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Matters for consideration or action by the Conference of the Parties: mercury-added products and manufacturing processes in which mercury or mercury compounds are used: review of annexes A and B

Review of annexes A and B

Note by the secretariat

I. Introduction

1. Articles 4 and 5 of the Minamata Convention on Mercury provide for the review of annexes A and B to the Convention no later than five years after the date of entry into force of the Convention. The Conference of the Parties to the Minamata Convention considered the matter at its third meeting and adopted decision MC-3/1 in this regard.

2. The present note presents the Convention provisions for the review of annexes A and B and the outcome of the work carried out in response to decision MC-3/1. Section II presents the provisions relevant to the review of annex A while section III presents those relevant to the review of annex B. Section IV reports on the work of the ad hoc group of experts established in decision MC-3/1 and section V reports on the outcome of the request of the Conference of the Parties in paragraph 9 of decision MC-3/1. Section VI provides an overview of the information at the disposal of the Conference of the Parties for its review of annexes A and B.

II. Review of annex A

3. Annex A to the Convention contains three sections: a list of products excluded from the annex; part I; and part II. The list specifies five categories of products that are excluded from the annex. Part I lists nine mercury-added products subject to paragraph 1 of article 4, which requires parties not to allow, by taking appropriate measures, the manufacture, import or export of such products after the specified phase-out date. Part II lists the products subject to paragraph 3 of article 4 and sets out the measures to be taken for those products. Dental amalgam is the only product listed in part II.

4. Paragraph 8 of article 4 provides that, no later than five years after the date of entry into force of the Convention, the Conference of the Parties is to review annex A and may consider amendments to that annex in accordance with article 27. Paragraph 9 provides that, in reviewing annex A, the Conference of the Parties is to take into account at least:

(a) Any proposal submitted under paragraph 7 of article 4;

* The resumed fourth meeting of the Conference of the Parties to the Minamata Convention on Mercury is to convene in person in Bali, Indonesia, and is tentatively scheduled for the first quarter of 2022.
** UNEP/MC/COP.4/1.

(b) The information made available pursuant to paragraph 4 of article 4;

(c) The availability to the parties of mercury-free alternatives that are technically and economically feasible, taking into account the environmental and human health risks and benefits.

5. Paragraph 7 of article 4 provides that any party may submit a proposal to the secretariat for listing a mercury-added product in annex A, which is to include information related to the availability, technical and economic feasibility and environmental and health risks and benefits of the non-mercury alternatives to the product, taking into account information pursuant to paragraph 4. In turn, paragraph 4 provides for the secretariat to collect and maintain information on mercury-added products and their alternatives, on the basis of information provided by parties, and to make such information publicly available, along with any other relevant information submitted by parties.

6. Paragraph 2 of article 4 provides that a party may, as an alternative to paragraph 1, indicate, at the time of ratification or upon entry into force of an amendment to annex A for it, that it will implement different measures or strategies to address products listed in part I of annex A, provided that it can demonstrate that it has already reduced to a *de minimis* level the manufacture, import and export of the large majority of the products listed in part I of annex A and that it has implemented measures or strategies to reduce the use of mercury in additional products not listed in part I of annex A. The same paragraph also provides that, no later than five years after the date of entry into force of the Convention, the Conference shall, as part of the review process under paragraph 8, review the progress and the effectiveness of the measures taken under paragraph 2.

III. Review of annex B

7. Annex B to the Convention consists of two parts. Part I lists two manufacturing processes that are subject to paragraph 2 of article 5, which requires that parties take the appropriate measures to not allow the use of mercury or mercury compounds in such processes after the specified phase-out date. Part II lists three manufacturing processes that are subject to paragraph 3 of article 5 and sets out measures that parties are to take to restrict the use of mercury or mercury compounds in those processes.

8. Paragraph 10 of article 5 provides that, no later than five years after the date of entry into force of the Convention, the Conference of the Parties is to review annex B and may consider amendments to that annex in accordance with article 27. Paragraph 11 of article 5 provides that, in reviewing annex B, the Conference of the Parties is to take into account at least:

(a) Any proposal submitted under paragraph 9 of article 5;

(b) The information made available under paragraph 4 of article 5. Paragraph 4 of article 5 provides for the secretariat to collect and maintain information on processes that use mercury or mercury compounds and their alternatives and to make such information publicly available, along with any other relevant information submitted by parties;

(c) The availability to the parties of mercury-free alternatives that are technically and economically feasible, taking into account the environmental and health risks and benefits.

9. Paragraph 9 of article 5 provides that any party may submit a proposal to amend annex B in order to list a manufacturing process in which mercury or mercury compounds are used, which is to include information related to the availability, technical and economic feasibility and environmental and health risks and benefits of the non-mercury alternatives to the process.

IV. Ad hoc group of experts

10. In decision MC-3/1, the Conference of the Parties established an ad hoc group of experts to prepare a document in which it would enhance and organize the information submitted by parties:

(a) On mercury-added products and on the availability, technical and economic feasibility and environmental and health risks and benefits of non-mercury alternatives to mercury-added products;

(b) On processes that use mercury or mercury compounds and on the availability, technical and economic feasibility, and environmental and health risks and benefits of mercury-free alternatives to manufacturing processes in which mercury or mercury compounds are used.

11. Eighteen members were nominated by the following parties through their bureau representatives: Côte d'Ivoire, Gabon, South Africa and Uganda from the African States; China, Indonesia, Iran (Islamic Republic of) and Japan from the Asia-Pacific States; European Union

(two members) and Montenegro from the Central and Eastern European States; Argentina, Guyana and Peru from the Latin American and Caribbean States; and Germany, Ireland, Norway and United States of America from the Western European and other States. The group elected Mr. Darren Byrne (Ireland) and Ms. Gwenetta Fordyce (Guyana) as co-chairs and invited eight observers who had technical knowledge to its meetings.

12. The group could not hold a face-to-face meeting due to the coronavirus disease (COVID-19) pandemic and therefore agreed to work electronically, with online meetings of the group convened by the co-chairs and thematic group calls convened by the secretariat. The group agreed to invite additional observers with specific technical knowledge to the thematic group calls.

13. In line with decision MC-3/1, the secretariat called on parties, non-parties and others to submit information described in paragraph 9 of article 4. The following nine parties submitted information: Argentina, Canada, Colombia, European Union, Montenegro, Norway, Japan, Uganda and United States. Nine non-parties and stakeholders also submitted information. All the submitted information was made available on the website of the Convention.

14. The group held 11 online meetings and 10 thematic group calls and developed a summary report, together with a compilation of submitted information on specific categories of products and processes. The summary report and the compilation were made available on the website as requested in MC-3/1. The summary report is set out in annex I to the present note and the compilation is set out in document UNEP/MC/COP.4/INF/3.

V. Information pursuant to paragraph 2 of article 4

15. In paragraph 9 of decision MC-3/1, the Conference of the Parties requested parties that submitted a notification pursuant to paragraph 2 of article 4 to report, by 30 June 2020, on the measures or strategies they had implemented to address the products listed in part I of annex A, including a quantification of the reductions achieved.

16. The secretariat received a report from the United States, which was posted on the Convention website and is set out in annex II to the present note.

VI. Overview of information at the disposal of the Conference of the Parties for its review of annexes A and B

17. Below is a summary of the information at the disposal of the Conference of the Parties for its review of annexes A and B, as per paragraph 9 of article 4 and paragraph of 11 of article 5.

Provisions	*Information*
Information pursuant to paragraph 9 (b) and (c) of article 4 and paragraph 11(b) and (c) of article 5	Annex I to the present note
Proposals from parties pursuant to paragraph 7 of article 4 and paragraph 9 of article 5	UNEP/MC/COP.4/26, UNEP/MC/COP.4/26/Add.1, UNEP/MC/COP.4/26/Add.2, UNEP/MC/COP.4/26/Add.3
Reports on the measures or strategies that a party has implemented pursuant to paragraph 2 of article 4, including a quantification of the reductions achieved	Annex II to the present note

Note: Document UNEP/MC/COP.4/5 provides the report of work on dental amalgam, as requested in decision MC-3/2.

VII. Suggested action by the Conference of the Parties

18. The Conference of the Parties may wish to take into account the information set out in the annexes to the present note, as well as the information submitted by parties as set out in documents UNEP/MC/COP.4/26, UNEP/MC/COP.4/26/Add.1, UNEP/MC/COP.4/26/Add.2 and UNEP/MC/COP.4/26/Add.3 in its review of the annexes A and B to the Convention pursuant to article 4, paragraph 9, and article 11, paragraph 5, of the Convention.

Annex I

Report on the work of the ad hoc group of experts pursuant to decision MC-3/1 on the review of annexes A and B

I. Introduction

1. The Conference of the Parties to the Minamata Convention on Mercury adopted decision MC-3/1 on the review of annexes A and B. In that decision, the Conference of the Parties requested the secretariat to call for submissions from parties, including information on mercury-added products, processes that use mercury or mercury compounds, and the availability, technical and economic feasibility and environmental and health risks and benefits of their non-mercury alternatives. The Conference of the Parties also decided to establish an ad hoc group of experts to prepare a document in which it would enhance and organize the information for each use submitted by parties, taking into account further information available to the experts, and in which it would clearly identify the sources of information.

2. The ad hoc group of experts was formed, consisting of 18 experts nominated by parties. The group elected two co-chairs and identified eight experts from non-governmental organizations and the scientific community as observers. The group also invited representatives of the United Nations Environment Programme and the World Health Organization to its meetings.

3. Decision MC-3/1 provided that the group would have one face-to-face meeting subject to the availability of resources; however, a face-to-face meeting could not be convened due to the coronavirus disease pandemic. The group agreed on an alternative arrangement for enhancing and organizing the information, involving online meetings of the group and a series of group calls with parties that submitted information and experts who have specialized technical knowledge on the specific categories of products and processes.

4. In response to the secretariat's call for information, Argentina, Canada, Colombia, the European Union, Montenegro, Norway, Japan, Uganda and the United States of America submitted information. Nepal, seven non-governmental organizations and one individual expert submitted additional information. Further information was collected from the members and the observers of the group, the parties and other stakeholders who had submitted information, and other experts identified by the group.

5. This report summarizes the outcome of the work of the group. The submitted and supplemented information, organized in a tabular format indicating the sources of information, is presented in the "compilation document" attached as an appendix to this report. As at 30 April 2021, the date by which the report on the work of the group was due, some additional information on mercury-added products, particularly on lamps, was still to be provided by experts or incorporated into the compilation document. The group will do further work to organize such additional information into the compilation document by 30 June 2021, which will be made available to the Conference of the Parties as an information document.[1]

II. Information on products

6. Part I of annex A to the Convention lists nine categories of mercury-added products subject to the general obligation of the parties not to allow manufacture, import or export after the specified phase-out date. Part II provides for measures to be taken on dental amalgam. Information submitted by parties and others on the nine product categories listed in part I, as well as on additional products not addressed by the Convention, are presented in this section. Information on the availability, feasibility, risks and benefits of non-mercury alternatives to dental amalgam was compiled following a separate decision in MC-3/2 and is therefore not included in this report.

[1] The compilation of information, which in the report is provided in an appendix, is not included here but is set out in document UNEP/MC/COP.4/INF/3 for the consideration of the parties.

A. Batteries

1. Information on the use of the product

7. Annex A to the Convention lists batteries, except for button zinc silver oxide batteries and button zinc air batteries with a mercury content of less than 2 per cent. Information was provided to the expert group on three types of button cell batteries that contain mercury: zinc air, silver oxide and alkaline. These batteries contain mercury in small amounts (typically 0.1–2 per cent) to prevent the build-up of hydrogen gas. The two exempt batteries, silver oxide and zinc air batteries, are generally used for powering high-drain devices such as watches and hearing aids.

2. Availability of mercury-free alternatives

8. All stakeholders agree that mercury-free alternatives are commercially available for all applications of the main types of button cell batteries (silver oxide, alkaline and zinc air) and have been available from major battery manufacturers since the late 1990s and early 2000s. All members of the battery associations of Japan, Europe, North America and Latin America have ceased the manufacturing of mercury-added button cell batteries and supply mercury-free alternatives. Indonesia stated that one of the four manufacturers in that country still uses mercury in dry cell batteries but that conversion to mercury-free alternatives is in progress.

9. An industry association also informed the expert group that mercury-free alternatives are available in China, India and Africa. China notified the World Trade Organization in their notification G/TBT/N/CHN/1503 dated November 2020 to the effect that China intends to limit the mercury content of all button cells to 0.0005 per cent. India relies upon imports, principally from China and European Union manufacturers, for non-mercury silver oxide and zinc air button cells, respectively. Africa relies upon imports as well, primarily from Europe, the United States and Japan.

3. Feasibility of alternatives

10. Information was provided on the availability of mercury-free alternatives to button cells and their performance parameters, such as self-discharge, leak resistance, capacity and pulse capability. Such information indicates that the technical performance of mercury-free alternatives is comparable to or better than traditional mercury-added button cells. Literature in 2012 showed that mercury-free alternatives cost approximately 10 per cent more than mercury-added cells. The Battery Association of Japan also reported on an increased cost of mercury-free button cells due to initial capital investments, which was alleviated by cost-recovery with increased production and no longer applies. There are economic benefits to waste collectors and recyclers from mercury-free alternatives, in the form of a 30–40 per cent lower cost of recycling button cell waste batteries.

4. Environmental and health risks and benefits of alternatives

11. No information was provided on the environmental or health risks of mercury-free alternatives.

B. Switches and relays

12. Part I of annex A to the Convention lists switches and relays, except very high-accuracy capacitance and loss measurement bridges and high-frequency radio frequency switches and relays in monitoring and control instruments with a maximum mercury content of 20 mg per bridge, switch or relay.

13. A number of countries reported on the use of exempted or allowed uses of mercury switches and relays. Japan reported that it could not confirm the domestic manufacturing of such exempted switches and relays. The United States reported on the use of mercury and mercury compounds in switches, relays, sensors and valves in the 2018 reporting period under the mercury inventory reporting rule. Canada reported that it is considering removing the exemption in its regulations for high-frequency radio frequency switches and relays due to the fact that there were no imports of these products in 2016.

14. The expert group noted that mercury-added thermostats used to control room temperature use a mercury-added switch to turn on and off heating and cooling equipment, and thus the switch is the sole mercury-added component of the product. Parties may therefore be considering such thermostats for inclusion under the listing of switches and relays in annex A. On the other hand, as a thermostat is used to measure room temperature, other parties may consider such products a measuring device. Annex A does list a number of measuring devices, but differentiates between electronic and

non-electronic measuring devices. As these particular kinds of thermostats are electronic, other parties may not be considering such switches and relays for inclusion in the products listed in annex A.

C. Lamps

1. Information on the use of the product

15. Annex A to the Convention lists and restricts compact fluorescent lamps (CFLs) and linear fluorescent lamps (LFLs) for general lighting purposes, and cold cathode fluorescent lamps and external electrode fluorescent lamps (CCFLs and EEFLs) for electronic displays with mercury content higher than specified thresholds. The annex also lists and restricts high-pressure mercury vapour lamps (HPMVs), which is one type of high-intensity discharge (HID) lamp, for general lighting purposes. The primary mercury-free alternatives to mercury-containing lamps for general lighting purposes are light emitting diodes (LEDs).

16. Information was submitted for fluorescent lamps listed in annex A and those not listed there, HID lamps not listed in annex A (i.e., high-pressure sodium lamps and metal halide lamps), and non-fluorescent low-pressure discharge lamps.

17. A fluorescent lamp is a low-pressure mercury-vapour gas-discharge lamp that uses fluorescence to produce light. An electric current in the gas excites mercury vapour, which produces short-wave ultraviolet light that is then converted by the phosphor coating inside the lamp to visible wavelengths. Fluorescent lamps require a ballast to regulate the current through the lamp. Fluorescent lamps are available in different shapes, including compact fluorescent lamps (CFL) and linear fluorescent lamps (LFLs). In CFLs, the ballast can either be integrated into the lamp (CFL.i) or separated from the lamp (CFL.ni). CFL.i are screw-based lamps that can be directly connected to mains-voltage lightbulb sockets. CFL.ni and LFL can only operate safely in combination with specific dedicated luminaires, which contain a matching driver or ballast. Most fluorescent lamps use electrodes that emit electrons by heat, known as hot cathodes, but cold cathode fluorescent lamps (CCFLs) have cathodes that emit electrons only due to the large voltage between the electrodes. Most fluorescent lamps have electrodes inside the glass tube, but external electrode fluorescent lamps (EEFLs) consist of a sealed glass tube containing mercury and external electrodes.

18. High-intensity discharge (HID) lamps are a wide range of lamp families, including types such as high-pressure mercury vapour, metal halide (MH) and high-pressure sodium (HPS) lamps. They produce light of extremely high intensity and are used for general lighting purposes (e.g., city streetlighting, sports facilities and entertainment) and for other applications.

19. Non-fluorescent low-pressure discharge lamps produce ultraviolet light. They are designed for applications in areas such as healthcare (e.g., therapy) and industry (e.g., water / wastewater disinfection and chemical and biological processes).

2. Alternatives to fluorescent lamps

20. In the opinion of the expert group, retrofit LED lamps as well as LED luminaires are alternatives to the large majority of CFL and LFL lamp types for general lighting purposes. The group noted that it is technically and economically feasible to retrofit LEDs for CFL.i. While in 2015 some retrofit products may have not provided the same light intensity, brighter LEDs are available today. Currently, the technical feasibility is lower for CFL.ni. In terms of cost, one country stated that LEDs have a larger upfront cost than CFL.i but it, like many other countries, believes that this cost is outweighed by higher energy-efficiency and longer product life. It was observed that the cost of LEDs has continuously declined over the last decade. For example, the payback period to replace CFL.ni with LEDs is 1.3–3 years. Various submissions reported that placing CFL.i on the market will be banned or is being phased down in many countries in Africa, Asia and Europe.

21. The expert group received diverging information on the availability of LED retrofit lamps for existing CFL.ni and LFL fixtures. Recent studies were presented indicating that a large majority of CFL.ni and LFL fixtures could receive LED retrofit lamps. On the other hand, industry associations pointed out that the replaceability may be somewhat lower due to incompatibility of LED products with some drivers in existing fixtures and because comparable efficiencies and life-time quality are sometimes not available; however, the expert group noted that the market is developing dynamically and retrofit LEDs to replace CFL.ni may become more widely available in the near future. To avoid quality and safety issues in the application, advice from professional installers is recommended before a replacement is undertaken and rewiring or replacing the luminaire may be necessary. A regional group reported that significant net savings were calculated from phasing out CFL.ni and T5 and T8 LFL lamps. Several studies have demonstrated significant cost savings from replacing CFL.i and

CFL.ni with LEDs, although there is disagreement on the exact amount of the savings and the length of the payback period.

22. Halophosphate LFLs can be replaced by triband phosphor lamps, which have a significantly lower mercury content, and/or by LEDs. Experts reported that halophosphate lamps are cheaper than triband phosphor lamps, but they have substantially lower lifetimes and are less energy-efficient. Halophosphate lamps have been phased out in many countries for more than a decade, but are still found in certain markets.

23. According to several submissions, LEDs have replaced CCFLs and EEFLs in the backlighting of flat-panel displays. LEDs are more energy-efficient, have longer lifespans and are produced for comparable costs when compared to CCFLs and EEFLs. CCFLs and EEFLs are still produced in limited numbers for replacement in certain control instruments (e.g., flight instrumentation displays) and for special-purpose applications in the chemical, biotechnical and vaccine industries.

24. Fluorescent lamps used for special purposes include products with distinct application features that are achieved by special design/specifications, materials and process steps. In comparison with other fluorescent lamps, their market share is rather small. LED alternatives are currently in development, but for many applications there are currently no mercury-free lamps available.

3. Alternatives to high-intensity discharge lamps

25. A wide range of HID lamp technologies, fixtures/drivers and applications exists. The group was informed that LED lamps are available for many indoor and outdoor general lighting applications where previously mainly HID lamps were used. The group took note of reports that HID lamps in new vehicles have been entirely or largely replaced by LED lamps in many countries and by many major automakers. LED lamps are also gaining market share in outdoor lighting. One large country in Asia is in the process of replacing most of their HID streetlights with LED fixtures. While one country noted that upfront costs for installing high-pressure sodium lamps can still be lower than for LEDs, lifespan costs for LEDs are lower considering the reduced maintenance and energy-efficiency improvements. Upfront costs for LEDs and metal halide lamps are now very close, and LEDs are more energy-efficient. Divergent information was presented regarding the extent to which HID lamps can be retrofitted with LED lamps in existing installations. A number of experts agree that LEDs can replace many types of HID lamps. Industry associations pointed out that mercury-containing HID lamps in existing installations may not be simple to replace, because, for instance, LED retrofit lamps have a higher weight, need more space or have compatibility issues. In such cases, the entire luminaire may need to be replaced.

4. Alternatives to non-fluorescent low-pressure lamps

26. The expert group was informed that ultraviolet (UV) LEDs have entered the market but are more costly and less energy-efficient than mercury-containing lamps. So far, UV LED lamps are only available for a limited range of applications.

5. Environmental and health risks and benefits of alternatives

27. The experts agreed that LEDs are a mercury-free and, in most cases, more energy-efficient alternative to mercury-containing fluorescent lamps. Improvements and new technologies for LEDs continue to be developed. An expert reported an estimation that if CFLs and LFLs were to be phased-out globally, several dozens of tonnes of mercury could be saved in a 10-year period. Due to lower energy consumption, further mercury emissions from coal-fired power stations could also be avoided. The expert group was informed of the phase-out of halophosphate lamps in a regional group of countries that had resulted in 53 per cent less mercury per lamp. Regarding end-of-life management, it was recommended that the copper and nickel content of LEDs be considered. The group was also informed that although there are no recent life cycle analysis studies comparing LFLs and LEDs, the life cycle impact of CFLs and LEDs were shown to be equivalent as early as 2012.

D. Non-electric measuring devices

28. Annex A to the Convention lists barometers, hygrometers, manometers, thermometers and sphygmomanometers, except those installed in large-scale equipment or those used for high-precision measurements, where no suitable mercury-free alternative is available.

29. Japan provided information on the continuing need for mercury-containing barometers and pressure gauges for reference standard and calibration. Argentina, supplemented by other experts, submitted information on the continuing need for the use of mercury in high-precision thermometers

and the measurement of temperatures greater than 150 °C. Information was provided by experts on the use of mercury in pyrometers, a type of remote-sensing thermometer used to measure the temperature of distant objects. Mercury pyrometers are no longer manufactured in the United States and Europe and have been replaced by infrared pyrometers, hence the technical and economic barriers do not appear to be a significant factor.

30. A country, supplemented by an expert, submitted information on hydrometers, which are used for measurement of relative density of liquids based on the concept of buoyancy. A hydrometer usually consists of a sealed hollow glass tube with a wider bottom portion for buoyancy, a ballast such as lead or mercury for stability, and a narrow stem with graduations for measuring, and can contain several grams of mercury, depending on the product type, measuring range and volume of the hydrometer. Mercury-free alternatives include hydrometers filled with lead or other high-density materials, and electric devices.

31. A country, supplemented by an expert, submitted information on flowmeters, which are used in water and sewage treatment plants, power stations, public water supply facilities and other industrial applications to measure the flow of gas, water, air and steam. A mercury flow meter can contain as much as five kilograms of elemental mercury, and mercury is typically encased in a manometer attached to an assembly or pipe system. Mercury-free alternatives include digital, optical and ball-actuated flow meters.

32. Information was also submitted with respect to strain gauges and tensiometers. Strain gauges are used to measure blood flow and blood pressure. Indium-gallium strain gauges are the main alternatives to mercury strain gauges. Photocell and doppler techniques are typically used for measurements of blood pressure in fingers and toes, for the case in which indium-gallium gauges are not suitable. Tensiometers are used to measure the surface tension of liquids, used in applications such as the determination of soil moisture tension, or for measuring tension in wire, fibres and beams. The potentially mercury-containing component of a tensiometer is a manometer. It is linked via a capillary tubing to a water-filled tube with a porous cup. If inserted into soil, water from the tube may be sucked into the soil, thus producing a vacuum that is measured by the manometer.

E. Other electric devices

1. Slip rings

33. A mercury slip ring is a device that provides 360-degree rotations to transmit signals and power between the stator (stationary) side and rotor side of different industrial equipment. This product uses mercury, a liquid at normal temperatures, as a conductor to transfer current and signals.

34. The expert group was informed that there are many manufacturers of mercury-free slip rings, which are widely available in all shapes and sizes. An industry association identified specific medical devices in which mercury-containing slip rings could not be replaced.

2. Reference electrodes

35. The expert group reviewed information on reference electrodes. Reference electrodes are used in electrochemical measurements, allowing the control of the potential of a working electrode or the measurement of an indicator electrode. Mercury-containing reference electrodes include calomel (Hg/Hg_2Cl_2), mercurous sulphate (Hg/Hg_2SO_4) and mercuric oxide (Hg/HgO) electrodes. The calomel electrode was widely used for pH measurements, while the mercurous sulphate electrode is used for other potentiometric measurements such as silver halides and chemical oxygen demand titrations and chemical oxygen demand titrations.

36. Non-mercury alternatives include standard hydrogen electrodes, silver chloride electrodes and proprietary electrode systems. At least for the vast majority of fluids to be measured (pH 1–14, aqueous and non-aqueous, presence or absence of chloride), these types allow reliable and traceable measurements of pH as well as other solution properties. Mercury-free measuring devices are also available for the monitoring of strong alkaline solutions (pH >14).

37. Silver/silver chloride electrodes have replaced mercury chloride electrodes in most applications but cannot replace low chloride, mercury sulphate or mercury oxide electrodes.

3. Infrared detectors

38. An infrared detector is a device for the measurement of electromagnetic radiation with wavelengths longer than those of visible light (700 nm to 1 mm). They are used in many civilian and military applications, such as thermal efficiency analysis, remote temperature sensing, short-range

wireless communication, moisture measurement, spectroscopy, astronomy, target acquisition, surveillance and night vision. Mercury-containing infrared detectors use semiconductors whose electrical resistance decreases with increasing radiation. Among them, mercury cadmium telluride (MCT) is the commercially most important material type. It is a mixture of mercury telluride (HgTe) and cadmium telluride (CdTe). Changing the mixing ratio allows optimization of the sensitivity at certain wavelengths. That is why MCT detectors, unlike other systems, can cover quite a broad spectral range (2–16 µm) that includes spectral ranges that are poorly covered by other semiconductor types, especially in the short wave and medium wave infrared spectrum. Detectors typically contain from 10 to 500 mg of MCT.

39. Depending on the application, several mercury-free types of infrared detectors are available, including: InGaAs (indium gallium arsenide), InAs/GaInSb (indium arsenide/gallium antimonide), InSb (indium antimonide), SiAs (silicon arsenide), PbSe (lead selenide), InSb (indium antimonide), SiSb (silicon antimonide) and SiGe (silicon germanium). Detectors may also use a combination of the different types of technologies. New high-performance infrared detectors are also using emerging technologies based on nanomaterials, including graphene. At least one regional group has exemptions in its domestic legislation for the use of mercury or cadmium in infrared detectors.

40. Information was also provided by experts on the potential use of mercury iodide (HgI_2) in detectors for other radiation, such as gamma rays; however, no information was found on the presence of such detectors on the market.

4. Melt pressure transducers, transmitters and sensors

41. Melt pressure transducers, transmitters and sensors enable accurate pressure measurements to be made, enhancing product quality and limiting damage to equipment. In melt pressure transducers, pressure transmission occurs in a closed capillary system filled with a transmission medium (i.e., mercury). The system is designed to transfer the pressure exerted on the diaphragm to the transduction feature (i.e., upper diaphragm with the strain gauge). The strain gauge then converts the physical pressure into an electric signal. In cases of excess pressure during extrusion, this process enables transducers to ensure safety by switching off extruder driving systems when defined pressure limits have been exceeded.

42. Although mercury devices are still on the market, a number of alternative transmission mediums exist. The two key alternatives to the use of mercury as a transmission medium are silicon oil and sodium-potassium alloy (NaK). The latter is capable of transferring pressure with comparable quality to mercury. Some companies have also developed sensors that do not require a transmission fluid; instead, pressure is transferred to a silicon element through a diaphragm. Mercury-free alternatives are technically feasible and already commercially available. Due to increasing pressure from a number of domestic regulatory authorities, several manufacturers already produce mercury-free alternatives.

5. Mercury vacuum pumps

43. A Sprengel pump is a form of non-electric vacuum pump that uses drops of mercury falling through a small-bore capillary tube to trap air. Another type of mercury-containing vacuum pump is electrical mercury diffusion pumps, which use the principle that a jet of heavy gas vapour directs (lighter) gas molecules in the pump throat down into the bottom of the pump and out the exhaust.

44. The main alternatives to mercury vacuum pumps are positive displacement pumps, which use a mechanism to expand a cavity, causing gases to flow in from the chamber that is to be extracted, after which the chamber is sealed and gases are exhausted. Those alternatives are technically and economically feasible.

F. Other non-electric products

45. Specialized silver halide photographic papers and motion picture and X-ray films may contain trace amounts of mercury in order to reduce the formation of an unwanted background image during processing, but mercury has now been replaced in silver halide photographic papers and films.

46. Canada also submitted information on mercury-containing counter balancers, including tire balancers or wheel weights. A number of parties have prohibited their use. The mercury-added products are being replaced by alternatives such as non-liquid wheel weights made of tin, steel or polymer composites.

G. Cosmetics

47. Annex A to the Convention lists cosmetics with a mercury content above 1 ppm, not including eye area cosmetics where mercury is used as preservative and no effective and safe substitute preservatives are available.

48. Mercury concentrations in eye makeup cosmetics vary depending on the product but usually do not exceed 1 ppm. Thiomersal is no longer used by the European and United States cosmetics industry. Non-mercury alternatives include phenoxyethanol, methylisothiazolinone, parabens, benzoic acid, sorbic acid, honey and sea salt. Some companies also use sterilization and replacement of water with a gelled substitute as an alternative to preservatives.

H. Pesticides, biocides and topical antiseptics

49. Annex A lists pesticides, biocides and tropical antiseptics. No information was submitted on the continued use of mercury in these product categories.

I. Satellite propulsion

50. Information on the potential use of mercury as a propellant for ion thrusters (ion engines) for satellites and spacecrafts was provided by a number of stakeholders, supplemented by individual experts from the space industry.

51. Ion thrusters are used for spacecraft propulsion to create thrust by accelerating ions using electricity, which ionize a propellant by adding or removing electrons to produce ions. According to published articles, mercury has been used as a satellite propellant in the past. Concerns related to mercury toxicity led to its abandonment. Potential risks associated with re-using mercury as a propellant for ion thruster were provided. According to available information, a thruster may contain up to 20 kg of mercury. Plans to launch several hundreds of satellites within a few years could lead to a release of up to 20 tonnes of mercury in orbit.

52. Although mercury is one of the cheapest and easiest-to-store propellants for electric propulsion, the group of experts pointed out the environmental and health risks of mercury use for ion thrusters, such as the risk of spillage and contamination on the ground and emissions of mercury in orbit. Considering typical failure rates for rocket launches, there is a risk of depositing high amounts of mercury directly on Earth, around the launch sites or in the oceans. An expert explained that mercury used as a propellant will possibly be expelled in the low earth orbit and exhausted mercury is likely to travel back to Earth's atmosphere and eventually to the surface of the Earth over several years.

53. Alternatives to mercury-based propellants are available and have been used for many years, including xenon (Xe), krypton (Kr), argon (Ar), neon (Ne), helium (He), hydrogen (H_2), iodine (I_2), buckminsterfullerene (C_{60}), adamantane ($C_{10}H_{16}$) and air (nitrogen/oxygen).

III. Information on processes

54. Part I of annex B lists two manufacturing processes, namely chlor-alkali production and acetaldehyde production, that are subject to the obligation of parties not to allow the use of mercury or mercury compounds in such processes after the specified phase-out date. Part II lists three manufacturing processes, namely vinyl chloride monomer production, sodium or potassium methylate or ethylate production and polyurethane production, and sets out measures that parties are to take to restrict the use of mercury or mercury compounds in those processes. Except for acetaldehyde production, information was received for all these processes, along with information on other processes in which mercury or mercury compounds are used.

Chlor-alkali production

55. Part I of annex B to the Convention lists chlor-alkali production as a process subject to the obligation of parties not to allow the use of mercury after the specified phase-out date. Some countries submitted information on their plan for phasing out the mercury-cell chlor-alkali process.

A. Other processes using mercury as electrodes

56. Apart from the chlor-alkali and alcoholates production processes, mercury electrodes are also found to be used in the production of sodium dithionite and production of alkali metals. Montenegro has developed a rulebook that prescribes its conditions of use and release of mercury, mercury

compounds and mixtures of mercury in these production processes. A number of parties have taken or will take measures that effectively prohibit all remaining processes using mercury as an electrode.

B. Vinyl chloride monomer production

57. Part II of annex B to the Convention lists vinyl chloride monomer (VCM) production and sets out measures that parties are to take to restrict the use of mercury or mercury compounds in the process, including not allowing the use of mercury five years after the Conference of the Parties has established that mercury-free catalysts based on existing processes have become technically and economically feasible.

58. VCM is an industrial chemical mainly used in the production of polyvinyl chloride (PVC), which is used as building material and in household products. In the acetylene process where mercury is used, coal-derived coke is heated with calcium carbonate to produce calcium carbide, which is then hydrolysed to create acetylene. Acetylene is then reacted with hydrogen chloride using mercury(II) chloride ($HgCl_2$) as a catalyst to produce vinyl chloride, which is then polymerized to create PVC.

59. Although there are a select number of VCM facilities using mercury in the European Union, Russia and potentially a limited number of other countries, the vast majority of this production is in China. China reported that, for calendar years 2017–2018, mercury use was in the range of 700–820 tonnes at 69 facilities. Approximately 20 tonnes of catalyst containing 10 per cent by weight of mercury chloride (2 tonnes) is consumed annually in the only plant within the European Union, which is required to cease the use of mercury as a catalyst by January 2022.

60. Except for a limited number of countries, VCM production does not involve mercury catalysts because ethylene is used as the hydrocarbon feedstock. Ethylene is produced from petroleum or natural gas, while acetylene is produced mainly from coal although it can also be produced from natural gas. There is ongoing research on using alternative catalysts in the production of VCM using acetylene, most notably gold catalysts, which have been demonstrated to have comparable catalytic efficiency to commercial mercury catalysts. Other alternative catalysts include nitrogen-doped activated carbon, copper and ruthenium.

61. There is a five-year project under way with Global Environment Facility funding of over $16 million for the reduction and minimization of mercury in PVC production in China. This project is scheduled to be completed in 2022. It includes an expert panel established to review the mercury-free VCM production technologies, and at least two mercury-free VCM production technologies have been evaluated.

C. Production of polyurethane

62. Part II of annex B to the Convention lists production of polyurethane using mercury-containing catalysts and sets out measures that parties are to take to restrict the use of mercury or mercury compounds in the process, including aiming at the phase-out of this use as fast as possible, within 10 years of the entry into force of the Convention. Unlike other processes listed in annex B, there is no prohibition on new facilities for polyurethane production.

63. In the formation of polyurethane, mercury catalysts are used in the reaction between a polyol and an isocyanate component. During the reaction, mercury catalysts enable a long induction period, followed by a rapid reaction for curing the product. The catalyst tends to be present in the polyol component. The mercury catalyst is integrated into the polymer and remains present in the final polyurethane product. Over time, and accelerated by exposure to such things as harsh environments, UV and abrasion, the polymer structure breaks down and mercury is likely to be released.

64. Viable substitutes for mercury catalysts are already in use for over 95 per cent of polyurethane elastomer systems and have been in use for many years, as attested to by regulations and information from Japan, the United States and the European Union, where only non-mercury alternatives are used. The cost of mercury-free catalysts is comparable to the cost of mercury catalysts. Tin and amine catalysts are alternatives to mercury catalysts for some polyurethane elastomer applications and titanium and zirconium compounds have been introduced for others, while bismuth, zinc, platinum, palladium, hafnium and other compounds are marketed for still others.

D. Other processes using mercury-containing catalysts

65. Apart from VCM and polyurethane production, mercury catalysts may also be used to promote a large range of chemical reactions in production processes, such as in producing 1-aminoanthraquinone and anthraquinone derivates, vinyl acetate and keto acids. There are substitutes available for the use of mercury in polymer production processes, such as catalysts based on zinc and palladium. A regional group reported that they have banned processes that use mercury-containing catalysts.

E. Other processes

66. Another expert submitted information on the use of mercury in gold plating / fire gilding in some countries, and electroplating as a mercury-free alternative.

Annex II

Report for 2020 from the United States of America in response to paragraph 9 of decision MC-3/1

Information on domestic measures and strategies implemented to address mercury-added products and quantifications of reductions achieved

1. Article 4, paragraph 2, of the Minamata Convention on Mercury (the Convention) permits a party to indicate, at the time of ratification or upon entry into force of an amendment to annex A for it, that it will implement different measures or strategies to address products listed in part I of annex A, as an alternative to article 4, paragraph 1. The same provision states that "No later than five years after the date of entry into force of the Convention, the Conference of the Parties shall, as part of the review process under paragraph 8, review the progress and the effectiveness of the measures taken under this paragraph." Below please find the contribution of the United States of America towards the requisite information for the aforementioned review process, as requested in paragraph 9 of decision MC-3/1.

2. Consistent with article 4, paragraph 2, of the Convention, the United States indicated at the time it joined the Convention that it would implement different measures or strategies to address products listed in part I of annex A. The United States also demonstrated at that time, consistent with article 4, paragraph 2, that it had already reduced to a *de minimis* level the manufacture, import and export of a large majority of the products listed in part I of annex A, and that it had implemented measures and strategies to reduce the use of mercury in additional products not listed in part I of annex A. Such information was presented by the United States in a notification submitted at the time of its acceptance of the Convention in October of 2013 (2013 notification), which can be found at: http://www.mercuryconvention.org/Countries/Parties/Notifications/tabid/3826/language/en-US/Default.aspx.

3. Through a multifaceted approach, including national and subnational legislation, regulation and public-private partnerships, the United States dramatically reduced use of mercury in products by over 97 per cent between 1980 and 2007, and the projected demand for and use of mercury in products remains in decline within the United States. As a result of the 2016 Frank R. Lautenberg Chemical Safety for the 21st Century Act, which amended the earlier Toxic Substances Control Act, the United States Environmental Protection Agency (EPA) is now required to collect information directly from producers, users and importers of mercury and mercury products in order to publish a mercury inventory every three years (see 15 USC 2607(b)(10)).[1] EPA published its initial mercury inventory in 2017 using only information that was publicly available at that time. The first inventory report using the information received directly from producers, users and importers of mercury and mercury products (as required by the federal mercury inventory reporting rule (see 40 CFR Part 713))[2] was published in March of 2020 (see https://www.epa.gov/sites/production/files/2020-03/documents/10006-34_mercury_inventory_report.pdf).

4. The United States is therefore now able to use data reported under the mercury inventory reporting rule and EPA national mercury inventory to identify key data points related to the production, use, import and export of mercury and mercury-added products.

5. At the time of the United States acceptance of the Minamata Convention in 2013, the United States compared data for the use of mercury in annex A products for the years 2001 to 2007 (data from the 1980 estimate was not able to be broken down among the annex A products). With the data collected via the 2018 national mercury inventory reporting rule, the United States is able to compare data for the years 2001 to 2018.

6. The initial comparisons compared United States and global content and consumption estimates among itemized annex A categories. Given that the United States demonstrated in its 2013 submission that it had met the article 4(2) *de minimis* standard for all products listed in annex A, part I, with the exception of switches and relays, and that United States data from its 2020 mercury inventory report continue to show consistent, overall declines in domestic content and consumption of mercury in mercury-added products, the comparisons below are presented for United States totals only and in the

[1] USC refers to "United States Code".

[2] CFR refers to "Code of Federal Regulations".

overarching annex A product categories (e.g., lamps, measuring devices). Measures to reduce mercury use in switches and relays are addressed further below.

Estimated mercury content/consumption by product category

Electrical/Electronic Equipment (i.e., Switches/Relays)		
2001	67.8 metric tons	
2007	30.5 metric tons	(Δ 2001–2007: -55 per cent)
2018	4.0 metric tons	(Δ 2001–2018: -94 per cent); (Δ 2007–2018: -87 per cent)
Lamps		
2001	9.7 metric tons	
2007	9.7 metric tons	(Δ 2001–2007: 0 per cent)
2018	1.8 metric tons	(Δ 2001–2018: -81 per cent); (Δ 2007–2018: -81 per cent)
Batteries		
2001	2.5 metric tons	
2007	1.9 metric tons	(Δ 2001–2007: -24 per cent)
2018	<0.1 metric tons	(Δ 2001–2018: -96 per cent); (Δ 2007–2018: -95 per cent)
Measuring Devices		
2001	4.6 metric tons	
2007	1.0 metric tons	(Δ 2001–2007: -78 per cent)
2018	0.3 metric tons	(Δ 2001–2018: -94 per cent); (Δ 2007–2018: -70 per cent)
Dental Amalgam		
2001	27.9 metric tons	
2007	18.1 metric tons	(Δ 2001–2007: -35 per cent)
2018	4.2 metric tons	(Δ 2001–2018: -85 per cent); (Δ 2007–2018: -77 per cent)

7. With respect to the annex A categories of cosmetics and pesticides, biocides and topical antiseptics, the EPA 2020 national mercury inventory (based on 2018 data) reported no manufacturing, import or export for those product categories.

8. In accordance with the obligation under paragraph 2 (a) of article 4 to report to the Conference of the Parties at the first opportunity a description of the measures or strategies implemented, including a quantification of the reductions achieved, the United States provided significant detail with respect to such measures, strategies and quantifications that address mercury-added products – both for those products listed in the Convention and additional products not listed in the Convention – in its 2013 notification. Because many of the statutes and regulations listed in that notification remain in force, the United States incorporates that notification by reference into the present report, as applicable to annex A products (e.g., automobile switches, barometers, manometers, hygrometers, lamps and batteries), as well as other mercury-added products (e.g., flow meters, pyrometers, toys and children's jewellery). The additional measures and strategies below, which reflect data and quantifications in the 2020 mercury inventory, highlight further significant actions taken, but are illustrative, and not necessarily comprehensive, in nature.

9. In June 2017, EPA also promulgated technology-based pretreatment standards to reduce discharges of mercury from dental offices into publicly owned treatment works (POTWs). (Dental offices discharge mercury present in amalgam used for fillings. Amalgam separators are a practical, affordable and readily available technology for capturing mercury and other metals before they are discharged into sewers that drain to POTWs. Once captured by a separator, mercury can be recycled.) The Dental Office Category regulation, codified at 40 CFR Part 441, requires dental offices to comply with requirements based on practices recommended by the American Dental Association, including the use of amalgam separators. EPA expects compliance with this final rule will annually reduce the discharge of mercury to POTWs by 5.1 tons, as well as other metals found in waste dental amalgam by 5.3 tons.

10. In addition, EPA has implemented the following measures and strategies:

September 2014: Published the EPA Strategy to Address Mercury-Containing Products, which was intended to: (1) provide a better understanding of the continuing uses of mercury in such products and processes; and (2) assist the United States to implement obligations under the Minamata Convention (https://www.epa.gov/mercury/epa-strategy-address-mercury-containing-products-2014).

March 2015: Issuance of subpoenas to primary United States recyclers/retorters of elemental mercury to obtain information on manufacture, import, export and other trade data.

August 2016: Publication of a list of five mercury compounds that are prohibited from export effective 1 January 2020 (81 Fed. Reg. 58926,[3] 26 August 2016; see also 15 USC 2611(c)(7)).

March 2017: Publication of the initial inventory report of mercury supply, use and trade in the United States (https://www.regulations.gov/document?D=EPA-HQ-OPPT-2017-0127-0002; see also 82 Fed. Reg. 15522, 28 March 2017).

June 2018: Publication of the mercury inventory reporting rule, which established the reporting requirements that supports the 2020 and subsequent triennial inventories (83 Fed. Reg. 30054, 27 June 2018; see also 40 CFR Part 713).

March 2020: Publication of the inventory of supply, use and trade of mercury in the United States (https://www.epa.gov/mercury/2020-mercury-inventory-report; see also 85 Fed. Reg. 18574, 2 April 2020).

11. To accompany these efforts, EPA created and issued outreach materials (https://www.epa.gov/mercury/resources-mercury-inventory-reporting-rule), including a compliance guide for the mercury inventory reporting rule and webinars to explain the reporting requirements and how to use its electronic reporting application. The compliance guide is available at: https://www.epa.gov/sites/production/files/2019-05/documents/reporting_requirements_for_the_mercury_inventory_final.pdf. The corresponding webinars can be found at: https://www.epa.gov/mercury/webinars-mercury-inventory-reporting-rule-0.

12. While these materials were designed to foster the implementation of reporting for the national mercury inventory, the topics covered included background information on mercury-added products and manufacturing processes, as well as the regulatory and market history of mercury manufacture, import and export in the United States.

13. This information will also be provided by the United States at the first full reporting period of the Convention.

14. The United States indicated in its 2013 notification that although significant domestic reductions had been made, switches and relays was the only product category of the nine listed in part I of annex A of the Convention for which there were insufficient data available to fully assess whether United States manufacture, import and export was or was not *de minimis*. The United States was not able at that time to separate out data on switches and relays that are covered under annex A from data on switches and relays that are excluded from the scope of annex A, such as products for use in refurbishment and replacement parts. As the United States moves ahead with clarifying national mercury inventory data reported in 2018 for switches and relays, such details will be provided to the secretariat at the earliest opportunity.

15. Domestically, specific measures and strategies to address switches and relays have been put in place, such as the National Vehicle Mercury Switch Recovery Program (NVMSRP), a collaboration for reducing mercury air emissions initially designed by EPA and industry stakeholders in 2006. Most recently, a memorandum of understanding was renewed on 15 November 2018, between EPA and 44 signatories, including the Steel Manufacturers Association, the American Iron and Steel Institute, the End of Life Vehicle Solutions Corporation, the Automotive Recyclers Association and the Institute of Scrap Recycling Industries. Involving more than 10,000 recyclers, the NVMSRP has removed and safely recycled more than 6.8 million mercury switches, containing a total of more than 7.6 tons of mercury. By diverting the switches from the waste stream, the programme also has prevented the release of mercury into the atmosphere. The program was set to expire in 2017; however, given its effectiveness, EPA and its partners extended it to 2021.

16. In addition, the 2016 Frank R. Lautenberg Chemical Safety for the 21st Century Act required the publication of an initial national mercury inventory in 2017, which resulted in better data from and outreach to mercury switch manufactures and importers in its 2020 iteration. As shown in the data comparisons above, there has been a consistent decline in the amount of mercury used for electronic/electrical equipment (i.e., switches and relays) in the United States. At this time, the United States is conducting additional outreach to several manufacturers of mercury-added switches and relays, as well as for dental amalgam and a few other products, to ensure that totals reported for 2018 are accurate. Reported totals will be updated as appropriate. The United States views such interactions with industry as part of its ongoing efforts not only to better understand where mercury is still used to manufacture certain switches and relays but also to encourage the development of effective alternatives.

[3] Fed. Reg. refers to “Federal Registry”.

17. In addition to the measures described above, the United States continues to consider additional measures to achieve further reductions, pursuant to article 4, paragraph 2 (c). As noted in its 2020 mercury inventory report, EPA was required to identify products and manufacturing processes with intentionally added mercury and make recommendations for actions to further reduce mercury use. In the report, EPA listed numerous products and manufacturing processes commonly known to coincide with annex A product categories (e.g., batteries, lighting, measuring devices). In addition, EPA identified several other products and manufacturing processes. Those uses include (as described by terms reporters used in submission to the mercury inventory):

Products

- The “burners” aspect of “low UV gas discharge lamps and burners”
- Wheel emblem
- Lead in water sensor
- Mercury analyser
- Air cylinders
- Connector pins
- Mass flow controllers
- Printed circuit board
- Motors

Manufacturing processes

- Bonding weld head (catalyst)
- Molecular beam epitaxy
- Quality analysis (density measurement of tungsten bars)
- Inactivation
- Quality control test (small arms ammunition case-mercury stress crack)

(See Inventory of Mercury Supply, Use, and Trade in the United States – 2020 Report: Conclusion and Data Interpretation, Identified Manufacturing Processes and Products; available at https://www.epa.gov/sites/production/files/2020-03/documents/10006-34_mercury_inventory_report.pdf)

18. EPA will carefully consider the reporting results in light of such factors as quantities of use and availability of safer, cost-effective alternatives and, at a future time, may recommend legal or regulatory actions, as appropriate and in accordance with the 2016 Frank R. Lautenberg Chemical Safety for the 21st Century Act, to complement the implementation of United States’ obligations under the Minamata Convention. For example, the mercury inventory reporting rule creates a legally enforceable reporting obligation. While that enforcement mechanism, should it be warranted, would not directly lead to a reduction in the use of mercury in products or manufacturing processes, it could be part of the multifaceted United States approach to better understanding the manufacture, import and export of mercury-added products and effectuate measures and strategies to achieve such reductions. Such measures and strategies could include regulatory and voluntary approaches, as well actions to enhance the administration of the mercury inventory and its electronic reporting application.

19. Consistent with article 4, paragraph 2 (d), the United States has not claimed, and does not intend to claim, any exemptions pursuant to article 6 for any product category for which the article 4, paragraph 2, alternative was chosen.

20. The United States stands ready to assist as appropriate in the review of annex A by the Conference of the Parties.