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TRANSBOUNDARY AIR POLLUTION**

Working Group on Strategies and Review

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Geneva, 31 August–4 September 2009  
Item 5 of the provisional agenda

**FOLLOW-UP ON THE REVIEW OF THE PROTOCOL ON HEAVY METALS**

Report by the Chair of the Task Force on Heavy Metals

1. This report, mandated by item 1.6 of the 2009 workplan for the implementation of the Convention (ECE/EB.AIR/96/Add.2) and the request by the Parties to the Protocol on Heavy Metals (ECE/EB.AIR/96, para. 37 (b)), presents the results of the sixth meeting of the Task Force on Heavy Metals, held from 27 to 29 May 2009 in Stockholm.
2. Ms. K. Kraus (Germany) chaired the meeting, which was hosted by Sweden.
3. Experts from the following Parties to the Convention attended the meeting of the Task Force: Austria, Canada, Czech Republic, Finland, France, Germany, Italy, Netherlands, Norway, Sweden, Ukraine, United Kingdom of Great Britain and Northern Ireland, and United States of America. Also present were representatives of the International Lead Association and the International Cadmium Association. A member of the UNECE secretariat also attended.
4. Ms. P. Hagström opened the meeting and welcomed the participants on behalf of the Swedish Environmental Protection Agency.

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## **I. OBJECTIVES OF THE MEETING AND SUMMARY OF THE MAIN CONTENTS**

5. In accordance with the request of the Parties to the Protocol on Heavy Metals represented at the twenty-sixth session of the Executive Body in December 2008 (ECE/EB.AIR/96, para. 37 (b)) the Task Force focused on preparing technical reviews of the proposal by the European Community and European Union (EU) Member States that were Parties to the 1998 Protocol to add mercury-containing products to annex VI to the Protocol on Heavy Metals (referred to as the EU proposal). This was done in line with the paragraph 5 of Executive Body decision 1998/1 and the procedures outlined in the generic guidelines for technical review of additional metals, product measures or product groups (EB.AIR/WG.5/2005/2, annex IV), with a view to reporting to the Working Group on Strategies and Review at its forty-fifth session in September 2009. The outcomes of this work are contained in chapter II.

6. In addition, in line with the 2009 workplan of the Convention, the Task Force:

(a) Discussed plans for the second workshop for Eastern Europe, Caucasus and Central Asia (EECCA), scheduled to be held from 26 to 28 October 2009 in Saint Petersburg, Russian Federation, in cooperation with the Expert Group on Techno-economic Issues. The workshop's objective is to promote the ratification and implementation of the Protocol on Heavy Metals, including through focusing on specific challenges identified in the Protocol's implementation at the Yerevan workshop (May 2008), recommending future actions and raising awareness of the local policymakers, and better involving experts from EECCA (Eastern Europe, Caucasus and Central Asia) in the activities of the Convention;

(b) Acknowledged and appreciated the contribution of several members of the Task Force into the work of the Expert Group on Techno-Economic Issues for the revision of the annexes to the Gothenburg Protocol and the accompanying guidance documents, including through providing information relevant to particulate matter (PM) for sources covered by the Protocol on Heavy Metals, and reviewing the Expert Group's proposals against the background material prepared by the Task Force, in particular as regards dust.

7. The Task Force also agreed proposals for its future priorities and workplan for 2010.

8. Other information presented and discussed at the meeting of the Task Force is summarized below.

9. A representative of the Convention secretariat informed the Task Force of the decisions on heavy metals made by the Executive Body at its twenty-sixth session, including regarding the Task Force's mandate, and presented the procedure to amend the Protocol on Heavy Metals as set

out in the Protocol's article 13, in Executive Body decision 1998/1 and in the generic guidelines (ECE/EB/AIR/WG.5/2005/2).

10. Mr. J. Forssell (Swedish Environmental Protection Agency) reported about the ongoing and planned work of the United Nations Environment Programme (UNEP) to negotiate a legally binding global instrument on mercury, which was scheduled to be completed by an International Negotiating Committee (INC) in time for the UNEP Governing Council in 2013. The Task Force discussed possibilities of sharing information from its own work on best available technologies (BAT) and emission limit values (ELVs) from mercury sources as well as other relevant knowledge and experiences gained under the Convention and its Protocol on Heavy Metals. This could support the UNEP negotiation process and serve as a potential model for the global Convention. In particular, the discussion focused on (a) the guidance documents on BAT and best environmental practices (BEP) prepared by the Task Force, (b) relevant institutional structures under the Convention as well as its horizontal provisions such as those on ratification, amendment and review procedures, and (c) methodologies for calculating and reporting emission data.

11. The Task Force stressed the importance of harmonizing international reporting obligations, of coordinating national positions of countries involved in both processes to avoid unnecessary duplication, and of striving for a maximum of cooperation and coordination at the regional and global levels. It also deemed it valuable for the Convention to keep track of the UNEP negotiating process and of commitments being considered at the global level, as well as of the information generated in the process, including that on air emission sources as well as the outcome of Global Mercury Partnership areas of coal combustion and waste management. The Task Force recommended that the reports and other information it had prepared be compiled and made more easily available for use in the negotiations under UNEP by linking the UNEP and UNECE websites.

## **II. TECHNICAL REVIEWS OF THE PROPOSAL TO ADD MERCURY CONTAINING PRODUCTS TO ANNEX VI**

12. The Task Force prepared technical reviews of the proposal forwarded by the Executive Body to add mercury-containing products to annex VI to the Protocol on Heavy Metals by initiating simultaneously a two-track review in accordance with the generic guidelines. It expressed its appreciation to the ad hoc drafting group of experts from Germany, the Netherlands, Sweden and the United States, for its work in drawing up a draft working documents for consideration of the Task Force.

13. In addition to the present report summarizing the main results of its work, the Task Force agreed to prepare a more detailed background document that would be made available for

information to the Working Group on Strategies and Review at its forty-fifth session in (September 2009), as an informal document.

14. The Task Force agreed with experts from Canada and the United States that the decision not to undertake the optional peer-review process set out in the generic guidelines would not constitute a precedent for the future, i.e. it would not permanently change the procedure of the future technical reviews of proposals.

#### **A. Track A reviews**

15. Track A reviews relate to the elements of the proposal and other information forwarded by the Executive Body that are relevant to a decision being made as to whether or not the product or product group should be added to the relevant annex of the Protocol. It involved the evaluation of the information, considering the guidance provided in Executive Body Decision 1998/1, paragraph 5(b)(i) and (ii).

##### **5(b)(i) Whether the product or product group intentionally contains one or more of the heavy metals specified in Annex I.**

16. The Task Force agreed that all the product or product groups as described in the EU proposal: batteries, measuring devices, vehicles, electrical and electronic equipment (EEE), fluorescent lamps, and dental amalgam, intentionally contain mercury. It specified that, except for dental amalgam, the proposal refers to new products placed on the market. It noted, furthermore, that annex VII to the Protocol on Heavy Metals acknowledged that the mentioned products contained mercury, since it listed them in its paragraph 3 (a)–(d) and (g) on electrical components, measuring devices, fluorescent lamps, dental amalgam and batteries.

##### **5(b)(ii) Whether atmospheric emissions occurring during manufacture, processing, distribution in commerce, use, and disposal of the product or product group, have the potential to lead to a bioavailable form. And, taking into account controls in place at each point of this process, whether these emissions account for a significant contribution to total transboundary atmospheric emissions of a heavy metal specified in Annex I, within the UNECE region, that cause adverse effects on human health or the environment**

17. The EU proposal referred to products and product groups. Although the products included in the proposal could emit mercury throughout their life cycle, most air emissions occurred during landfill and incineration. To assess whether atmospheric emissions occurring during their manufacture, processing, distribution in commerce, use and disposal have the potential to lead to a bioavailable form, the Task Force acknowledged that this potential was documented in many reports and articles, which demonstrated a wide dispersion of mercury (Hg) and its fate.

18. To assess whether emissions occurring during their manufacture, processing, distribution in commerce, use and disposal “accounted for a significant contribution to total transboundary atmospheric emissions of a heavy metal specified in Annex I”, the total emission of Hg in the UNECE region was calculated and the overall emissions compared to emissions from the products. The Task Force pointed out, furthermore, that measures for emission reduction from products have been implemented in the United Nations Economic Commission for Europe (UNECE) region and that this has contributed to reductions of regional mercury emissions.

### **Mercury emissions**

19. The Task Force considered two recent sources that provided estimations for air emissions for the UNECE region. Data included in the Arctic Modelling and Assessment Programme (AMAP)/UNEP (2008) report were used to provide a best estimate (of 377 tons) as well as a range (from 227 to 746 tons) for total atmospheric emissions of mercury from the UNECE region for the year 2005.<sup>1</sup>

20. The Task Force concluded that based on the data for the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP) for the year 2005, the overall emissions of mercury for the EU countries were 97 tons, for EECCA and South-Eastern Europe (SEE) 138 tons, and for the North America 114 tons. In summary, in the entire UNECE region about 349 tons of mercury were emitted in 2005.

### **Emissions from products included in the proposal**

21. The Task Force reviewed and reported separately on each of the products and product groups included in the proposal:

(a) Batteries: The consumption of mercury in batteries in 2005 has been estimated to be 28 tons in the EU, 19 tons in North America and 10tons in EECCA and SEE (AMAP/UNEP 2008). The Task Force stressed that the mercury consumption in batteries was primarily in button cells and mercury oxide batteries rather than in general purpose batteries. Relatively few emissions of mercury were associated with manufacture, processing, distribution in commerce and use of batteries. However, the disposal of batteries could lead to atmospheric emissions – particularly if batteries were incinerated. Taking account the likely recovery rates, incineration

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<sup>1</sup> The calculation used the AMAP/UNEP report’s emissions estimates for Europe, North America and the Russian Federation. In the report, North America includes Canada and the United States as well as Mexico, the Caribbean and Central America.

rates and mercury abatement rates, the associated atmospheric emissions were estimated to be less than 5 tons per year in the UNECE region in 2005.

(b) Measuring devices: The Task Force screened several reports to evaluate the mercury emissions to air from measuring and control devices. The best estimate was 11-20t per year for the year 2005 (the corresponding figures for the EU were 3–6 tons/year, for EECCA and SEE 3-5 tons/year, and for North America 5–9 tons/year). Other reports estimated the mercury emissions to air from measuring and control devices in the United States at 6.2 tons per year. For the year 2005, in the EU approximately 3 tons (ranging from 2 to 4 tons) were emissions to air from measurement and control devices, half of them originating via incineration. The total use of mercury for measuring and control devices was 35 tons per year for the UNECE region in 2005.

(c) Vehicles: Emissions occurred during the end-of-life vehicle processing. Twelve million vehicles had been disposed of in North America in the year 2000 containing around 10 tons of mercury. Thirteen million passenger cars were scrapped in EU in the year 2000. Most of the mercury contained in these cars would be emitted to the air by melting the scrap. When extrapolating the number of cars for the whole UNECE region, emissions to air could be roughly estimated to be 25 tons (based on the 2000 data). The Task Force anticipated that currently the emissions were lower because in some countries of the region measures were in place to take out switches before scrapping. In addition, in Europe and North America new vehicles placed on the market do not contain mercury switches. The expert estimate of the Task Force for air emissions from vehicles for the UNECE region in 2005 was 12 tons.

(d) EEE: For the UNECE region, AMAP/UNEP (2008) reports emissions per annum of 9–14 tons for North America, 2–3 tons for EECCA (reported as the Commonwealth of Independent States), and 2–3 tons for EU 25. Task Force members added those estimates to determine total emissions per annum of 13–20 tons for the UNECE region for the year 2005.<sup>2</sup>

(e) Fluorescent lamps: The AMAP/UNEP Report (2008) estimates that in 2005 atmospheric emissions of mercury from lamps for the UNECE region were in the range of 5–10 tons. This estimate is further broken down by the regions comprising the UNECE member countries as follows: 2–4 tons for North America, 1–2 tons for the EECCA countries and 2–4 tons for the EU. Other information sources (Lessen 2008, Cain et al., 2007) contain atmospheric

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<sup>2</sup> Data gaps for the AMAP/UNEP (2008) data included: (a) the absence of data for SEE; and (b) compilation of data for North America that exceeded the U.S. and Canada (e.g., Mexico, the Caribbean, and Central America). Other data gaps and comments of Task Force members are noted in background information for the Track A, criterion 5(b)(ii) assessment of EEE.

mercury emissions estimates, which seem to be of the same order of magnitude as the AMAP/UNEP 2008.

(f) Dental amalgams: In 2005 in North America 40 tons of Hg were consumed in dental applications, in EECCA and SEE countries 11 tons of Hg per year, and in the EU 95 tons of Hg per year (AMAP/UNEP 2008). The report of the European Environment Bureau (EEB) from 2007 estimated that in 2006 in Europe emissions to air from all steps in the dental amalgam chain were 23 tons and further 54 tons as potentially bioavailable (via emissions to surface water, groundwater and soil). As a very rough estimate, using the proportional consumption of dental amalgam, the corresponding figures for North America would be 10 tons of Hg emitted to air and a further 23 tons potentially bioavailable. Similarly for the EECCA and SEE countries Hg emissions to air would be 2.4 tons with further 5.7 tons potentially bioavailable. In total for the UNECE region approximately 35 tons of Hg was emitted to air and a further 70 tons was potentially bioavailable annually.

### **Total emissions of mercury**

22. The total emission of mercury in 2005 in the UNECE region is estimated at 349 tons of Hg, using the EMEP data. The Task Force estimated that emissions from the products and product groups included in the proposal account to 81–102 tons of Hg. Therefore the emissions from these product groups were estimated at about 23–29 per cent of total regional emissions.

**Table 1 on total emissions of mercury of the product groups contained in the EU proposal**

<b>Product group</b>	<b>Hg air emissions in tons in 2005</b>
Batteries	5
Measuring devices	11-20
Vehicles	12
EEE	13-20
Fluorescent lamps	5-10
Dental amalgam	35
Total	81-102

23. Data from AMAP/UNEP (2008) allowed for an estimate of 377 tons for total atmospheric emissions of mercury from the UNECE in 2005. Emissions from products in the EU, EECCA and SEE as well as in North America range from 54 to 90 tons (excluding emissions from vehicles). In total, these product groups account for about 14-24 % (without emissions from vehicles) of the total regional emissions.

## **B. Track B reviews**

24. Track B reviews evaluate the parts of the proposal forwarded by the Executive Body, which are related to the development of a strategy for the heavy metal, product control measure, product or product group under consideration. It involved the evaluation of the information considering the guidance provided in Executive Body decision 1998/1, paragraph 5(b)(iii) and relevant to a management strategy.

5(b)(iii) The extent to which the proposed measure reduces emissions, and an assessment of its costs, benefits, and, as appropriate, its efficacy and risks or the extent to which suitable alternative measures exist

25. For each of the proposed measures, the Task Force assessed the potential reduction in Hg emissions of the measure. Secondly, it assessed its costs and its efficacy and effectiveness. Thirdly, it discussed alternative measures. Fourthly, it discussed benefits of reducing Hg emissions derived from a number of studies.

26. Based on a draft Track B review prepared by an ad hoc drafting group in advance of the Task Force meeting, the Task Force, in small break-out groups, considered questions of relevance for Track B for each product group. The break-out groups drew on the draft text prepared in advance as well as on other relevant information, also initiating some alternative analysis.

## **Batteries**

27. In accordance with the EU proposal, batteries that contained more than 0.0005 per cent of mercury by weight could not be placed on the market, regardless as to whether they were incorporated into appliances or not. The value of 0.0005 per cent was chosen to certify that no mercury was intentionally added in the batteries, but trace amounts/impurities could be possible.

## Emission reduction

28. If all mercury-containing batteries were banned mercury emissions from battery waste treatment would eventually stop. Moreover, if the markets in countries that are Parties to the Protocol on Heavy Metals were closed for mercury-containing batteries, the production of these



batteries was likely to be substantially reduced and consequently the mercury emissions from their production.

29. Although not covered in the EU proposal, the Task Force wished to point out that most of the mercury was consumed in the batteries exempted from the limit value (button cells and military equipment). The reduction potential within the general purpose batteries was practically equal to zero. Therefore, the following paragraphs also include considerations on button cells and mercury oxide (HgO) batteries.

30. Costs

31. Manufacturers increasingly are marketing mercury-free alternatives for all types of batteries. For example, in 2004 a manufacturer had to accept 30 per cent higher costs for mercury-free button-cells (Galligan C. and G. Morose. 2004). At this time, it was already expected that the cost difference would gradually diminish the more mercury-free alternatives enter the market. At least two companies are offering mercury-free silver-oxide batteries for button-cells for sale on the world market (Lassen et al. 2008). All major EU manufacturers of portable primary batteries produced mercury-free batteries.

32. In Germany, the costs of treatment of collected mercury-containing batteries were €3.03 per kilo. In 2007, 38 tons were treated and two tons of mercury were recycled (average mercury content 5.3 per cent). The cost of treatment of mercury-free batteries was 0.80 to €1.35 per kg of batteries. Additional advantages are fewer costs for screening and classification of collected batteries and for flue-gas treatment<sup>3</sup>.

Alternative measures:

33. Collection systems and sound waste treatment could reduce emissions. However, effective collection systems were costly and difficult to achieve and collection was not efficient in all countries. Collection rates between 0 and 90 per cent existed in EU countries. The Task Force had concluded in its background report on technological developments on BAT and ELVs that removing mercury from the waste stream before it enters the incinerator was much more cost-effective than capturing mercury later from flue gases using emissions control devices (Task Force on Heavy Metals 2006b).

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<sup>3</sup> Stiftung gemeinsames Rücknahmesystem Batterien, 2008.

34. The Task Force concluded that the referenced studies did not suggest that there were any significant concerns regarding the risks associated with the mercury-free button cells (based on the three types currently in use – alkaline, zinc-air and silver oxide) or, indeed, alternatives such as lithium.

### **Measuring devices**

35. In accordance with the EU proposal for measuring devices, mercury may not be placed on the market: (a) in fever thermometers; or (b) in other measuring devices intended for sale to the general public (e.g. manometers, barometers, sphygmomanometers and thermometers other than fever thermometers). Some exceptions are suggested.

#### Emission reduction:

36. As the total accumulated amount of mercury in the devices in use in the EU ranged from 40 to 100 tons, compared to the consumption of 12 tons a year, emissions from breakage and disposal would continue after the ban was introduced. Full implementation of the proposal could result in reduction or elimination of the contribution to regional mercury emissions from new measuring devices.

#### Costs:

37. Adequate mercury-free alternatives for measuring devices were widely available. They are available mostly at comparable costs. Replacement of mercury products could lead to reduction in costs due to breakages and spills including clean-ups that are required. Alternative electronic devices may require more often calibration, but offer additional advantages like data storage and automatic reading.

38. As mentioned above, some measuring devices ended up in waste incinerators. The Task Force had concluded in its background report on technological developments on BAT and ELVs that removing mercury from the waste stream before it enters the incinerator is much more cost-effective than capturing mercury later from flue gases using emissions control devices (Task Force on Heavy Metals 2006b).

39. Alternative measures could also include prohibitions on manufacture and import, collection systems, source separation and sound waste treatment.

## **Vehicles**

40. In accordance with the EU proposal, vehicles placed on market after 1 July 2012 should not contain mercury-containing materials and components exceeding 0.1 per cent mercury by weight in homogenous materials. Exempted were discharge lamps for headlights and fluorescent tubes used in instrument panel displays. These components shall be labelled or made identifiable to facilitate removal at end-of-life.

### Emission reduction

41. The Task Force reported that mercury in cars was used for headlights, fluorescent tubes and switches. In 2000, 99 per cent of mercury in automobiles was used for switches. Gradually over time, these switches have been phased out in the automobile industry; in North America and Europe these switches were not used anymore in cars. The emissions were expected to decrease considerably during the next 10 to 15 years, when most of these cars will have been recycled.

### Costs

42. There were alternatives on the market for all switches. The increased costs for alternatives to mercury-containing switches were outweighed by the extra costs for the recovery by avoiding the costs associated with removing and disposing of switches from cars.

### Alternative measures

Shredding of vehicles and the subsequent sending of the vehicles to the iron and steel production furnaces contributed to air emissions. The background report of the Task Force on BAT<sup>4</sup> states that it is best environmental practice to develop and implement operating practices to prevent or minimize the presence of mercury in the scrap. Only 30 to 60 per cent of mercury emissions from iron and steel production was captured. Reducing these emissions could be done by removing all mercury-containing switches before melting.

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<sup>4</sup> The background document and other material from the Task Force's meeting in Ottawa in 2006 are available at: <http://www.unece.org/env/lrtap/TaskForce/tfhtm/3rdmeeting.htm>  
See also document ECE/EB.AIR/WG.5/2006/2.

## **Electrical and electronic equipment**

43. In accordance with the EU proposal, new electrical and electronic equipment exceeding 0.1 per cent mercury by weight in homogenous materials may not be put on the market.

### Emission reduction

44. The implementation of proposed control measure could result in reduction of up to 20 tons per annum in the UNECE region. Reduction from status quo could be affected by various factors (e.g., product service life, product value, consumer attitudes and new alternative products).

### Costs

45. A summary of information regarding alternatives to mercury containing switches, relays and other electrical components was given in Lassen et al (2008). Lassen et al. indicated that mercury-free alternatives are commercially marketed and have replaced mercury-containing products at little or no cost difference to the status quo.

46. The European Commission's impact assessment for EEE (European Commission 2000) found that substitutes existed for most applications and that there would be only limited costs for manufacturers to phase-out heavy metals in EEE. Financial benefits were found due to lower production and disposal costs through use of secondary materials and reusing/recycling. The Commission also concluded that clean-up costs and costs for environmental impacts were not included in the prices of the products, and that the associated risks were substantial and therefore prevention at the source was preferable to end-of-pipe solutions. Thus, the Commission's impact assessment concluded that because of fewer costs for production, disposal and recycling switching to mercury-free alternatives was economically advantageous. On this basis, the Task Force concluded that the proposed control measure could be considered cost-effective.

### Alternative measures

47. The Task Force noted that collection systems, source separation, and sound waste treatment could reduce emissions, but that effective collection systems could be costly and difficult to achieve. In countries that had implemented the EU Directive on Waste, Electric and Electronic Equipment (WEEE) such collection, separation, and treatment systems were already required.

## Fluorescent lamps

48. In accordance with the EU proposal, mercury-containing fluorescent lamps may not be put on the market if their mercury content exceeds: f (a) 5 mg mercury per lamp for compact fluorescent lamps; (b) 10 mg Hg per lamp for lamps with halophosphate for straight fluorescent lamps for general purposes; and 5 mg Hg per lamp for lamps with triphosphate and normal lifetime.

### Emission reductions:

49. Current emissions of mercury from lamps were estimated in Track A at 5–10 tons per annum.

50. The average content of mercury in lamps has been decreasing steadily for many years. The Hg content of lamps representing BAT decreased from about 30 mg per lamp in 1994 to about 8 mg per lamp in 2000 (Lassen et al 2008). Lassen also reported that the average mercury content in lamps in the United States had declined from 13.34 mg in 2000 to 11.50 mg in 2005. In the EU, the average declined from 11.56 mg in 2001 to 9.72 mg in 2006. According to the Deutsche Umwelthilfe<sup>5</sup>, modern fluorescent lamps contain about 2 mg of Hg. Lamps taken back at the moment still contain 4-8 mg Hg.

51. Although the mercury content per unit is decreasing the total mercury consumption has been increasing due to increasing number of “low energy” lamps used.

52. In conclusion, given these trends, the measures proposed to limit the mercury content of lamps to 5.8–10 mg (depending on type) might therefore have only limited potential to achieve further reductions in emissions from the current estimate of 5–10 tons for the UNECE region.

### Costs and benefits

53. Mercury containing lamps require less energy than conventional incandescent lamps and thus there is a potential to achieve mercury emissions reductions over the lifetime of the lamp depending on how the electricity is generated. A study by Deutsche Umwelthilfe from 2008, quantified this benefit, concluding that an incandescent lamp of 60 watts represents mercury emissions of about 1 mg per year if used for 3 hours per day, while a comparable 11 watt fluorescent lamp represents emissions of 0.2 mg per year. Other forthcoming studies attempted

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<sup>5</sup> A German environmental non-governmental organization.

to quantify this benefit. A detailed review of these studies by the Task Force in the future could enable more conclusive findings regarding the benefits of the proposed control measures for lamps.

54. Most of these studies were not referenced in the documents tabled for discussion at the Task Force meeting; however, as an example, a study published by Eckelman et al. in 2008 in *Environmental Science and Technology* analysed net emissions of mercury in 130 countries with varying energy mixes. The findings of the study included the following statement: “In general, it appears that increasing the use of fluorescent lighting is an effective way to reduce life-cycle mercury emissions. In countries where there is a small percentage of coal-based power generation and little to no recycling, the use of fluorescents may instead increase national atmospheric mercury emissions. It is also the case that many of the countries where fluorescent lighting would be most effective at reducing emissions are also places where recycling infrastructure is lacking.”

#### Alternative measures

55. Production and marketing of mercury-free lamps is increasing. For most applications, mercury-free alternatives are available but have often only a marginal market share.

56. Efficient collection and handling systems could reduce the emissions after the end-of-life of lamps. In the EU, 13 per cent of Hg is recovered in lamp waste-handling installations, the efficiency differs greatly within the countries of the EU.

#### **Dental amalgams**

57. In accordance with the EU proposal, a Party should ensure the installation of amalgam separators at dentist practices within its territory.

#### Emission reduction

58. The Task Force reported that most dental facilities in Europe have a basic chair side filter or trap in the wastewater system to capture larger particles. Separator technologies were available that can potentially remove over 90 per cent of the mercury from the waste water. In some countries (e.g. Austria, France, Finland, Germany, Netherlands and Sweden) a separator efficiency of at least 95 per cent is required. (Lassen et al. 2008) Based on EEB (2007), it was roughly estimated that for the EU 45–65 tons Hg is collected in this way. This corresponded to 55–60 per cent of the waste from amalgam from dental clinics.

### Costs and benefits

59. Elements involving extra costs would be installation, maintenance of amalgam separators and training of personnel. On the other hand, there were reduced costs for: (a) special deposition of sludge because of high Hg contents; (b) treatment and disposal capacity for Hg-containing dental waste; and (c) environmental and health impacts of Hg released via sewage and waste. Lassen et al. (2008) conclude that it is clearly indicated that applying high-efficiency filters and maintenance requirements is a very cost-effective measure. The costs to reduce one kg Hg is stated as being within the range of €1,400 to €1,800. The benefits of reduced environmental and health impacts of Hg released from the entire life cycle of amalgam fillings were not assessed in this study. However, they are regarded as being significant.

### Alternative measures

60. An alternative approach to reduce the emissions of mercury from amalgam use was to avoid using amalgam as a filling material, i.e. to introduce measures upstream that would eventually eliminate the emissions downstream. Since a large portion of the populations in the UNECE countries already had amalgam fillings, a substitution approach needed to be accompanied with amalgam separators in dental clinics during a transition period.

61. Although there were suitable and available alternative filling materials on the market, and a few countries (Norway, Sweden, Denmark) had completely banned the use of new amalgam fillings, no general understanding of their feasibility yet existed. Amalgam fillings were often cheaper to the patient, a price which did not include the external (e.g. environmental) costs of mercury, i.e. special waste treatment and emission control on crematoria.

62. In Canada, it has been proposed to require the preparation and implementation of pollution prevention plans in respect of mercury releases from dental amalgam waste. This would supplement existing requirements for amalgam separators.

### **Conclusions on the benefits of reduced mercury emissions**

63. The measures proposed to reduce Hg emissions could lead to costs to society. However, Hg pollution also resulted in costs to society including for example damage costs from negative impacts on human health and the environment, loss of income from reduced commercial fisheries, administrative costs for scientific research and development, and control and risk communication (Nordic Council of Ministers 2008).

64. For human health impacts, the two main exposure pathways were ingestion of methyl mercury via fish and inhalation of mercury vapours. Health benefits due to reduced atmospheric emissions have been estimated in recent research studies carried out. A Norwegian study states

that the costs for releases to air can be NOK 27,000 to 67,000 (in the order of €3,000 to €7,400) per kg Hg. The releases to water costs are estimated to NOK 3,440,000 to 8,600,000 (€382,000-€956,000) per kg Hg, but the exact background for the data were not presented in ECON 2000.

65. Damage cost to society due to Hg pollution has been assessed by the Nordic Council of Ministers (2008). The cost of IQ loss in Europe was estimated at €8,000 per 1 kg of emitted Hg to air. Apart from IQ loss a number of other environmental and human health impacts had resulted in damage costs for society, although even more difficult to calculate than the cost of IQ loss. In one study attempting to estimate total human health benefits from reduction of Hg, the human health benefits came to about seven times higher than if only the loss of IQ was estimated (Rae and Graham, 2004).

66. Estimates of the benefits for human health from decreased releases of Hg involve a degree of uncertainty, as was always the case with this type of estimate. Rice and Hammit (2005) give as a general value for their wide range scenario an annual benefit of some US\$ 4,000–110,000 per kg reduction of Hg emissions.

67. Some of the proposed measures involved costs, e.g. costs for traps to reduce dental amalgam (€1,400–1.800/kg Hg, costs for treatment and recycling). Some of the alternatives for batteries and technical devices cost the same or were only slightly more expensive (a maximum of 30 per cent for batteries).

68. In the EU an impact assessment for all these products was made before the measures were adopted. The measures were seen as cost-effective and introduced in the EU (see page 5 of the original proposal).

69. In Canada, a socio-economic study of mercury-containing products and their alternatives had been completed as part of the development of a risk management strategy for mercury-containing products. Cost to consumers as well as economic impact on manufacturers and importers were taken into consideration. It was found that many mercury-free alternatives were currently available in the marketplace and had small or no significant cost implications for the consumer. As part of the strategy, it was planned to develop a federal regulation that would prohibit the import and manufacture of all mercury-containing products with the exception of lamps and dental amalgam. As part of regulation development, a regulatory impact assessment would be conducted.

70. A similar socio-economic study that included product use-substitute analyses, exposure and risk assessments, and cost-benefit analyses was under way in the United States. The first results were expected before the end of 2009.



71. The Task Force was not in the position to draw final conclusions for each product group and region concerning the provisions on benefits and efficacy.

### **III. CONCLUDING SESSION AND FURTHER WORK OF THE TASK FORCE ON HEAVY METALS**

72. The Task Force adopted the outcomes of its work on the track A and B reviews. The Chair thanked the members of the Task Force for their work and constructiveness in seeking consensus on the issues discussed.

73. Following discussions of its further work, the Task Force on Heavy Metals:

(a) Agreed to carry out further work in 2010 as required by the Executive Body on the basis of the recommendations of the Working Group on Strategies and Review;

(b) Agreed to hold its next meeting in spring 2010, if necessary.

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