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Compilation of information on techniques for emissions abatement and on the possibility of replacing lead and cadmium with less hazardous substances or techniques

Note by the Executive Director

Summary

In accordance with United Nations Environment Programme Governing Council decision 27/12 II and resolution 1/5 VI on lead and cadmium of the United Nations Environment Assembly of the United Nations Environment Programme, the present note sets out a summary of a compilation of information on techniques for emissions abatement and on the possibility of replacing lead and cadmium with less hazardous substances or techniques. It also provides information to supplement the report of the Executive Director on resolution 1/5 (UNEP/EA.2/4). The summary is based on information submitted by Governments and stakeholders as of December 2015. The full compilation of information on techniques for emissions abatement and on the possibility of replacing lead and cadmium with less hazardous substances or techniques is available at: http://www.unep.org/chemicalsandwaste/LeadCadmium/Publications/DevelopmentofTechniquesforEmissions/tabid/838787/Default.aspx. Governments and stakeholders are invited to consider follow-up activities as exemplified in paragraph 27 of the present note.

* UNEP/EA.2/1.

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A. Background and mandate

1. Lead and cadmium are hazardous to human health. In the environment, they are toxic to plants, animals and microorganisms and they are transported over distances at the local, national and regional levels. The trade in new and used products containing lead and cadmium remains a challenge for developing countries and countries with economies in transition which lack the capacity to manage and dispose of the substances in products in an environmentally sound manner.

2. Since 2001, the United Nations Environment Programme (UNEP) has been mandated to address lead and cadmium issues. Its key activities on lead and cadmium have included leading a global initiative promoting cleaner fuels and vehicles in developing countries and countries with economies in transition through the Partnership for Clean Fuels and Vehicles (PCFV). Lead in automobile fuels, which used to be the main source of human exposure to lead worldwide, has been phased out in all but three countries.

3. Although some restrictions on the use of lead in paint were imposed in many countries in the first third of the twentieth century, it has become clear in recent years that paints containing high levels of lead are still widely available for purchase for residential purposes in many countries. Available data from paint testing studies in 37 countries have revealed that new paints with high lead concentrations are widely available in many regions of the world.

4. In the context of the Global Alliance to Eliminate Lead Paint, 59 Governments recently reported having legally binding restrictions in place on the use of lead in paint, while 65 Governments reported not having such restrictions in place, and information on the matter was lacking for a further 71 countries. The data suggest that much work remains to be done before all countries have effective measures, including regulations, in place with the aim of phasing out the use of lead in paint by 2020.

5. The situation with regard to other products containing lead and cadmium, most notably batteries, needs to be analysed further.

6. Lead-acid batteries and nickel-cadmium batteries are the major end-uses of lead and cadmium. The final reviews of scientific information on lead and cadmium (UNEP 2010) estimate that batteries account for 78 per cent of reported global consumption of lead in 2003 and 82 per cent of the estimated world consumption of cadmium in 2005. The *Global Chemicals Outlook: Towards Sound Management of Chemicals* (UNEP 2013) estimates that lead-acid batteries accounted for about 89 per cent of lead consumption in 2009 and that figure remains at over 80 per cent in 2011 (International Lead and Zinc Study Group, 2012). Lead and cadmium are also used in pigments and compounds, cable sheathing, rolled and extruded products and ammunition.

7. In February 2013, the UNEP Governing Council, by decision 27/12 II on lead and cadmium, requested UNEP to compile information on techniques for emissions abatement and on the possibility of replacing lead and cadmium with less hazardous substances or techniques.

8. In June 2014, at its first session, the United Nations Environment Assembly of UNEP adopted resolution 1/5 VI on lead and cadmium, in which it recognized the significant risks to human health and the environment arising from the releases of lead and cadmium into the environment; welcomed the upcoming third meeting of the Global Alliance to Eliminate Lead Paint and the associated workshop focusing on the development of national legislation to phase-out lead in paint, and requests the United Nations Environment Programme, in coordination with the World Health Organization, to continue to build capacity on lead paint through possible regional workshops; and looked forward to the compilation of information on techniques for emission abatement and on the possibility of replacing lead and cadmium with less hazardous substances or techniques.

9. Accordingly, a summary of the compilation of information on techniques for emissions abatement and on the possibility of replacing lead and cadmium with less hazardous substances or techniques is set out in the annex to the present note.

B. Scope and coverage of the compilation

10. The compilation of information on techniques for emissions abatement and on the possibility of replacing lead and cadmium with less hazardous substances or techniques is based on information submitted by Governments, intergovernmental organizations and regional economic integration organizations, non-governmental organizations and other stakeholders.

11. Submissions of specific relevance to the techniques for emissions abatement and the possibility of replacing lead and cadmium with less hazardous substances or techniques were received from the following: Argentina, Azerbaijan, Belarus, Brazil, Chile, China, Costa Rica, Ecuador, the European

Union and its member States, Finland, Kiribati, Madagascar, Malaysia, Mauritius, the Philippines, Poland, Russian Federation, Togo, Turkey, the United States of America, and the Organization for Economic Cooperation and Development (OECD), the International Cadmium Association (ICdA), the International POPs Elimination Network (IPEN), the Research and Education Centre for Development (CREPD), OK International, RSR Corporation and VinylPlus. Additional information, where easily available, has either been included or referenced by hyperlinks.

12. In addition to the information submitted, UNEP has made available technical information that aims to contribute to the reduction of the health and environmental risks of lead and cadmium. This includes the information on alternatives to lead-containing paints presented in the "Toolkit for establishing laws to control the use of lead in paint" (http://www.unep.org/chemicalsandwaste/noleadinpaint/toolkit) and the East Africa Subregional Workshop on the Establishment of Legal Limits on Lead in Paint held at the United Nations Conference Centre, Addis Ababa, on 2 and 3 December 2015 (http://www.unep.org/chemicalsandwaste/LeadandCadmium/LeadPaintAlliance/MeetingsandEvents/EastAfricaSub-regionalWorkshop/tabid/1060793/Default.aspx). It also includes information on the sound management of used lead-acid batteries presented at a workshop held in Osaka, Japan, in November 2015, and posted on the website for the workshop (http://www.unep.org/chemicalsandwaste/LeadandCadmium/PbandCdBatteries/ULABWorkshop-Osaka/tabid/1060855/Default.aspx).

C. Call for information

13. In response to Governing Council decision 27/12 II, UNEP sought technical input and submissions of information from Governments and other stakeholders with regard to the compilation of information on techniques for emissions abatement and on the possibility of replacing lead and cadmium with less hazardous substances or techniques.

14. An initial request was sent in a letter, dated 14 April 2014, from the Head of the Chemicals and Waste Branch of the UNEP Division of Technology, Industry and Economics, to all the Strategic Approach to International Chemicals Management focal points, copied to all the permanent missions in Geneva and in Nairobi and to members of the working group on lead and cadmium.

15. In response to resolution 1/5 VI on lead and cadmium, UNEP extended the deadline for submission of further information in relation to the compilation of information.

16. As of 6 January 2016, a total of 19 Governments and the European Union and its Member States, 1 intergovernmental organization, 4 non-governmental organizations and 2 other organizations had submitted information with regard to the compilation of information.

17. The majority of the submissions were received in English, with a few exceptions received in other official languages of the United Nations. All the information received by the Chemicals and Waste Branch has been made available on the lead and cadmium activities website, and wherever necessary and possible an English translation has been made available. The information submitted is available at: (http://www.unep.org/chemicalsandwaste/LeadCadmium/Publications/DevelopmentofTechniquesforEmissions/tabid/838787/Default.aspx).

D. Overview of the submissions

18. The submissions received by the end of 2015 are summarized in the annex to the present note.

19. Submissions from Governments and other stakeholders included information on (a) government policies and regulations on the management of lead and cadmium, (b) technologies and alternatives to reduce their use and emissions, and (c) inventories and risk assessments.

20. A number of Governments provided information on their regulations, product standards and voluntary measures regarding lead and cadmium, including the following:

(a) Restriction of lead in automobile fuels;

(b) Restriction of lead and cadmium in paints, batteries, plastics stabilizers, automobiles, electric and electronic equipment, jewellery, ceramics and toys;

(c) Best environmental practices in mining;

(d) Regulation of emissions to air and discharges to water of lead and cadmium;

(e) Environmental quality standards;

(f) Management of hazardous wastes;

(g) Battery recycling, including environmentally sound management of used lead-acid batteries.

21. The European Union and its member States submitted the best available technology reference document describing emission control technologies for waste incineration, cement, lime and magnesium oxide production, glass manufacturing, non-ferrous metals production, ferrous metals processing, iron and steel production, and smitheries and foundries. Their other submissions included information on technology to reduce or replace the use of lead and cadmium in products and processes such as batteries, pigments, stabilizers and plating. A number of other countries and organizations submitted information on these specific technologies.

22. Governments also reported on the risk assessments conducted in regulatory and voluntary processes, and their work on establishing inventories of use and emissions of lead and cadmium.

23. Some submissions also highlighted the health and environmental risks posed by the recycling of used lead-acid batteries, the production of batteries, and other uses of lead and cadmium.

E. Future considerations

24. The survey provided an initial overview of policies, technologies and alternatives contributing to the assessment and reduction of the risks posed by lead and cadmium for human health and the environment. Further submissions are encouraged and will be added to the full compilation which is available on the website of the UNEP lead and cadmium programme.

25. Various submissions suggested that information contained in the final reviews of scientific information on lead and cadmium published by UNEP in 2010 could be examined to identify further techniques for emission abatement and the possibility of replacing lead and cadmium with less hazardous substances or techniques.

26. It should be noted that UNEP and WHO conducted a review of government regulations on lead in paint submitted to the International Conference on Chemicals Management at its fourth session in a note by the secretariat entitled “Status of the phasing out of lead in paint by countries: 2015 global report” (SAICM/ICCM.4/INF/25), and that UNEP plans to publish a further analysis of such regulatory measures. The Partnership for Clean Fuels and Vehicles reviews regulations on lead in automobile fuels. A global review of regulations relating to other uses and emissions of lead and cadmium has not been conducted to date.

27. Building on the survey, possible follow-up activities that might be considered include:

(a) Collecting further scientific and technical information, for example on uses and emissions of lead and cadmium, human and environmental exposure, reduction technologies and alternatives, and analysing it to update of the final reviews of scientific information on lead and cadmium;

(b) Conducting a survey of regulations and voluntary measures on the use of lead and cadmium in products and processes, environmental emissions and waste management with a view to sharing knowledge and encouraging the replication of good practices;

(c) Establishing a partnership to disseminate technologies and alternatives to reduce the risk posed by lead and cadmium.

28. Governments and stakeholders are invited to consider the above-mentioned or any other possible follow-up activities.

Annex

Compilation of information on techniques for emissions abatement and on the possibility of replacing lead and cadmium with less hazardous substances or techniques

A. Submissions by Governments

Argentina

1. In its submission, Argentina made reference to Directive 2013/56/EU, which amends Directive 2006/66/EC on batteries and accumulators, as regards the market for portable batteries and accumulators containing cadmium based on the availability of substitutes on the market for this type of batteries, such as nickel-metal hybrid and lithium-ion. In Argentina, the legal limits for mercury, cadmium and lead content in batteries are 0.0005 weight per cent (wt%), 0.015 wt%, and 0.200 wt%, respectively. At present there is no information available on techniques to reduce emissions of lead and cadmium and to replace such metals with less hazardous substances.

Azerbaijan

2. Azerbaijan highlighted the particular importance accorded to the introduction of new technologies, the reduction of all kinds of harmful substances formed during the production process, including the management of heavy metals as well as the replacement of lead to nickel-plated compounds, cadmium to titanium oxide or zinc compounds, stating that projects to replace harmful substances by more advanced methods were a key priority.

Belarus

3. Under the "National Strategy for Sustainable Socioeconomic Development of the Republic of Belarus for the period up to 2020", Belarus has set targets for improving waste management that aim to achieve 85 per cent reuse of waste and a 50 per cent reduction in the volume of classes 1–3 stored hazardous waste. Private companies are engaged in collecting various types of hazardous waste, in the disposal and recycling of such waste, and in the production of energy from them. The submission reports on the number of actors involved. In addition, air quality is being monitored under the National Environmental Monitoring System, and the emission limits are determined by the Protocol on Heavy Metals to the Convention on Long-Range Transboundary Air Pollution. The Ministry of Health restricts the use of lead and cadmium in consumer goods, and the health sector monitors the content of heavy metals in the environment.

Brazil

4. According to Brazil's submission, lead and cadmium are not utilized in the production process of the automotive industry owing to the implementation of extremely restrictive policies on toxic substances concerning the replacement of the following products: C.I pigment yellow, Cobal(II) etylhexanoate, iron oxide and hydrated iron oxide.

5. Furthermore, emissions of lead and cadmium have been significantly reduced due to the removal of tetraethyl lead in gasoline since1989 and its replacement by ethanol, which has in particular brought about a significant reduction of the level of lead in the air.

6. Restrictions on the use of lead in paint became effective in 2008 (Law 11.762/2008). Current legislation aims at prohibiting lead in household paints, while allowing for exceptions of some level of lead concentrations in paints for industry and agricultural equipment, traffic paint and other applications. Paint manufacturers have found alternatives to the use of hazardous substances, including the experimental use of nanoscience and nanotechnology.

Chile

7. Chile described a project launched by the Ministry of Environment in 2011 entitled "Identification of the Main Sources of Cd and Pb at a National level, National Registry of Sites with Potential Presence of Cd and Pb, and Development of a Methodological Guide for the Assessment of Use, Consumption and Emissions of Cd and Pb".

8. The main objective of the project was to develop methodological guidelines for the identification and quantification of lead and cadmium emissions and to estimate the magnitude of the presence of lead and cadmium (emission sources and potentially polluted sites) in Chile. The project also considered gathering information regarding internationally used alternatives to products

containing lead and cadmium and processes using lead and cadmium, as well as the assessment and proposal of alternatives that could be applicable in Chile.

China

9. China submitted information about lead and cadmium emission reduction technologies and pollutant control technologies for non-ferrous metal smelting industries, including lead, zinc, and copper smelting. The mechanisms and efficiency of each technique are described in detail in the submission.

10. Substitutes for lead and cadmium in the battery industry, including lithium-ion batteries, nickel-hydrogen batteries and zinc-manganese dioxide batteries, and their performances are also discussed in the submission. In addition, a list of alternatives to toxic and hazardous materials whose use is encouraged by the Government is attached to the submission. The list includes: calcium hypophosphite antirust pigments instead of lead, lead calcium and zinc chromium antirust pigments; novel alloy lead-acid batteries instead of cadmium-containing lead-acid batteries; lead-free solder paste for hybrid integrated circuits, thermistors and solar cells; and calcium-zinc and rare earth stabilizers instead of lead stabilizers for polyvinyl chloride (PVC).

Costa Rica

11. Costa Rica noted that it has eliminated the lead additive in fuel, and limits on the amount of lead and cadmium in the atmosphere are being established. There is only one lead smelter company in the country, PB Metals, which has had the technologies for collecting, transporting and recycling lead-acid batteries since 2012. Batteries containing cadmium are subjected to controls under special waste regulations.

Ecuador

12. Ecuador said that it has enacted national standards to govern the usage of lead and cadmium in various products including jewellery, paint, and household goods, especially in reference to ceramic products. In addition, requirements and guidelines for adequate handling and management of used lead-acid batteries have been established. Based on existing legislation, the Ministry of Environment has been developing restrictions on lead and cadmium content in imported products and has drafted instructions for the management and recycling of lead-acid batteries. Lastly, ceramic dishes imported from China were recalled due to high levels of lead and cadmium content – over 2 mg/L and over 0.25 mg/L, respectively – in March of 2013.

European Union and its member States

13. The European Union and its member States submitted documents and links to websites that contain information on techniques for emissions abatement and on the possibility of replacing lead and cadmium with less hazardous substances or techniques, including the following:

14. The compilation of information from the best available techniques reference documents (BREFs) concerning emissions to air of lead and cadmium and best available techniques conclusions adopted by the European Commission provides information on current emissions of lead and cadmium from relevant processes, candidates for the application of best available techniques, and the emission levels that can be achieved by applying what are considered to be best available techniques in terms of the following activities: waste incineration, cement, lime and magnesium oxide production, glass manufacturing, non-ferrous metals production, ferrous metals processing, iron and steel production, and smitheries and foundries.

15. *European Union Risk Assessment Report on Cadmium Metal and Cadmium Oxide: Part I – Environment* describes the general uses of cadmium, including for nickel-cadmium batteries, pigments, stabilizers, alloys and plating, and also introduces legislative and voluntary control measures. The document focuses on giving detailed information on the sources of cadmium metal and cadmium oxide released into the environment, the local exposure assessments of aquatic, terrestrial, and atmospheric compartments, and the risk characterizations for each region. *European Union Risk Assessment Report on Cadmium Metal and Cadmium Oxide: Part II – Human Health* explains possible exposure paths to cadmium metal and cadmium oxide, including for occupational, consumer and environmental exposures, and focuses on delivering information on the health hazards caused by cadmium poisoning, giving specific case study examples.

16. The report entitled “Socio-economic impact of a potential update of the restrictions on the marketing and use of cadmium” reports on cadmium usage and current restrictions on cadmium usage within the European Union. In addition, the document discusses the socio-economic impacts and the

effectiveness of the various policy options in terms of health and environmental risk reduction, particularly for the use of cadmium in brazing alloys, jewellery, and recycled PVC.

17. The background document to the "Opinion on the Annex XV dossier proposing restrictions on lead and compounds in articles intended for consumer use" provides concise information on hazards, exposure routes, costs for substitutions and restriction assessments.

18. The background document to the "Opinion on the Annex XV dossier proposing restrictions on lead and its compounds in jewellery" reports on the use of lead and its compounds in fashion jewellery and the assessments of the resulting human health hazard, exposure and risk. Detailed information about possible alternatives to lead – silver, tin, zinc, copper and bismuth – is given, regarding their availability and potential risks for human health and the environment. In addition, risk management options are evaluated based on their effectiveness, practicality, monitorability and socio-economic impacts.

19. The voluntary risk assessment for lead metal, lead monoxide, lead tetraoxide, poly-basic lead fumerate, basic lead sulphate, basic lead carbonate, tetrabasic lead sulphate, dibasic lead phosphite, dibasic lead stearate, neutral lead stearate, dibasic lead phthalate, tetrabasic lead sulphate, and basic lead sulphite provides comprehensive information on the effects of certain chemicals on human health and the environment.

20. The Economic Commission for Europe guidance document on best available techniques for controlling emissions of heavy metals and their compounds from the source categories listed in annex II to the Protocol on Heavy Metals describes the possibilities for controlling or preventing heavy metal emissions and monitoring abatement procedures. The document reports on control measures, efficiency reduction and the related costs of the best available techniques for different emission sources.

21. Directives 2000/53/EC on end-life-vehicles ("ELV" Directive) and 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment ("RoHS" Directive) restrict the use of lead, mercury, hexavalent chromium and cadmium in vehicles and in electrical and electronic equipment (EEE), respectively. Exemptions to each of the directives are subjected to technical and scientific evaluations and the results are reported in "Adaptation to Scientific and Technical Progress of Annex II to Directive 2000/53/EC" and "Adaptation to Scientific and Technical Progress of Annex II to Directive 2000/53/EC (ELV) and of the Annex to Directive 2002/95/EC (RoHS)."

22. The "End-of-life vehicle directive 2000/53/EC Annex II: Study on analysis of costs and environmental benefits of heavy metal ban, and proposal for better regulation" by the European Car Manufacturers' Association (ACEA), reports that emissions of lead, cadmium, mercury and hexavalent chromium reduced by 99.6 per cent, 96 per cent, 0 per cent (negligible gross amount) and 99.99 per cent, respectively, between 2000 and 2005, demonstrating that the phase-out of such heavy metals from the end-of-life vehicles waste stream is close to completion.

23. The report on a study carried out by the European Commission, *Comparative Life-Cycle Assessment of nickel-cadmium (NiCd) batteries used in Cordless Power Tools (CPTs) vs. their alternatives nickel-metal hydride (NiMH) and lithium-ion (Li-ion) batteries*, presents the results of the life cycle assessment carried out for the three battery types and the comparative assessment of the environmental impacts over their whole life cycles. Moreover, the report considers the economic, social and environmental impacts of the various policy options to reduce the environmental impact and human exposure to cadmium associated with these batteries.

24. The "Survey of mercury, cadmium and lead content of household batteries" conducted by the German Federal Environment Agency considers the situation regarding the compliance of commercially available batteries with the existing limits for heavy metal contents in Germany (5 ppm for mercury, 20 ppm for cadmium, and 40 ppm for lead). The results show that the mercury and cadmium contents were mostly below the limits, while the lead content exceeded the limit in many cases.

25. The German Federal Environment Agency submitted a report on action areas and criteria for a precautionary, sustainable substance policy using the example of PVC, including an evaluation of possible alternatives to lead and cadmium as stabilizers in PVC (the report is available upon request).

26. The *Vinyl 2010 Progress Report 2010* is based on the Voluntary Commitment of the European PVCindustry, a 10-year plan signed in 2000 to ensure and improve product stewardship across the lifecycle of PVC. According to the report, cadmium stabilizers have been phased out and the majority

of lead stabilizers have been replaced with calcium-based stabilizers. Moreover, the achievements in PVC waste collection and recycling schemes are discussed in the report.

Finland

27. Finland submitted a Control of Hazardous Substances in the Baltic Sea Region (COHIBA) Guidance Document, *Measures for Emission Reduction of Cadmium in the Baltic Sea Area*, which is a product of multinational research and was financed in part by the European Union. The document reviews the chemical properties, production and use, emission sources, and environmental fate of cadmium. In addition, it considers existing regulations and analyses various aspects of measures for emissions reduction.

28. Finland also submitted national guidance, *Best Environmental Practices in Metal Ore Mining*, which includes information on environmental studies on the emissions and wastes generated during each step of mining activities, and the relevant legislation and administrative procedures to reduce and prevent such environmental pollution.

Kiribati

29. Kiribati reported that the country is not industrialized in making lead and cadmium, but they are imported for various purposes.

Madagascar

30. Madagascar conducted a preliminary investigation on sources of lead and cadmium contamination and responses thereto (technical, legal or precautionary measures). The use of leaded fuel is forbidden in Madagascar, there are plans to replace water pipes made with lead with PVC pipes, and the investigation report provides precautionary measures for avoiding possible risks from lead paint used in houses. The investigation found that cadmium contamination could be the result of untreated industrial wastewater containing cadmium and accumulators and batteries with cadmium, or of the repetitive practice of incineration of waste that contains used accumulators and batteries with cadmium.

Malaysia

31. In Malaysia, according to the Department of Environment's premises inventory, lead is used in the paint, cosmetics and furniture industries, in newspaper production and in recycling facilities for used batteries. In addition, cadmium is widely used in the electrical and electronics, metal plating and aerospace industries. All industries are required to install air pollution control systems and to take necessary action to reduce air pollutants by implementing best environmental practices and best available techniques. Furthermore, hazardous wastes containing lead and cadmium are regulated by the Environmental Quality (Scheduled Wastes) Regulations 2005 and the acceptable levels of lead and cadmium are limited to 0.5 mg/m^3 and 0.05 mg/m^3, respectively, under the Environmental Quality (Clean Air) Regulations 2014. Unleaded petrol has been introduced and most paint manufacturers no longer use lead as paint pigment. However, the high cost of alternatives remains a challenge, especially in small and medium-sized enterprises. The use of chemical alternatives to cadmium is very limited owing to the high performance of cadmium as a coating material in the industry.

Mauritius

32. Local paint manufacturers in Mauritius do not use lead. However, some imported paints contain lead and requests have been made for draft legislation on imported paints. Mauritius has three standards for paint: gloss paint, emulsion paint and road marking paint.

Philippines

33. In the Philippines, the threshold limit of lead in paint is 90 ppm and the Chemical Control Order (CCO) has proposed the elimination of lead in paint by 2020. Threshold limits of lead in other uses – coal fire power plants, smelters, kiln operations in cement plants, melting operations in ferrous foundries, and others – have been initiated. A Priority Chemical List Compliance Certificate is required for the industry sectors to ensure proper handling, management and disposal of lead and cadmium. Emissions of lead and cadmium are controlled through the application of alternative fuels and air pollution control devices, including scrubbers, electrostatic precipitators, baghouse filters and DeSOx.

Poland

34. Poland referred to information provided in two reports, "Annex XV Restriction Report – Lead and Its Compounds in Articles Intended for Consumer Use" and "Annex XV – Proposal for Identification of a Substance as a CMR 1A or 1B, PBT, vPvB or a Substance of an Equivalent Level

of Concern – Cadmium", published by the Swedish Chemicals Agency. The documents report on the human health and environmental hazard assessments for lead and cadmium. Moreover, they provide information on alternative substances to lead in pigments, stabilizers and metallic materials for cadmium in batteries and metal coatings.

35. It also referred to the "Opinion of the Committee for Socio-economic Analysis on an Annex XV dossier proposing restrictions of the manufacture, placing on the market or use of a substance within the European Union", based on a detailed evaluation of the socio-economic benefits and costs of the proposed restrictions on lead and its compounds in articles intended for consumer use.

Russian Federation

36. The use of lead, cadmium and their compounds in paint is prohibited in residential areas in the Russian Federation. The majority of paints produced in the Russian Federation do not contain lead, and decorative paints contain low concentrations of lead and cadmium.

Togo

37. According to the national report on cadmium and lead submitted by Togo, the country decided to use only unleaded fuel from 2005. The main sources of lead and cadmium pollution are household and industrial wastes, and chemical fertilizers and pesticides used in agriculture. Concentrations of these toxic metals in the aquatic environment in Togo are higher than the tolerable thresholds. The personnel and technical capacities for carrying out research on heavy metals and for managing pollution need strengthening.

Turkey

38. Turkey has legislation on the limit values for emissions of lead and cadmium to air. However, there is no specific technique currently available to reduce heavy metal emissions. Studies on emission reduction techniques and substitutes for lead and cadmium will be carried out based on the best available techniques reference documents (BREFs).

United States of America

39. Under the Clean Air Act, the use of fuel containing lead or lead additives has been prohibited since 1996. Further, hazardous air pollutant emissions from industries, including lead emissions, are regulated by the Maximum Achievable Control Technology (MACT) standards. The standards are reviewed by the United States Environmental Protection Agency within eight years from their date of publication. The concentration of lead in the ambient air is limited by the National Ambient Air Quality Standard (NAAQS).

40. In 1978, the United States banned the use of paint containing more than 0.06 percent (600 ppm) lead by weight on toys, furniture, and interior and exterior surfaces in housing and other buildings and structures used by consumers. New standards for lead in paint and consumer products in the United States became effective in 2009. The standards now require that all children's products, including toys, and some furniture, for adults and children, must not contain a concentration of lead greater than 0.009 percent (90 ppm) in paint or any similar surface coatings. Household paint must also meet this requirement. Additionally, the United States Consumer Product Safety Commission requires, with a few limited exceptions, that any children's products manufactured after 14 August 2011 must not contain more than 100 ppm of total lead content in accessible parts.

B. Submissions from intergovernmental organizations

Organization for Economic Cooperation and Development

41. Intensive work was undertaken on risk reduction measures for lead and cadmium during the 1990s and the findings of that work are still valid in many countries.

42. The Organization for Economic Cooperation and Development (OECD) project on cadmium focused on developing a series of good practices to further support the collection and recycling of nickel-cadmium batteries, and encouraged collaboration between industry, Governments and other key stakeholders at the local, regional and international levels. The results are published in the "Proceedings of the OECD workshop on the effective collection and recycling of nickel-cadmium batteries, Lyon, France, 23–25 September 1997" (1999). Detailed information on measures undertaken by OECD member countries to reduce risks associated with exposure to cadmium can be found in "Risk Reduction Monograph No. 5: Cadmium – Background and National Experience with Reducing Risk" (1994).

43. The OECD project on lead highlighted the following risk reduction measures for lead: regulations and standards to reduce lead emissions to air, water and soil; implementation of cleaner

technology and environmentally acceptable waste treatment; abatement activities to reduce risks from exposure to historical sources of release, such as paints and water pipes; elimination of lead in products, including soldered food cans and household paints; and review of progress every few years. Implementation of the risk reduction measures lowered the average blood lead levels for the general population in OECD countries to below 10 µg/dl. Detailed information on measures undertaken by OECD member countries' to reduce risks associated with exposure to lead can be found in "Lead: Background and National Experience with Reducing Risk" (1993) and "Lead Risk Management Activities in OECD Countries from 1993 to 1998" (2000).

C. Submissions by non-governmental organizations

International Cadmium Association

44. The International Cadmium Association stated that the main sources of human exposure to cadmium are phosphate fertilizers, fossil fuel combustion, natural sources, iron and steel production, nonferrous metals production, cement manufacture, waste incineration, and production and use of cadmium products.

45. Most occupational exposure standards for cadmium in developed nations are at or below $10\mu g/m^3$ and the emission limits are well regulated. Efforts should be made to transfer the existing technology and expertise to developing countries.

46. The estimated recycling rates of industrial nickel-cadmium batteries are generally in the range of 90 per cent or above, and such batteries are being replaced with lithium-ion cells in the consumer market. The cadmium telluride solar cell industry has also adopted collection and recycling programmes for its wastes and spent modules.

International POPs Elimination Network

47. According to the statement by the International POPs Elimination Network (IPEN), most highly industrial countries have adopted regulations to control the lead content of decorative paints and paints used in applications with the possibility of lead exposure in children, based on scientific and medical findings that the major source of lead exposure in children is lead paint. Exposure to lead damages the nervous system, causing impulsive and violent behaviour. Children aged six years and under are known to be more vulnerable, and the acceptable blood lead level for children has not been determined.

48. While substitutes for lead pigments and driers are widely available, high levels of lead, reaching 10–20 per cent of the total dry weight of the paint, have been detected in decorative paints in almost all paint studies conducted in countries lacking enforced legislation in the global South.

49. Non-lead alternatives to lead pigments are available via reformulation processes. However, at present there is no publicly available comprehensive list of non-leaded pigments for use in decorative paints, which makes it challenging for smaller manufacturers to produce lead-free paint. In addition, an unwillingness to reformulate leaded paints also remains a challenge.

50. Eliminating lead in decorative paint in developing countries and countries with economies in transition is particularly important, since paint sales in most of those countries are growing rapidly. Failure to address this problem now will create high social and economic costs later.

Research and Education Centre for Development of Cameroon

51. The Research and Education Centre for Development (CREPD) reported information on a project on lead in paints carried out in Cameroon showing that 63 per cent of domestic and imported paints contain lead concentrations higher than 90 ppm, and only 9.77 per cent of the labels on these paints mention lead compounds. In terms of strengthening techniques for emissions abatement and possibly the substitution of lead in products or processes with less hazardous substances and techniques, CREPD highlighted the need to take global measures, such as prohibiting imports of paints with lead concentrations exceeding 90 ppm, in addition to strengthening national resources in developing countries for the establishment of national legislation regarding the concentration of lead in products and strengthening existing regulations for the sound management of lead-containing product streams.

52. Cadmium in dry-cell portable batteries and in plastics is also found in Cameroon.

OK International

53. OK International referred to the fact that lead battery production consumed over 80 per cent of global lead production, and to its rapid growth around the world, as lead batteries remain the most reliable and cost-effective batteries for stationary applications and are the most widely used for back-up power in data centres.

54. There have been many published articles and media reports of lead poisoning incidents in communities surrounding lead battery manufacturing and recycling facilities in many low-income and moderate-income countries. The neurotoxic and developmental impacts of lead have been well established for decades.

55. Studies show that children living near battery recycling facilities in developing countries have approximately 13 times more lead in their blood than children in the United States, and that workers in battery recycling facilities in developing countries have blood lead levels approximately three times higher than those of battery workers in the United States. Levels of lead in the air inside lead battery plants in developing countries have been shown to be seven times greater than the levels permitted by the United States Occupational Safety and Health Administration. The hazards associated with the manufacture and recycling of lead batteries should be addressed, and adequate regulations should be established, especially in developing countries.

D. Submissions by others

RSR Corporation

56. RSR Corporation responded to the UNEP request by referring to its subsidiaries operating three secondary lead smelters in the United States. RSR Corporation described how installing wet electrostatic precipitators at secondary lead smelting facilities had cut emissions of hazardous air pollutants identified as such by the United States Environmental Protection Agency under the Clean Air Act, including lead, cadmium and arsenic, by over 90 per cent. Wet electrostatic precipitators remove metallic particulate matter in process exhaust streams after they pass through upstream baghouses and scrubbers.

VinylPlus

57. The submission by VinylPlus, the voluntary sustainable development programme of the European PVC industry, referred to the European PVC industry's experience in replacing lead-based and cadmium-based stabilizers. Lead-based and cadmium-based PVC stabilizers show excellent technical performance and cost-effectiveness. However, the use of cadmium-based stabilizers has been phased out in the European Union area owing to their toxicity and possible accumulation in the body. According to the submission, barium/cadmium stabilizers have been replaced in foils by barium/zinc stabilizers. Lead-based stabilizers, on the other hand, are being progressively replaced by calcium-based stabilizers, which are used as an alternative.