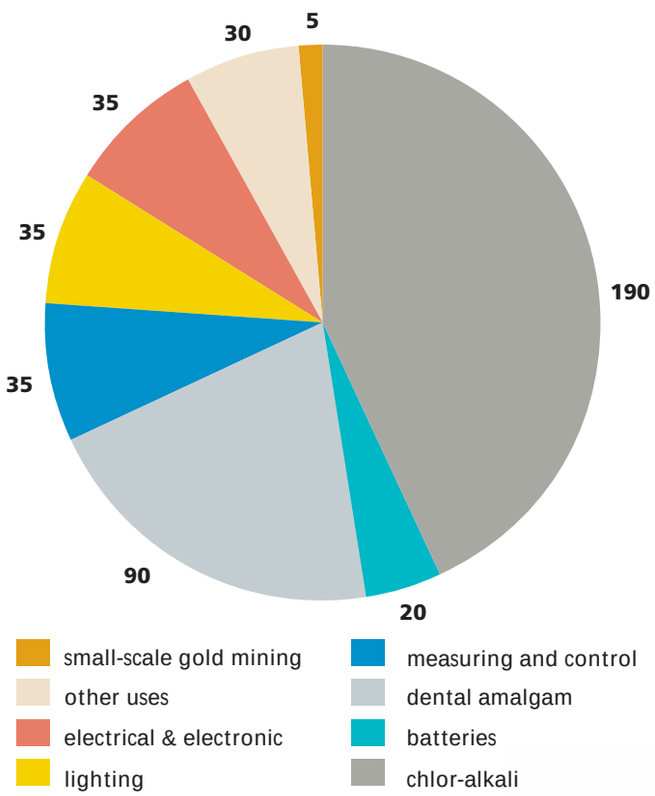
[g] A very detailed list of mercury use in products is available, see: The European Commission, DG Enterprise. **Risks to Health and the Environment Related to the Use of Mercury Products**. Prepared by Risk & Policy Analysts Limited, Norfolk. J372/Merkury. August 2002. Annex 3.

**Table 2. USE, EXPOSURE ROUTES AND TOXICITY OF MERCURY AND ITS COMPOUNDS**[54] [55]

| Mercury Form | Elemental ($Hg^o$) | Inorganic (mercury salts) ($Hg^{1+}$) | Organic- methyl mercury ($CH_3Hg$-) | Organic – ethyl mercury ($C_2H_5Hg$-) | Organic – phenyl mercury ($C_6H_5Hg$-) |
|---|---|---|---|---|---|
| **Main Use** | Dental fillings (amalgam is a mix of mercury and other metals like Ag, Sn, Cu, In, Zn) | Medicines, Cosmetics (used as a preservative) | No intentional uses, when deposited into water, mercury is transformed into methylmercury by micro organisms and bacteria. | Vaccines (the preservative thimerosal is 49% ethyl mercury | Fungicide, bactericide |
| **Other uses** | Goldmining<br>Chloralkali plants<br>Products (batteries, switches, fluorescent bulbs, measuring and control devices eg. thermostats)<br>Medical devices (thermometers, gastrointestinal tubes, sphygmomanometers)<br>Santoria and other ethnic and religious rituals | Disinfectants and anti-microbials<br>Electrical equipment<br>Photography | | | |
| **Source of exposure** | Hospital spills – eg. broken thermometers<br>Dental amalgam<br>Home spills<br>Children playing with quicksilver used in ethnic/ religious rituals | | Fish consumption (the fish have ingested methyl mercury and it is in their muscle tissue) | | |
| **Route of exposure and absorption rate** | Inhalation: 80% absorbed<br>Ingestion: 0.01% absorption<br>Dermal: minimal absorption | Ingestion: ~10% absorbed<br>Dermal: lethal doses can be absorbed | Inhalational: well absorbed<br>Ingestion: 90-100% absorbed | Injection: 100% absorbed | Ingestion: 80-100% absorbed<br>Dermal: see salts |
| **Toxicity - primary** | Lungs, Skin, Eyes, Gingiva | Kidneys, Gastro-intestinal tract | Central nervous system | under study | Kidneys |
| **Toxicity - secondary** | Central nervous system, Kidneys | Central Nervous system | Cardio-vascular under study | | Central nervous system |
| **Transport in body** | Crosses blood- brain barrier<br>Crosses the placenta<br>Found in breastmilk | Does not easily enter the brain or cross the placenta | Crosses blood-brain barrier<br>Crosses the placenta<br>Found in breastmilk | Crosses blood-brain barrier<br>Crosses the placenta<br>Found in breastmilk | |

NOTE: Dose and Timing of Exposure are not reflected in this table

**FIGURE 5.[56] Mercury consumption (tonnes per year) 2005 EU-25**




Note: Small-scale gold mining occurs in French Guiana, which is formally part of the EU[57].

## *How do we use mercury?*

In Europe, the largest portion of mercury use is in chlor-alkali plants, with the second largest use being dental amalgam, which uses 90 tonnes annually[58] (see Figure 5). Other important uses of mercury include medical measuring and control equipment such as thermometers, sphygmomanometers[59].

The only remaining mercury mine in Europe – MAYASA in Almaden, Spain – stopped mining in 2003 and is not expected to restart[60] but continues to trade mercury on the open market. Mayasa has an agreement with the EU chlor-alkali industry to buy the surpluses of decommissioned mercury from their plants[61] and resell them. Europe is the dominant exporter of mercury worldwide to the developing world and the net annual export in recent years has been 1000 tonnes[62]. Large amounts of mercury currently circulating on the European market come from decommissioned chlor-alkali plants and from recovered mercury from waste and other sources.

*Use of mercury has tripled over last 50 years*

### *CASE STUDY – MERCURY-FREE HOSPITALS*

Several EU countries including France (1999), Sweden (1992), Denmark (1994) and the Netherlands (2000) have banned the use of mercury thermometers for consumer as well as healthcare use. Hospitals in Austria, such as the Vienna Hospital Association and Styrian Hospital Association, have voluntarily eliminated mercury thermometers and blood pressure devices from their wards and their purchasing policy prohibits them to procure any products containing mercury.

Mercury elimination efforts are also evolving outside of Europe and other industrialised countries.

In the Philippines, a number of private and public hospitals are moving to eliminate mercury from hospitals and the Philippine Department of Health initiated a nationwide inventory of supplies and costs of existing mercury thermometers and sphygmomanometers in hospitals. The country is moving toward a policy on regulating mercury use and recommending solutions to minimise mercury pollution from healthcare facilities with specific focus on costs and availability of alternatives.


In Latin America, the Buenos Aires City Government in Argentina has committed to transform 33 hospitals into mercury-free facilities. Several other hospitals in the country are moving toward mercury-free health care. Similarly, in Sao Paulo, Brazil, fourteen hospitals have committed to become mercury-free. In Cuba, the government has replaced mercury sphygmomanometers with aneroid devices**.** Four hospitals with 180 to over 600 beds in Delhi, India have switched from mercury containing devices to safer alternatives.

As mercury-based devices are phased out in developed countries, the possible export of medical equipment containing mercury, either for profit or as "charitable" donations, threatens to undermine efforts to make the switch.

*"Mercury is in widespread use in health care facilities. Thermometers and sphygmomanometers contain mercury and so do many medical batteries, fluorescent lamps and electrical switches. Mercury compounds are also in preservatives, fixatives and reagents used extensively in hospital laboratories. In soviet time there were regulations on all discharged mercury-containing products, which had to be recycled in an appropriate plant. Currently, no such regulations exist in Armenia."*

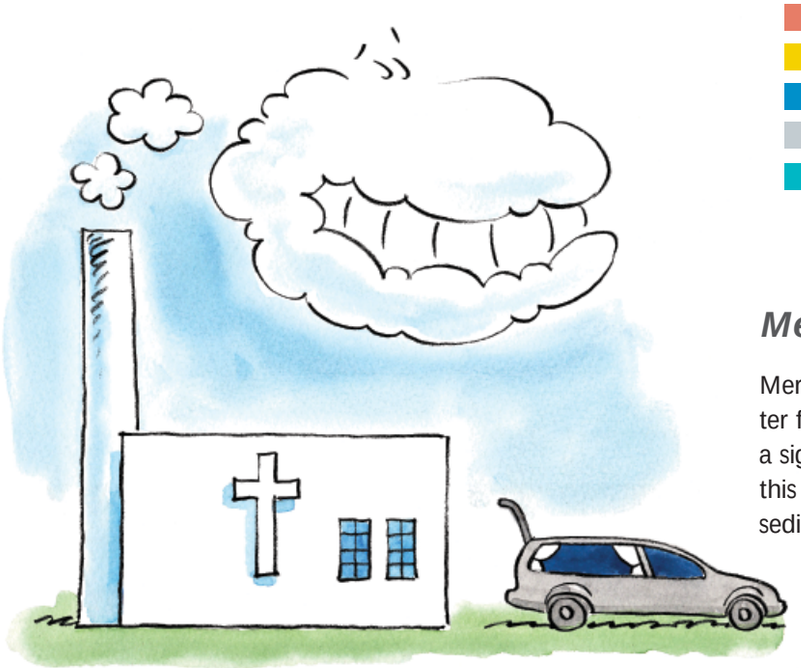
Emma Anakhasyan, The Armenian Women for Health and Healthy Environment, Armenia

## *Mercury emissions – to air*

In the EU, coal combustion is the single largest source of mercury emissions to the air[63], due to the fact that mercury is contained as a trace element in coal. Cement production and waste disposal such as medical and municipal waste incineration are the next most significant sources (see Figure 6). Incinerator ashes and discarded products dumped at landfill sites create another source of potential exposure to soil and water.

***"Health-care facilities are one of the main sources of mercury release into the atmosphere because of emissions from the incineration of medical waste." WHO*** [64]

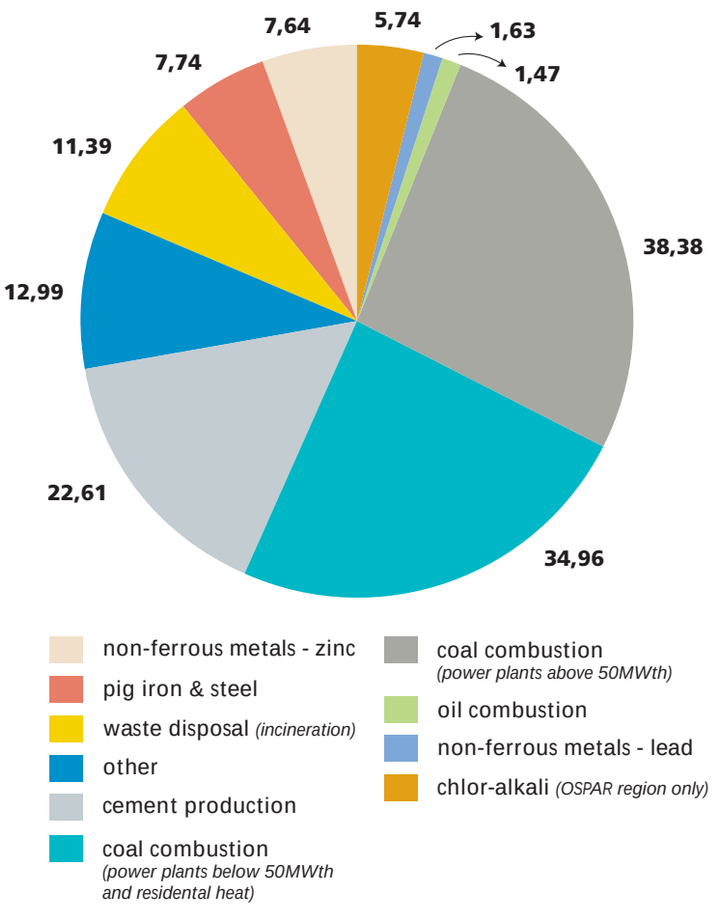
In Europe, emissions from the incineration of hospital waste have declined over the past 5 years due to stricter legislation on pollution prevention (IPPC Directive) and more significantly due to the substitution of mercury measuring devices with safer alternatives in a number of progressive EU countries (Denmark, Austria, Sweden, the Netherlands, France, Germany).



*After coal combustion, crematoria are among the most significant contributors of mercury air emissions in Europe*

**FIGURE 6. Mercury emissions to air in Europe[h] (tonnes per year, 2000 [65]).**

Chlor-Alkali (OSPAR region only, as reported by industry)[66].




## *Mercury emissions – to water*

Mercury also enters the environment through discharges to water from various industries. The chlor-alkali industry represents a significant contributor and there is an extensive literature on this subject which shows severe contamination, for example of sediments, fish and marine mammals. Another major source is discharge of dental amalgam waste from dental clinics. Mercury is classified as a priority hazardous substance under the Water Framework Directive[67]. Mercury from various waste streams (used products, landfills, emissions from industrial sources) ends up in the sewage sludge that is used as agricultural fertiliser. If contaminated with mercury, it causes contamination of soil.

[h] Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Monaco, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, The Netherlands, U.K.

## *Emissions from health care, including dental amalgam*

Dental amalgam represents the second largest use of mercury within the EU after the industrial use of mercury for chlorine production, with 90 tonnes consumed in 2005[68]. It is also a large source of emissions from dental clinics and crematoria; next to coal combustion, crematoria are among the most significant contributors of mercury air emissions in Europe. Furthermore, there is currently no Community legislation to regulate crematoria emissions EU-wide[i].

"According to a report submitted to the OSPAR Commission, in the United Kingdom, annually 7.41 tonnes of mercury from dental amalgam is discharged to sewer, atmosphere or land, with another 11.5 tonnes sent for recycling or disposed with the clinical waste stream. Together, mercury contained in dental amalgam and in laboratory and medical devices, accounts for about 53% of the total mercury emissions[69]." Dental amalgam in crematoria is currently responsible for up to 16% of the UK's air emissions[70] and by 2020 cremation is expected to be the single most significant source of UK mercury emissions[71].

The health effects of mercury used in fillings is still being debated. However, the mercury used in fillings eventually ends up in the environment, either through the sewage system or through incineration (crematoria), and inevitably ends up in the food chain. Many safer alternatives are commercially available and even promoted in some countries like Sweden.

Thermometers are also considered a major source of mercury pollution in waste in Europe, accounting for 80% to 90% of the mercury used in measuring devices (out of 33 tonnes of mercury used in measuring devices)[72].

## *Mercury in the environment*

Mercury enters into the environment in variety of forms. The majority of emissions to air are in the form of gaseous elemental mercury, which can be transported globally to regions far from the emissions source. The remaining emissions are in the form of gaseous inorganic ionic mercury forms (such as mercuric chloride) or bound to emitted particles. These forms have a shorter atmospheric lifetime and will deposit to land or water bodies within roughly 100 to 1,000 kilometres of their source. The ocean currents are also media for long range mercury transport[73].

When mercury is released into the environment from whatever source, it is highly mobile, cycling between the atmosphere and the earth's surface, where it is deposited in soils, water bodies and bottom sediments. In soil and water, microorganisms convert elemental mercury into the more toxic methyl mercury which aquatic plants and animals ingest or absorb. Methyl mercury has the capacity to collect in organisms (bioaccumulate) and to 'biomagnify' as the concentrations increase up each level of the food chain, especially in the aquatic food chain[74].

*How does mercury get into fish?*

As a transboundary pollutant, mercury can be transported globally to regions far from its source. It has led to contamination of regions with few or no mercury sources, like the Arctic[75]. Sweden for example has been very successful in eliminating most uses of mercury and still the mercury deposition over Sweden is large. The Swedish EPA has estimated deposition at about 4.2 tonnes per annum, most of which comes via long-distance atmospheric transfer, principally from Europe but also from other parts of the world[76].

A further source of mercury (and other persistent organic pollutants) in the future is likely to be the remobilisation of methyl-mercury frozen in ice, due to the melting of the polar and glacial ice resulting from climate change.

[i] Countries that are subject to the OSPAR Convention are recommended to reduce the emissions and a few other EU member states have already implemented similar regulation nationally.

## *Alternatives to mercury are available*

There are various strategies for reducing mercury emissions, the most effective of these involve phasing out the use of mercury in products and industrial processes.

### Mercury in health care products

***Thermometers*** Electronic thermometers may be more expensive; however, as glass thermometers often break, they may ultimately be comparable in cost.

***Sphygmomanometers*** Sphygmomanometers are an area of concern because they contain a large amount of mercury per device (80 – 100 g/unit compared to 1 g/unit for thermometers), and therefore pose a greater hazard in the event of a breakage. Both mercury and aneroid sphygmomanometers have been in use for about 100 years. All types of sphygmomanometers require maintenance and calibration to give accurate results. In Sweden, Denmark, Austria and the Netherlands, only positive experiences have been reported from the use of the mercury-free devices[77]. And finally, mercury-free sphygmomanometers can greatly reduce the risk of mercury exposure to patients, staff, and leakage into the environment[j].

***Dental amalgam*** Alternatives to the use of mercury dental amalgams already exist and are being used in some Nordic Member States. It is estimated that less than 6% of all new fillings in Sweden now contain mercury[78]. Replacing mercury as a dental filling material would be far easier and less costly than applying technologies to reduce crematoria emissions from dental amalgams.

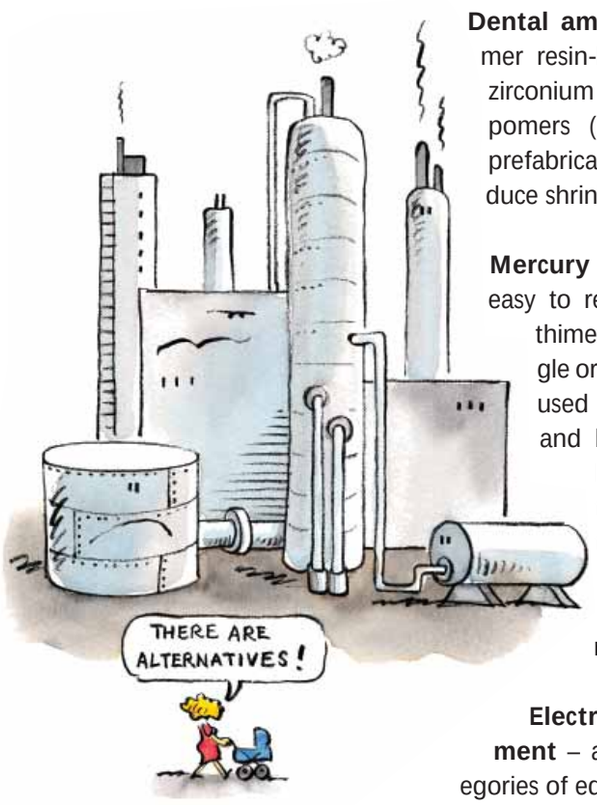
ALTERNATIVES AT A GLANCE

**Coal-fired power stations -** alternative, renewable means of energy generation; mercury emission control; the use of low mercury coal, coal cleaning or switching to a cleaner fuel[79].

**Chlor-alkali plants -** diaphragm and membrane technologies.

**Thermometers –** electronic, glass containing gallium/indium/tin alloy or other liquids such as alcohol.

**Sphygmomanometers –** aneroid, automated, semi-automated




**Dental amalgam -** composites (polymer resin-based materials), ceramics, zirconium oxide, glassionomers, compomers (modified composites, and prefabricated ceramic cones, to reduce shrinkage of composite fillings.

**Mercury in vaccines -** it is relatively easy to replace, reduce or eliminate thimerosal as a preservative in single or multi-dose vaccines that are used in industrialised countries, and both the USA and Europe have begun to take action to phase it out. However, this is harder to do in the Global South because of extra costs and the need for refrigeration.

**Electrical and electronic equipment** – alternatives exist for all categories of equipment, apart from lamps, where viable substitutes for mercury are currently available for only limited applications[80]

[j] For more information, consult the HCWH fact-sheets on Mercury in Health Care and Substituting Mercury Sphygmomanometers.

*"All hospitals and other health care units in Sweden have switched to mercury-free devices. There is a ban in Sweden on purchasing, sale and production of mercury containing thermometers and other measuring devices, including sphygmomanometers (blood pressure meters with inflatable cuff), since 1992. The mercury containing devices were collected and replaced by mercury free devices, as part of every health care organisation's environmental policy. Doctors and nurses find the mercury-free alternatives very acceptable. Nowadays, the young doctors and nurses do not know about anything else."*

Ingrid Eckerman, Swedish Doctors for the Environment, Sweden

*"I work as a dental assistant eight hours per day. I decided to be tested because I prepare the amalgam fillings. I wear gloves and tell the patients about the risks and their options. Will they have the amalgam or a mercury-free filling that is a bit more expensive?"*

Natasa Trajkovska is a 26 year-old dental assistant in Macedonia.

# 3. Mercury control – how far have we come?

Decades have passed since the tragic pollution episodes in Japan and Iraq first demonstrated that the foetal brain is particularly susceptible to methyl-mercury toxicity. It is more than seven years since research findings from a long-term study in the Faroe Islands, co-sponsored by the European Commission, showed conclusively that low-level exposure to mercury in the womb could cause brain damage in children.

Too little has happened since. Government authorities have continued to argue about the correct 'intake dose' for mercury and while mercury emissions in some countries have reduced, globally emissions may be rising[k].

However, the challenge of reducing mercury pollution is now climbing up the political agenda. Many authorities worldwide have recognised the toxicity of mercury and undertaken specific measures to reduce mercury pollution, our exposure to it and to phase out its use. More significantly, progressive countries are concerned with the global nature of mercury pollution. The issue has been taken in its entire complexity. It has been recognised that it is not sufficient to just decrease mercury exposure to tolerable levels in their own countries, but that a long-term, global solution is needed.

The biggest concern is the shift of mercury pollution to Global South countries. Scientific studies prove that persistent chemicals contaminate even remote areas far from pollution sources and that global pollution has serious effects especially on populations dependent on – or accustomed to – marine diets, for instance the Inuit of the Arctic. International action is therefore needed to address mercury pollution and exposures. The European Union is taking a leading role with its Mercury Strategy, which attempts to address this problem as does the UNEP Mercury Programme.

## *Global action*

The United Nations Environmental Programme (UNEP) has taken a lead in bringing together countries to discuss policy solutions for reducing mercury. Internationally, UNEP initiated a Global Mercury Assessment[81], which resulted in the establishment of a mercury programme within its chemicals unit in 2003. This programme was further strengthened by the Governing Council in February 2005 (see box), who will consider the need for further action at its next session, including the possible adoption of a legally binding instrument[82].

OUTCOME OF UNEP GOVERNING COUNCIL, FEBRUARY 2005[83]

- To report on supply, trade and demand for mercury on the global market
- To facilitate partnerships to reduce risks to human health & environment from mercury
- To encourage Governments, intergovernmental agencies, non-governmental agencies and the private sector to take immediate actions to reduce the risks to human health and environment posed on a global scale by mercury in products and production processes.

The Global Mercury Assessment states that local, regional or national measures are often insufficient to tackle mercury contamination. Despite a number of measures taken by some countries, these were not sufficient and mercury pollution still remains an issue, due to long-range transport of pollution. Even nations with minimal mercury releases, and other areas remote from industrial activity, are adversely affected.

The Global Mercury Assessment also notes that although industrialised countries have successfully reduced mercury emissions and alternatives to mercury containing products are readily used and available, less developed countries do not have such strict mercury regulations or it is difficult to enforce them sufficiently.

Because mercury exposure comes primarily from fish consumption, the mercury contamination of lakes, rivers and especially oceans requires global action. The Assessment therefore calls on governments to consider developing a legally binding agreement that would reduce risks to human health and the environment from the release of mercury and its compounds.

The World Health Organization has also issued a policy paper calling for the gradual global phase-out of mercury-based medical devices. Several countries are beginning to implement this policy (see Case Study, Mercury Free Hospitals, Page 23).

[k] Global emissions grew about 20% between 1990 – 2000. European emissions fell by 60% during the same period, although Europe remains a net 'exporter' of transboundary mercury pollution (i.e. there is more deposition outside Europe from European emissions than deposition within Europe as a result of emissions in other regions) (European Commission SEC(2005)101).

## *EU mercury strategy*

The European Union adopted its Mercury Strategy in January 2005. It is a positive initiative comprised of a wide range of legislative, policy and market measures to reduce mercury's impact. The Strategy also prioritises better education and measures to protect those groups most vulnerable to health damage from mercury[84].


EU MERCURY STRATEGY PRIORITIES:

1. **Reduce mercury emissions,** i.e. implement and review measures that require polluters to adequately control emissions (such as adequate control of emissions from chlor-alkali plants or emission to water from dental amalgam clinics) and subsequently move to best available technologies that do not require mercury.

2. **Reduce** the entry of **mercury** into the environment **by cutting the demand and supply**, i.e. ban the use of mercury in remaining products and practices such as measuring devices – thermometers, blood pressure devices, dental amalgam and chlorine production. Subsequently, the EU will ensure that the surplus mercury from the phased out products and services will not be exported to other parts of the world. Apart from cutting the primary mining of mercury, EU will adopt a mercury export ban.

3. Resolve the long-term fate of **mercury surpluses and reservoirs**, i.e. looking for the best solution for **long-term storage** of mercury surpluses from phased out products and services.

4. **Protect against mercury exposure**, i.e. providing information on dietary recommendation for fish consumption which is the primary source of mercury exposure. The EU will biomonitor the levels of mercury in EU population, see that the mercury content in drinking water is under the limits etc.

5. **Support and promote international action on mercury**, i.e. supporting technology transfer of mercury-free practices, establishing a funding scheme for countries dependent on mercury technologies and advocating for global phase-out of mercury production and use by introducing an international legally binding agreement on mercury.

## *Getting rid of mercury in products: highlights from EU action so far*

The European Union has already implemented a number of measures restricting the use of mercury in certain everyday products. Such restrictions are very effective as they prevent additional mercury entering the market and consequently the environment. Other measures address mercury in the waste stream and mercury in our diet.

- ***Waste*** Mercury is classified as hazardous waste and therefore strict regulations apply to the disposal of waste containing mercury; the incineration of waste containing mercury is forbidden, and where possible it is recovered. Mercury-containing dental amalgam waste is considered to be hazardous waste within the European Union, and must be disposed of in accordance with applicable laws[85]. There are other measures regulating mercury waste from cars and other vehicles.

- ***Batteries*** The first product to be regulated was batteries, which used to be amongst the largest users of mercury. In 1991, the EU enacted a Directive which successfully eliminated the use of mercury in batteries[86]. A new Directive 2006/66, repealing the first one, now also requires the collection of used batteries, especially batteries containing lead or cadmium.[87]

- ***Water*** In 2000, the EU also implemented a wide number of measures regulating the disposal of mercury into water, sludge and soils through the Water Framework Directive[88].

- ***Electric and electronic equipment*** The use of mercury in electric and electronic equipment was restricted under the ROHS Directive, agreed in 2002[89]. From 1 July 2006, new electrical and electronic equipment put on the market shall not contain a number of specified hazardous substances, including mercury[I]. Unfortunately, electric and electronic **medical** devices are exempted from this directive.

- ***Electronic waste*** A Directive was agreed at the same time, on waste electric and electronic equipment[90] that requires manufacturers to take back and recycle their own products at the end of their lives, free of charge. This introduces the concept of 'producer responsibility' and discourages the use of hazardous substances in products as this adds to the difficulty and cost of recycling.

- ***Dental amalgam in EU member states*** Several EU Member States including Denmark and Sweden have already initiated the continuous phase out of mercury in dental amalgam with a combination of voluntary and legislative measures. Sweden has made dental amalgam more cost-neutral against other filling materials by denying it insurance coverage. Alternatives were made preferable and more affordable by changing the insurance policy that often disqualified them against the fully covered dental amalgam[91]. Vulnerable populations including pregnant women, children and youth were identified to be the first to be protected against dental amalgam use.


[I] The other substances were lead, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE).

▲ ***Fish consumption recommendations*** The European Food Safety Authority (EFSA) has also made a recommendation on consumption of fish by women of childbearing age, followed by an 'Information Note' released by the European Commission (see Chapter 1, box on fish consumption). However, it is unclear how widely EU and national guidelines are disseminated and promoted. Returned questionnaires from the women taking part in our hair sample testing survey revealed that many women are unaware or confused about what fish to be wary of and during which periods of their life.

Currently, there is no EU regulation regarding the proper collection and disposal of mercury thermometers and other measuring equipment. The use of mercury cells in the chlor-alkali industry will also continue until 2020, despite a 1990 Paris Commission (PARCOM/OSPAR)[92] recommendation to phase them out by 2010[93m].

## *EU level action in the pipeline*

The European Mercury Strategy has foreseen a number of additional measures that should address the continuous use of mercury in certain products and the export of mercury.

▲ ***Non-electric and non-electronic measuring equipment*** One most relevant to the health community is what is known as the Limitations Directive[94] which bans or restricts certain chemicals from the EU market, and in this case would ban the use of mercury in certain measuring and control devices. In 2006, the Commission proposed a directive that would ban mercury for some public and some healthcare measuring devices such as thermometers. In September, the EU Parliament introduced an amendment to the Commission's proposed Directive to widen its scope. The amendment included blood pressure devices for use in hospitals that were exempt in the Commission's original proposal[n]. The reason for including blood pressure devices is that of all mercury instrumentation used in health care, sphygmomanometers contain a significant mass of mercury per device (approximately 80 to 100 g/unit). At a plenary vote in November 2006, the European Parliament rejected a compromise deal with EU Member states where the European Commission would report within two years on the feasibility of phasing out mercury in devices such as blood-pressure measuring devices used and industrial applications, with a view to banning these "whenever technically and economically feasible" The amendment will therefore be considered at a second reading in the European Parliament in early 2007.

▲ **EU export ban and safe storage of metallic mercury** The other very significant step forward is the EU plan to reduce the movement of mercury globally, by banning the export of mercury. Europe represents one of the largest exporters of raw mercury accounting for about 1000 tonnes per year (out of global export of 3600 tonnes per year)[95]. The European Union has already committed to passing a law which would ban the export of mercury by 2011 at the latest. An effective export ban should cover not only metallic mercury, but also mercury compounds and mercury containing products already restricted on the EU market.

▲ ***Dental amalgam*** The European Parliament also recommended urgent consideration of restricting mercury use in dental amalgams, particularly with regard to high-risk sections of the population[96]. It encouraged the Commission to review the use of alternative dental fillings.

*"The EU is the world's largest mercury exporter, and most of its mercury goes to developing countries. This dangerous neurotoxin is often haphazardly used and released, contaminating workers, their families, local communities and global food supplies. By proposing an EU mercury export ban and safe storage of metallic mercury, the European Commission has taken a leadership role in the world through its hands-on approach to reducing mercury in the environment."*

Elena Lymberidi, Zero Mercury Campaign Project Coordinator, European Environmental Bureau, Belgium

[m] Environment and health groups are also urging the EU to make this phase out by 2010 one of its highest priorities. However, the European chlorine industry has resisted this recommendation and says that it intends to close or convert mercury cell facilities only when economically favourable. Euro Chlor member companies' current commitment is to convert to membrane technology or closure of mercury cells by 2020 (see www.eurochlor.org).

[n] The European Commission originally wanted to ban sphygmomanometers for domestic use only, exempting their use in hospitals and laboratories.

## *Biomonitoring in Europe*

While people across Europe are exposed to methyl mercury through consumption of fish at a level that could be having detrimental impacts on health and development, there is little awareness of this problem or of what steps can be taken to reduce exposure. There may be specific groups that are particularly exposed, such as dentists that use amalgam, health workers using equipment containing mercury, and patients of both of the above.

At present, the EU does not have a coordinated approach to biomonitoring, and thus is not able to provide comparable European data on how exposed people are to various pollutants, such as mercury. However, in its recent Action Plan on Environment and Health, the EU prioritises setting up such a system and commits to launching a human biomonitoring pilot-project in 2007 which will initially focus only on a few pollutants. Methyl mercury will be one of these pollutants and biomonitoring activities will target women of child bearing age and children.

The ultimate aim of human biomonitoring is to support environmental policy as well as public health policy by better data comparability and accessibility within and between countries and more effective use of resources through shared development of scientific tools and appropriate strategies.

### *How will the EU use biomonitoring?*

The European Commission is preparing the ground for its pilot project through an EU funded project called ESBIO (Expert team to Support BIOmonitoring) and a technical working group comprised of government representatives and human biomonitoring experts.

The European Community foresees the use of human biomonitoring to develop political strategies in various ways:

- To serve as an early warning function and highlight the need to develop new political strategies on a European scale
- To provide an indication of the different importance of sources, exposure, regional and geographic aspects etc. Considering this information might lead to adaptations of existing political policies
- To evaluate and assess existing policies[97].

A five year EU research project called PHIME (Public health impact of long-term, low-level mixed element exposure in susceptible population strata) will focus on understanding better the links between heavy metals and health, particularly in relation to children and pregnant women and low level exposure. Several of the work packages will focus on obtaining comparable biomonitoring data across the 22 countries, and on studying further the effects of methyl mercury exposure in the womb and early life on child development in a number of fish eating communities[98].

# 4. Conclusion and recommendations

Health effects from low doses of mercury, especially on the developing nervous system of the foetus and in young children, are causing concern among scientists and authorities. Mercury should not be in our bodies, nor our children's, even at low levels.

The existing research on levels of exposure in some European populations, while still insufficient, nevertheless gives us reason to be concerned about our vulnerable groups. The research also shows that consumption of fish is the most important source of exposure. Although the risk from low doses of mercury may be low at an individual level, this does not mean we should be reluctant to take appropriate action. Developmental effects on children today will impact on the whole population in the future.

All sources of mercury emissions need to be addressed systematically. In healthcare products, the use of mercury inevitably leads to its release into the environment and contamination of the food chain. The relative importance of the healthcare sector's contribution will only increase as other sources of mercury are addressed and phased out, unless concerted action is taken to substitute mercury with safer alternatives. The historic and continuing use of mercury in dental amalgam will be a growing source of mercury emissions through crematoria.

Regulatory measures adopted so far have begun to make a difference to the amount of mercury emitted to the environment in Europe; however, globally emissions may be rising. There is considerable scope for the reduction of the use and emission of mercury globally, as well as further scope within Europe to address remaining sources of mercury.

The proposals by the EU and the possibility of a global legal instrument on mercury are both positive steps towards reducing man-made sources of mercury into the environment. However, the action taken must be swift and ultimately phase out the use of mercury. If we keep using mercury in products and processes, it will continue to be emitted and added to the 'global pool'[99] where it can re-circulate again and again in the global environment. Even if all uses and emissions of mercury were stopped immediately it is not known how long the contamination of the food chain would continue[100].

It is therefore essential to take action on two levels; *first,* to phase out the use of mercury globally by substituting it with safer alternatives, and *second*, to ensure that people are better informed about how to prevent the build up of mercury in their bodies, in order to protect the health of future generations.

## *Specific recommendations for future EU and global action to reduce mercury use and pollution*

### Global and regional

Ultimately, the solution is to globally eliminate all uses of mercury, collect and safely store the remaining mercury in a permanent fashion and clean up mercury pollution.

*The global community should:*

- Commit to a legally binding instrument that includes a global ban on the use of mercury as soon as possible, via UNEP as a mechanism.

*"As a politician, a consumer and a mother I have long been very concerned about the dangerous effects of hazardous chemicals on our children. Recent studies have once again confirmed the detrimental and irreversible effects toxic substances like mercury have during phases of a child's brain development. A brain is unique and cannot be replaced. It is highly regrettable that the new EU-chemicals legislation REACH does not adequately protect humans and the environment from dangerous chemicals.*

*I hope that the EU will take the lead for a global ban on mercury, not only at the UNEP conference in February 2007. This ban is long overdue. This report from the "Stay Healthy, Stop Mercury" campaign underlines these arguments."*

Hiltrud Breyer, Member of the European Parliament, Greens/EFA, Germany

- Establish a global mercury use reduction goal of 70% by 2017, and achieve the goal by ending the use of mercury in electronics, button cell batteries, thermometers, and other non-electronic measuring equipment; phasing out the mercury-cell chlor-alkali process; and decreasing the use of mercury in artisanal and small-scale gold mining.
- At the same time, reduce the supply of mercury by ceasing primary mining, except where mercury is produced as by-product from other ore processing; restricting mercury exports from developed nations; and managing mercury from closing mercury cell chlor-alkali facilities.
- Developed nations should provide new and additional financial resources to support these activities in developing nations.

*The EU should:*

- Take the lead in these global discussions.
- Enact a general restriction on all remaining uses of mercury in products, including thermometers, blood pressure devices, dental amalgam, medical electric and electronic devices and preservatives in vaccines, as soon as possible. Permit exemptions only in cases where no mercury free alternatives exist.
- Ensure a comprehensive system of collection and safe disposal of all mercury-containing products still circulating in society.
- Implement an export ban that covers all mercury, mercury compounds and mercury-containing products which are or about to be banned in the EU.
- Motivate industries to use safer technologies and products that are already available for majority of applications sooner than the legally mandated deadlines; for example, to get the chlor-alkali industry to change to membrane technology at the latest by 2010.
- Set legal limits to prevent mercury pollution from crematoria and coal fired power stations, and promote best available technologies.

*"European institutions should work swiftly to adopt a ban on mercury in measuring devices including those used in healthcare such as blood pressure devices, granting exceptions only if there is a evidence that no safe and accurate alternatives are available for clinical use."*

Karolina Ruzickova, Health Care Without Harm Europe, Czech Republic

- Ensure proper mercury waste collection from homes and hospitals.

In addition to restricting the use of mercury in products, addressing the mercury problem involves several other approaches. We need to raise public awareness so that vulnerable groups have the opportunity to reduce their methyl mercury intake. While it is important to recognise that eating fish provides excellent nutrition, certain kinds of fish now contain high levels of mercury. Until mercury contamination can be reduced, sensitive groups in the population, and people in general can best protect their health by avoiding certain kinds of fish and eating smaller kinds of fish from lower on the food chain and from less polluted waters.

Therefore *the EU should:*

- Ensure that EFSA obtains specific intake data of fish consumption of pregnant women and women of childbearing age.
- Formulate and agree on advice on how the public, especially vulnerable groups, can limit their exposure, and make this part of the European Commission's health web portal.
- Establish precautionary standards for dental amalgams, and vaccinations, while the use of mercury in these products is being phased out.
- More protective recommendations on fish consumption by vulnerable groups should be issued and extensively promoted by EFSA and the European Commission.
- Prioritise completing the picture about our current levels of exposure, through biomonitoring (and the compilation of Member State data on biomonitoring of mercury), so as to inform public education campaigns on the best exposure reduction measures.
- Widely publicise the results of the EU pilot human biomonitoring project to be launched in 2007 concerning children and women of childbearing age.

## National

*In addition to the steps outlined for the EU (above), national Governments across the globe should:*

- Enact a general restriction on mercury in products, similar to EU legislation (see above).
- Issue more protective recommendations on fish consumption for women of childbearing age, pregnant women, breastfeeding women and children.
- Start, or continue, the testing of both local and imported fish for mercury.
- Begin, or continue, investigations on mercury levels in their populations, particularly women and children, through hu-

man biomonitoring activities. This will help to better assess exposure and guide the formulation of recommendations on fish consumption.
- ▲ Raise awareness about reducing our exposure to mercury.
- ▲ Support mercury-free healthcare, including financial assistance.
- ▲ Better monitor and enforce adherence to laws concerning waste from dental practices.
- ▲ Ensure that the health care system advises all women contemplating pregnancy who have a high fish/seafood intake to have a sample of hair or blood analysed, which should be free of charge, and give them subsequent dietary advice on how to avoid mercury.

## Healthcare sector

*Healthcare practitioners (Hospitals, General Practitioners, Dentists) should:*

- ▲ Replace products containing mercury, such as thermometers, sphygmomanometers and dental amalgam, with mercury free alternatives as soon as possible. Ensure that existing products containing mercury are collected separately, disposed of or recycled safely.
- ▲ Submit annual reports on mercury reduction initiatives, including the quantities of mercury used and recycled.

*Dentists should:*
- ▲ Offer proven alternatives to amalgam fillings to patients, with priority for children and pregnant women.
- ▲ For existing uses of mercury, adhere to stringent best management practice; install amalgam separators in dental facilities which can reduce mercury discharge substantially; clean and replace mercury-laden pipes and plumbing fixtures in dental facilities.

## What you can do

*Ask your politician – Minister of Health, Parliamentarian (national and European) to:*
- ▲ Encourage and legislate the phase out of mercury use as soon as possible in all products where alternatives are available (see EU above).
- ▲ For the remaining uses of mercury where safer substitutes are not available, authorise this use for restricted time periods under REACH.
- ▲ Support international actions to restrict mercury through a global agreement and ensure that Europe takes the first step and implements a mercury export ban as soon as possible.

*"Even if we stopped all mercury production and spills and emissions today, our global food supply would still be contaminated for years to come. Yet we face a future of mercury-contaminated fish, a valuable source of nutrition particularly for pregnant women, with no real end in sight.*

*If we have to ask women to eat only certain types of fish, and we do, we must also ask how quickly we can stop using mercury and change industrial processes that contribute to mercury contamination.*

*We hope this campaign transmits to leaders and industry worldwide, the silent, but increasing health damage of mercury to our children, and the urgency of acting today, not next year or the year after".*

Hg Genon K. Jensen, Executive Director, Health & Environment Alliance

*As an individual you can protect yourself and your family from mercury exposure:*

- ▲ Avoid where possible direct personal contact with all kinds of mercury.
- ▲ Inform yourself about mercury levels in seafood, follow national/international advisories (read *HCWH/HEAL Mercury and Fish Consumption Factsheet*) and learn what types of fish pregnant women, babies and young children should avoid.
- ▲ Buy fever thermometers and other products without mercury, replace any existing mercury-containing products, and dispose of the mercury-containing ones properly (see local municipal guidelines; Health Care Without Harm resources).
- ▲ Ask your dentist about non-mercury alternatives and management of mercury-containing waste.
- ▲ Encourage your hospital to use safer alternatives to mercury-containing medical devices.
- ▲ Ask your paediatrician if children's vaccines contain thimerosal with mercury and if alternative vaccines are available for your infant (read *HCWH/HEAL Mercury & Vaccines Factsheet*).

# Annex 1: The testing protocol

Total mercury is tested in all samples.

**Testing method:** graphite furnace atomic absorption after microwave-oven digestion with a Perkin Elmer material SAA600. The full process is detailed in the document "Methodologie dosage métaux dans cheveux".

**Quality control:** reference material used for the hair testing: CRM397 human hair produced by the Community Bureau of Reference, according to the guidelines set out in EU Publication "The certification of the contents of Cd, Hg, Pb, Se and Zn in human hair – CRM 397", Report EUR 13433.

**Quality assurance:** The Hygiène Publique en Hainaut (HPH) works with the Provincial Institute of Hygiène and Bacteriology of the Hainaut, certified and accredited ISO17025 "General requirements for the competence of testing and calibration laboratories". The T89 certificate is provided by Beltest (Belgian Accreditation Structure).

## 1. What is measured?

Total mercury level in hair is measure to include all sources of exposure and all forms of mercury (organic and inorganic).

The results gave a complete picture of the contamination but did not allow identification of the contribution of different sources of exposure to the total result.

The Provincial Institute of Hygiène and Bacteriology of the Hainaut is able to detect mercury at lower levels (approximately 0.1 ppb (parts per billion)).

## 2. Strengths and weaknesses of hair mercury testing

**Strengths:**

- Non invasive method
- Integrates a few months' worth of exposure
- Biological matrix (tissue substance) does not degrade as rapidly as blood and urine
- Integrates internal and external exposure (for example, from air pollution, shampoo, hair cosmetics and so on)
- A correlation exists between mercury concentration in hair and others tissues.

**Weaknesses:**

- Samples are susceptible to contamination during testing preparation.

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# Annex 2: Hair sample results, mean values per country

Mean values per country in ug/g:

| Origin country | Number of participants | Mean value |
|---|---|---|
| Armenia | 11 | 0.13 |
| Argentina | 8 | 0.16 |
| Macedonia | 19 | 0.16 |
| Bulgaria | 6 | 0.17 |
| The Netherlands | 8 | 0.22 |
| Poland | 24 | 0.25 |
| Slovakia | 9 | 0.26 |
| Germany | 17 | 0.29 |
| Sweden | 5 | 0.3 |
| Czech Republic | 10 | 0.33 |
| Ireland | 18 | 0.35 |
| India | 10 | 0.37 |
| Belarus | 11 | 0.43 |
| South Africa | 3 | 0.53 |
| UK | 12 | 0.54 |
| Cyprus | 9 | 0.55 |
| France | 8 | 0.57 |
| Belgium | 36 | 0.65 |
| Croatia | 10 | 0.66 |
| Philippines | 9 | 0.92 |
| Spain | 9 | 2.18 |

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For further information and recommendations, please refer to the **Fact Sheets on Mercury** issued by the Health & Environment Alliance and Health Care Without Harm:

*Mercury and Health*
**http://www.env-health.org/IMG/pdf/How_toxic_is_Hg.pdf**

*Mercury and Fish Consumption*
**http://www.env-health.org/IMG/pdf/Fish_consumption.pdf**

*Mercury and Vaccines*
**http://www.env-health.org/IMG/pdf/Mercury_and_vaccines.pdf**

*Mercury in Health Care*
**http://www.noharm.org/details.cfm?type=document&id=1309**

*Managing Small Mercury Spills*
**http://www.noharm.org/details.cfm?ID=1410&type=document**

*Substituting Mercury Sphygmomanometers*
**http://www.env-health.org/IMG/pdf/Sphygmo.pdf**

*Mercury in Dental Amalgams*
*Forthcoming* **http://www.env-health.org**

**Health Care Without Harm** (HCWH) is an international coalition of more than 450 groups in 55 countries. Because the health of humans is intimately linked with the health of the environment, and healthcare is founded on the Hippocratic principle to 'first, do no harm', we believe healthcare should avoid polluting practices wherever possible. We are working together to transform the healthcare industry so that, without compromising patient safety or care, it is ecologically sustainable and no longer a source of harm to people and the environment. Our members include hospitals and healthcare systems, medical and nursing professionals, community groups, health-affected constituencies, labour unions, and environment and health organisations.

**The Health & Environment Alliance** (HEAL) is an international non-governmental organisation that aims to improve health through public policy that promotes a cleaner and safer environment. Our work draws on the findings of the environmental health science revolution, which is revealing the impact of environmental degradation on health in an ever-widening range of diseases and conditions. We represent a diverse network of more than 50 citizens', patients', women's, health professionals' and environmental organisations across Europe with a strong track record in bringing environmental health science and policy to an increasing number of fora. Our vision is that of a healthy planet for healthy people.

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