KEMI
Swedish Chemicals Agency

22 February 2008

Consultation on SCHER preliminary report on “The environmental risk and indirect health effects of mercury in dental amalgam” (29 Nov 2007) after questions posed by the European Commission.

Response from the Swedish Chemicals Agency

Question 1

Are mercury releases caused by the use of dental amalgam a risk to the environment? The fate of mercury released from dental clinics as well as the fate of mercury released from air, water and soil from fillings placed in patients should be taken into account.

The assessment, including the conclusions, is unacceptable because it:
i) does not include emissions from fillings placed in patients (which was in the posed question from COM)
ii) is based on unrepresentative figures
iii) does not consider realistic worst case scenarios
iv) does not include all emission sources from dental amalgam which should also have been added to the contributions from all other sources

<u>Specific comments</u>:

1) The ‘screening risk assessment’ for <u>aquatic</u>, as well as <u>soil, organisms</u> only covers emissions from dental clinics to the WWTP. It ignores all other releases from fillings placed in patients, e.g. emissions to waste water and air during everyday “use” of fillings, including further fate of the sludge, as well as emissions from crematoria.
a) For the city of Stockholm, the average emissions from amalgam fillings during use (calculated from concentrations in faeces and urine) has been estimated to 13-14 kg y^{-1}, which is about 40 % of the total Hg (TotHg) load to the WWTP. The load from dentists are more difficult to calculate, but is estimated to about half the load compared to fillings during use (Sörme et al 2001; Sörme & Lagerquist, 2002; Sörme et al 2003; Skare & Engqvist, 1994).
b) Data on practice regarding cremation, and emissions, has been reported for 9 EU countries (OSPAR 2006). The emission of Hg to air from cremation in EU27 has been estimated to 2-5 tonnes y^{-1} (Kindbom & Munthe, 2007), while Maxson (2007) estimated the emissions to air from use and disposal of dental amalgam in the EU to be 23 tonnes Hg y^{-1}.
2) The risk assessment is based on Swedish figures, which are not representative for the whole of the EU27. ‘Realistic worst case’ scenarios should be used in risk assessments, but the Swedish circumstances may be more representative for a ‘realistic best case’:
a) Swedish release estimates from dental clinics are used as an average EU scenario. However, all these clinics had some type of amalgam separator, which is far from the practice in all EU27 countries (EC, 2006).
b) Swedish dentist have more or less phased out the use of amalgam. In 2003 only 2-5% of new fillings were made with amalgam, corresponding to about 100 kg Hg y^{-1} (KemI, 2004). The total amount of Hg used for amalgam in EU27 has been estimated to 125 tonnes Hg y^{-1} (Maxson, 2007). This means that Sweden, constituting about 2% of the population, uses 0.08 % of the new

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amalgam. Thus, Hg emission figures from dental clinics in Sweden are mostly due to removal of old fillings, and therefore not representative for the extensive EU use of new amalgam.

3) In order to evaluate the potential environmental risk from dental amalgam, all emissions from dental fillings (comment 1) must be added to the contribution from natural as well as other anthropogenic sources. This has not been done.

4) For the soil compartment atmospheric emissions from crematoria are mentioned, but it is concluded that “the environmental relevance cannot be assessed without an in-depth analysis of the soil fate and ecotoxicology of mercury in soils”. Why would contributions from crematoria differ, in this aspect, from other sources of Hg to soil (e.g. sludge)?

5) Paragraph 3.1.2.3: the comments 1-3 above are relevant also for this paragraph, in addition:
a) calculation of risk for biota based on methyl mercury (MeHg) discharge from dental clinics to waste water is irrelevant since both demethylation of MeHg and methylation of inorganic Hg occurs in the waste water system as well as in the recipient, a fact of uttermost importance for the exposure of the biota.
b) a reference on relative MeHg content in waste water from dental chairs/clinics is used. However, MeHg concentrations are not reported pair wise with corresponding TotHg concentrations in this reference, why SCHER seems to have used the ratio between the mean MeHg and the mean TotHg concentrations for the respective clinics. This is another example where the realistic worst case is not considered.

References Question 1

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Sörme, L., B. Bergbäck, and U. Lohm, 2001. Goods in the anthroposphere as a metal emission source – A case study of Stockholm, Sweden. Water, Air and Soil Pollution: Focus 1 (3-4), ppg 213-227.

Question 2

Is it scientifically justified to conclude that mercury in dental amalgam could cause serious effects on human health due to mercury releases into the environment?

A conclusion is drawn that “the predicted indirect exposure of humans to methylmercury resulting from emissions due to dental amalgams are much lower than these tolerable limits indicating a low risk for serious health effects”.
It is not explained on what basis this conclusion has been drawn, i.e. what calculations constitute the basis for the conclusion. However, we assume that the same severe shortcomings as commented above (point 1-3 and 5?) are also valid for these calculations, and hence also for the conclusion.

When calculating the effects on human health due to mercury releases into the environment, all emissions to air, water and soil from dental amalgam must be considered, and must be added to the contribution from other sources.

In Sweden, heavy restrictions have been set on fish for human consumption due to diffuse mercury contamination of the environment. It has been estimated that the atmospheric deposition in Sweden must decrease by 80 %, in order to decrease the concentrations in fish to levels below the maximum tolerable content of MeHg for fish, set by WHO/FAO (Johansson et al., 2001, UNEP, 2002).

References question 2

Johansson K, Bergbäck B and Tyler G (2001): Impact of Atmospheric Long Range Transport of Lead, Mercury and Cadmium on the Swedish Forest Environment. Water, Air and Soil Pollution: Focus 1:279-297.

UNEP, 2002. Global Mercury Assessment. UNEP Chemicals, Geneva, Switzerland, 257ppg.

Question 3

Comparison of environmental risks from use of mercury in dental amalgam and use of alternatives without mercury

From the view that SCHER has drawn conclusions by only considering releases of dental mercury from dental clinics in this risk assessment, it is surprising to note that they conclude that for the assessment of environmental impacts of the substitute, a risk assessment for the relevant environmental compartments and a life-cycle assessment covering all kind of aspects is required.

Environmental toxicity data for the alternatives are scarce, but as far as we know none of the substances in composite material are on any list for priority substances, or have been subject to any alerts from waste water organisations. On the contrary, mercury is listed as a priority hazardous substance e.g. within the Water Framework Directive. Mercury is also one of few chemicals that have been acknowledged as a global environmental problem, based on the comprehensive scientific evidence presented in the Global Mercury Assessment Report (UNEP 2002).

References question 3

UNEP, 2002. Global Mercury Assessment. UNEP Chemicals, Geneva, Switzerland, 257ppg.

Question 4

If the Committee under its work finds out that more information is needed, for one or more questions, the Committee is asked to provide a detailed list on what kind of information is needed to carry out the tasks.

We agree that the information available does not allow to comprehensively assessing the environmental risks and indirect health effects from the use of dental amalgam.

The main difficulty is the fact that use and release data are based on total Hg concentrations, while methyl mercury is the most toxic form and also the form that accumulates, and biomagnifies in the food chain. Methyl mercury is formed abiotically and biotically under certain favourable environmental conditions. Microorganisms are also able to demethylate mercury. The importance and rates of these processes may vary considerably during the season, but also between recipients as well as within a recipient, and hence is very difficult to model. In an opinion of the CSTEE (EC, 2003) it was concluded that “the problem of speciation of mercury and the complex environmental chemistry and biochemistry of mercury cannot be solved in a satisfactory way in EUSES”. SCHER have performed the risk assessment partly according to TGD, although it is not clear to the reader exactly in which parts and if modelling with EUSES have been performed. Using TGD default values may also imply that important factors determining the fate of MeHg relative to inorganic Hg are overlooked, e.g. differences in retention at the WWTP between inorganic Hg and MeHg, Hence, it is very challenging to try to comprehensively risk assess specific sources of mercury to the environment.

In addition, we believe that it is very difficult, not to say impossible, to get all required information listed by the Committee, from all the member states.

However, it is our opinion that there is sufficient data to conclude that mercury emissions originating from the life cycle of dental amalgam constitute a significant source of mercury in the environment and hence contributes to the risks for organisms as well as to the risk for indirect health effects. For instance, the results in figure 1, which is based on the “best case” of Sweden and only includes discharges from dental clinics (see our comments to question 1), show that even for this low emission scenario some aquatic organisms may be at risk without consideration of all other sources.
Furthermore, according to calculations based on the critical load concept (mainly based on ecotoxicological effects), more than 70% of the European ecosystem area is estimated to be at risk today (Hettelingh et al, 2006).

References question 4

EC, 2003. Opinion of the Scientific Committee on Toxicity, Ecotoxicity and the Environment (CSTEE) on “Risk to health and the environment related to the use of mercury products” (RPA final report; J372/mercury) Adopted by the CSTEE during the 40th plenary meeting of 12-13 November 2003.

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