



## Zero Mercury Working Group Views on COP4.2 Decisions February 2022

This paper summarizes the recommendations of the Zero Mercury Working Group (ZMWG) on the anticipated decisions at COP4.2. We highlight only the priority issues, and the key points on these issues. We encourage COP4.2 delegates to consult with ZMWG representatives for more details or positions on documents not discussed below.

In the following document you can find the ZMWG recommendations on:

1. Proposed Revisions to Annex A and B;
2. Setting Waste Thresholds under Article 11;
3. The report from the Releases expert group (related to Article 9);
4. Effectiveness Evaluation; and
5. Harmonized Custom Codes

### ***ZMWG RECOMMENDATION ON THE PROPOSED REVISIONS TO ANNEX A AND B***

#### **Annex A Revisions**

1. **Batteries** - There are two categories of button cell batteries not currently subject to Convention prohibitions on manufacture and trade: silver oxide (often used in watches), and zinc air (primarily used in hearing aids). During the intersessional process, the Battery Associations of Japan, Europe, North America, and Latin America, representing 90% of global manufacturing, indicated they stopped manufacturing these mercury-added batteries and are only producing mercury free silver oxide and zinc air button cells.<sup>i</sup> In addition, China battery manufacturers are producing mercury free silver oxide and zinc air button cells, and new legislation in China requires the phase out of the mercury-added versions.<sup>ii</sup> ***Global availability of non-mercury alternatives has been clearly established, and Annex A should be revised so that all mercury-added battery types are subject to the prohibition against manufacture and trade.***
2. **Satellite Propulsion.** In April 2019, a USA company submitted a license application to put into orbit a communications satellite using mercury as the satellite propulsion fuel. The company initially declared the identity of the fuel was Confidential Business Information (CBI), but this attempt at secrecy was ultimately unsuccessful. More importantly, the purpose of the pilot mission was to prove mercury is a viable rocket fuel, so that it could power thousands of future satellites to be deployed by this company and others in the industry.

Mercury was used as a rocket propellant in the past, but it was abandoned by NASA and other space agencies due to health and safety concerns, among other reasons.<sup>iii</sup> Recent estimates indicate significant mercury air emissions would result from a high volume of

satellite deployments.<sup>iv</sup> There is also the risk from launch vehicle accidents, since one launch vehicle can carry as many as 100 satellites, each containing mercury fuel.<sup>v</sup> Although the USA company ultimately withdrew its application in April 2021, recent published reports indicate satellite companies are exploring venues in other countries as possible launch locations, thus making this potential mercury use a global concern.<sup>vi</sup> ***The Conference of the Parties should address this potential mercury use before it becomes a bigger problem. Annex A should be revised to prohibit the manufacture or trade of satellites or other spacecraft with mercury-added fuel.***

**3. Switches/Relays, Wheel Weights, and Other Miscellaneous Products.** Other proposed amendments address a variety of products where there are clearly non-mercury alternatives. For example, there is currently an exemption in Annex A for certain “high capacity” or “high frequency” switches or relays, but the intersessional expert group could find no evidence this exemption is necessary because non-mercury alternatives are available.<sup>vii</sup> Similarly, mercury-added wheel weights, or rotational balancers, for use on trucks and other vehicles are produced by at least one manufacturer,<sup>viii</sup> even though there are a variety of equally functional and much more commonly used non-mercury alternatives.<sup>ix</sup> ***Annex A should be revised to eliminate the unnecessary exemptions identified and add those products where the intersessional process documented the availability of non-mercury alternatives.***

**4. Dental Amalgam -** There are two separate proposals for strengthening Convention restrictions on dental amalgam. Both seek to restrict the use of dental amalgam in the short-term for children and subpopulations of women associated with childbirth. One of the proposals also includes a longer-term phase out for the general population as well.

Many governments and other stakeholders submitted information on the alternatives to dental amalgam and measures to phase down the use of dental amalgam.<sup>x</sup> Similarly, in a 2016 UNEP publication<sup>xi</sup>, several countries attested to having phased out dental amalgam. Since then, the Czech Republic<sup>xii</sup>, Ireland<sup>xiii</sup>, Italy<sup>xiv</sup>, Moldova<sup>xv</sup>, Nepal<sup>xvi</sup>, Philippines<sup>xvii</sup>, Russia<sup>xviii</sup>, Slovakia<sup>xix</sup>, St. Kitts and Nevis<sup>xx</sup>, and Suriname<sup>xxi</sup> have phased out amalgam use, announced plans for doing so, or use de minimis amounts. In addition, measures requiring mercury-free dentistry for children have been adopted in Belgium<sup>xxii</sup>, Bulgaria<sup>xxiii</sup>, Croatia, Czech Republic<sup>xxiv</sup>, Denmark<sup>xxv</sup>, Estonia, Finland<sup>xxvi</sup>, Germany, Hungary, Ireland<sup>xxvii</sup>, Italy,<sup>xxviii</sup> Japan<sup>xxix</sup>, Latvia, Lithuania, Luxembourg, Mauritius<sup>xxx</sup>, Moldova<sup>xxxi</sup>, Nepal<sup>xxxii</sup>, Netherlands<sup>xxxiii</sup>, Norway<sup>xxxiv</sup>, Philippines<sup>xxxv</sup>, Poland, Portugal, Russia,<sup>xxxvi</sup> St. Kitts & Nevis,<sup>xxxvii</sup> Slovakia,<sup>xxxviii</sup> Slovenia, Spain, Sweden<sup>xxxix</sup>, Suriname<sup>xl</sup>, Tanzania<sup>xli</sup>, the United Kingdom, Vietnam<sup>xlii</sup>, and Zambia.

The United States Food and Drug Administration (FDA) recently issued an updated safety communication<sup>xliii</sup> that called for non-mercury dental fillings to be used in people at higher risk of adverse health effects from mercury exposure, including pregnant women and their developing fetuses; women who are planning to become pregnant; nursing women and their newborns and infants; children and people with pre-existing neurological disease; impaired kidney function; and known heightened sensitivity (allergy) to mercury or other components of dental amalgam. As explained in the US submission to the Secretariat:

“Key among the FDA’s findings were the uncertainties about the acceptable reference exposure levels for mercury vapor (gas), the potential for mercury to convert to other mercury compounds in the body, and whether the degree of accumulation of mercury from dental amalgam results in negative (adverse) health outcomes.”<sup>xliv</sup>

As a further indication of the availability of non-mercury alternatives, Dentsply Sirona – the world’s largest manufacturer of dental products – exited the amalgam market. In its annual report to the U.S. Securities and Exchange Commission, Dentsply Sirona stated that: “[W]e have discontinued sales for all amalgam products as of December 2020.”<sup>xlv</sup>

***Since non mercury dental fillings are cost effective, perform as well or better, and are available and used worldwide, we support the objectives of both proposed amendments calling for the prompt discontinuation of dental amalgam use in children and pregnant or breastfeeding women, and urge that a date certain be established worldwide for its ultimate phase out.***

5. **Lamps** – Current provisions under Annex A limit the maximum mercury content per lamp for most compact fluorescent lamps (CFLs), most triband and halophosphate phosphor linear fluorescent lamps (LFLs), and cold cathode and external electrode fluorescent lamps (CCFL and EEFL). In addition, there is a ban the manufacture and trade of high-pressure mercury vapour lamps.

Since Annex A was first developed, the global lighting market has changed significantly. Light emitting diode (LED) lamps are replacing CFLs, LFLs and CCFL/EEFLs, and are widely available, as shown by several studies.<sup>xlvi</sup> Moreover, LEDs are twice as efficient as CFLs and LFLs, and LEDs last two to three times longer. Reviews of manufacturers’ literature on compatibility has shown that 91-94% of fluorescent fixtures in North America and Europe can accept a ‘plug and play’ LED tube, like-for-like products needing no specialist installation<sup>xlvii</sup>. For the other 6-9% of fixtures, an electrician can by-pass the ballast and operate the LED tubes on mains voltage – thus, all existing fluorescent fixtures can be retained.

The EU has already banned most CFLs (CFL integrated ballast), and almost half of LFLs (including most T8 and T12 as well as halophosphates) for general purpose lighting. A subsequent set of rules is now pending for a full phase out of both CFL and LFLs for general purpose lighting. Other countries around the world are also in the process of taking decisions to shift to LEDs.<sup>xlviii</sup>

In addition to the reduction of mercury use associated with a transition to LEDs, there are other important co-benefits. Shifting to LEDs, will minimize handling waste mercury added lamps for which environmentally sound management requirements are not in place in many developing countries. A global approach will prevent the developing world from becoming the dumping ground for mercury-added lamp sales when developed countries phase out the sale of mercury lamps in their markets.

Moreover, banning the manufacture and trade of most CFLs and LFLs under Minamata would avoid the use and emission of 232 metric tonnes of mercury from the lamps and coal fired power stations by 2050.<sup>xlix</sup> In addition, replacing mercury-added lamps with

mercury-free, energy-efficient LED alternatives would cut global electricity demand and avoid 3.5 gigatons of CO<sub>2</sub> emissions by 2050.<sup>i</sup>

LED lamps are highly cost effective. CFLs generally payback instantly, as LED lamps are now essentially at price parity with CFLs, or in some cases, cheaper. LED tubes replacing LFLs are at the same price in some markets, but in others, there is a slight incremental cost for the LED which pays back quickly through savings on the electricity bill. A company website states that payback periods can be as short as four months<sup>li</sup> thanks to the lower sales prices and high efficiency of LED.

***Given the availability and overall superiority of LED alternatives, Annex A should be revised so that a timetable for phasing out the manufacture and trade of the various types of fluorescent lamps is established.***

## **Annex B Revisions**

1. **Polyurethane production using mercury containing catalysts** – Current provisions request Parties to take at a minimum the measures listed under Annex B Part II, including measures to reduce the use of mercury for polyurethane production, “aiming” at a phase out of this use within 10 years of the entry into force of the Convention.

The primary use of mercury catalysts is in the production of polyurethane coatings, adhesives, sealants, and elastomers (PU elastomers represent around 90% of the mercury catalyst market). The mercury catalyst remains in the final polyurethane product, which can then be used in bedding, thermal insulation and in floorings. The floors can emit mercury vapours over the course of their lifetime, as well as when the flooring material is removed.

Perfectly viable substitutes to mercury catalysts are already in use for over 95% of PU elastomer systems, and have been in use for many years (e.g. tin, amine, and titanium, zirconium bismuth, zinc, platinum, etc compounds). The cost of most mercury-free catalysts is quite competitive with the typical mercury catalyst cost, and even more so if one takes account of waste disposal costs, environmental and other customer concerns. (COWI, 2008, 117)

In the most recent inventory of mercury use in the USA, no company reported the production or import of polyurethane using mercury containing catalysts, and it is believed this use has been discontinued for years.<sup>liii</sup> In the EU (and Norway), Regulation (EC) No 2017/852 prohibits manufacturing processes in which mercury or mercury compounds are used as a catalyst from 1 January 2018. In its National Implementation Plan, Japan states that ‘no manufacturing process using mercury catalysts has been found in the polyurethane production processes’<sup>liiii</sup>

***Given non-mercury alternatives are globally available, as demonstrated by the prohibitions already in place and the transitions already accomplished, Annex B should be revised so that production of polyurethane using mercury containing catalysts is prohibited.***

## **ZMWG RECOMMENDATION ON SETTING WASTE THRESHOLDS UNDER ARTICLE 11**

The expert group on waste thresholds considered appropriate thresholds for Convention coverage of three different categories of waste: (1) ASGM tailings; (2) Category C wastes, or wastes contaminated with mercury, such as industrial waste and sewage sludge, and (3) industrial non-ferrous mine tailings. Wastes below the threshold would be excluded from Convention coverage, and thus not subject to Article 11 environmentally sound management (ESM) requirements.

1. ASGM Tailings. The expert group unanimously recommended that no threshold be established for ASGM tailings. Article 7 and the associated National Action Plan obligations address the potential for mercury releases from the entire ASGM operation, including tailings management. It would be both inefficient and counterproductive to start differentiating portions of the tailings disposal areas for the sole purpose of defining Convention coverage. Moreover, sampling capacity at these remote locations is likely to be quite limited, so it is also impractical to set thresholds based upon mercury concentrations.<sup>liv</sup> ***We agree with the no threshold recommendation for ASGM tailings, thus we urge COP adoption of this approach.***

2. Category C Wastes. The waste threshold expert group agreed that the Category C threshold should be based upon the total concentration of mercury in the waste, and not a leach test or other approach which pre-determined how a waste would be managed. The group recognized the many ways Category C wastes are disposed or recycled, therefore basing a threshold only on engineered land disposal would not be protective.<sup>lv</sup> The expert group was divided on what that total concentration threshold should be. One proposal was to set the threshold at 25 ppm, a number derived from applying the UN Globally Harmonized System of Classification and Labeling of Chemicals (GHS).<sup>lvi</sup> However, both the GHS approach and the 25 ppm value are not protective of human health, particularly in the developing world for the following reasons:

- The GHS classification system is intended to facilitate hazard communication, and broadly classify chemicals for the purpose of applying reporting (MSDS) and labeling requirements. It was never designed to produce thresholds for requiring environmentally sound management, or to define levels protective of human health.<sup>lvii</sup> While proponents argue this is the only globally recognized approach for setting thresholds, this is simply not true. GHS is a global approach, but it is designed for something completely different.
- The misuse of the GHS methodology is best illustrated by the proposed threshold itself. It is based on the ecotoxicity of mercury, because the way the GHS considers human chronic toxicity does not allow for the consideration of the unique adverse impacts of mercury at low concentrations. Consequently, the GHS generated human health protection value for mercury is an unprotectively high 1,000 ppm.
- Proponents of the 25 ppm threshold assume Category C wastes are disposed in licensed, engineered waste management facilities.<sup>lviii</sup> Not only is this assumption inconsistent with the justification for basing the thresholds on total concentrations (see above), but it ignores the reality of the developing world.
- Waste management in the developing world is very different than in the developed world. Much of it is uncontrolled, resulting in open dumping and unlicensed landfilling.<sup>lix</sup> Even where waste management facilities may be licensed, enforcement

is problematic. Communities may be located adjacent to or, or even on, dumpsites. Close proximity to and direct contact with wastes, including Category C wastes, may occur under the following circumstances:

- Open dumping or air dispersion of waste into residential areas;
- Residential structures adjacent to or on disposal sites;
- Informal pickers and/or children accessing disposal sites;
- Landspreading near residential areas; and/or
- Reuse as fill and other reuse scenarios allowing for direct exposure.

Recognizing the risks remaining if the threshold is set at 25 ppm, proponents of the 25 ppm threshold want to address these risks as contaminated sites or leave the problem for Parties to solve at the national level.<sup>ix</sup> Both these approaches are non-starters since:

- no Convention resources would become available for wastes falling below Convention thresholds,
- the whole point of Article 11 is to prevent the creation of new contaminated sites rather than create more of them, and
- if the developing world had the capacity to address these issues on their own, they would have done so already.

***We agree with the experts supporting the alternative recommendation i.e. that work should continue, to establish a threshold between 1 and 25 mg/kg total mercury content, and recommend further work by the expert group to find a threshold protective of human health under real-world exposure scenarios in the developing world.*** There are a substantial number of national thresholds already in place that could be used as a starting point for this further work (See Attachment 1). Once the COP makes clear that these exposure scenarios must be taken into account, progress can be made in finding an appropriate protective threshold.

3. Industrial Non-Ferrous Mine Tailings. Tailings from non-ferrous industrial mining, other than tailings from primary mercury mining, are exempt from Convention coverage until relevant thresholds are established. Once thresholds are established, tailings above the thresholds are subject to the Convention ESM requirements.

The expert group reached consensus on a two-prong threshold for this category: a total concentration-based threshold of 25 ppm to address the ecotoxicity of the tailings, and a human health-based leach threshold of 0.15mg/l based upon disposal in a tailings impoundment.<sup>lxi</sup> ***We can concur with this expert group recommendation, provided the Parties understand this threshold for mine tailings has no relevance or precedent for setting the Category C waste threshold.*** As agreed to in the expert group report, the threshold considerations are very different:

- In the case of mine tailings only one disposal method (impoundment disposal) was considered, while for Category C wastes many management options must be taken into account;
- In the case of mine tailings separate ecotoxicity and human health thresholds are included, while for Category C wastes only one threshold is contemplated, and thus this one threshold must be protective of both human health and the environment; and

- Direct or proximate human exposure to Category C wastes through inhalation or ingestion is much more likely than such exposure to mine tailings, given the remoteness and property control associated with mining sites.<sup>lxii</sup>

### **ZMWG RECOMMENDATION ON THE REPORT OF THE RELEASES EXPERT GROUP**

At COP3, the releases expert group was requested to draft:

- Guidance on the methodology for preparing inventories of releases to land and water;
- Proposed categories of point sources of releases; and
- A road map for the development of guidance on best available techniques and best environmental practices (BAT/BEP) for addressing point source releases to land and water.

The expert group reached a consensus on the first and third items, and ***we recommend adoption of the draft guidance for preparing inventories and adoption of the road map for the development of BAT/BEP guidance during the intersessional period following COP4.2.***<sup>lxiii</sup>

Regarding the identification of potential categories of point source releases to land and water, the group largely reached agreement, but had divergent views on one key issue – whether waste management activities exempt from coverage under Article 11 could be identified by Parties as potential release sources under Article 9. The disagreement stems from differing interpretations by what it means to be “addressed” by other parts of the Convention, since Article 9 sources are defined to include sources not addressed by other parts of the Convention.

We agree with the view that if a waste is exempt from coverage under Article 11, it cannot be considered “addressed”, since addressed means more than just “mentioned” and implies some level of control. We also take the view that to the extent the term “address” is ambiguous, a Party should be allowed to list Article 11 exempt point sources under Article 9 if it wishes to do so. This could be justified since the list of sources to be controlled under Article 9 is at a Party’s discretion anyway.

***Therefore, we recommend adoption of the list of sources presented by the expert group with this understanding regarding the relationship between Articles 9 and 11.***

### **ZMWG RECOMMENDATION ON THE EFFECTIVENESS EVALUATION FRAMEWORK**

Previous work on effectiveness evaluation (EE) has produced proposals for key elements of the framework, including a proposed process/flow diagram, draft Terms of Reference (TOR) for an Effectiveness Evaluation Committee and associated scientific committees, recommended indicators, and proposed monitoring guidance. The Secretariat has previously invited comment on these proposals and in particular has summarized views on the proposed indicators in UNEP/MC/COP4/INF/11. Key decisions from the COP will be needed to finalize these proposals including confirming the timing of the evaluations, agreeing on the final process and timeline, reconciling comments on the indicators to create a final list, agreeing to the TOR of the committees, and providing formal direction to the Secretariat to begin collection of data and production of reports needed as inputs to the process.

***We urge the COP to come to rapid agreement on these remaining items so that work on the first EE can begin within the timeframe established by the Convention.***

During the first segment of COP4, Norway and Canada submitted a CRP for consideration at COP4.2, to facilitate this discussion and final decision regarding the framework (UNEP/MC/COP.4/CRP.1). The framework proposed in the CRP enhances previous work by providing more oversight opportunities by the Conference of the Parties at all critical steps in the process. It also further clarifies the specific roles of the Effectiveness Evaluation Committee and Scientific Advisory Group on Effectiveness Evaluation (SAGE). ***We support using the CRP as the basis for negotiation at the second segment of COP4.***

***The COP's decisions should be based on the following principles:***

1. The data and methods used, as well as results of the evaluation, must be transparent.
2. The evaluation should use the full range of relevant scientific, environmental, technical, financial and economic information, as stipulated in Article 22, and not be limited to Party submissions only.
3. The proposed indicators should be appropriately streamlined, for example to remove duplication between indicators, but must remain sufficiently robust to reflect the full range of Convention measures and potential impacts. Further, EE is not a “compliance” assessment to evaluate compliance with mandatory provisions, but must consider how **all** parts of the Convention may contribute to its effectiveness in achieving the Convention objective as stated in Article 1. Therefore, indicators should not only focus on implementation of mandatory measures within the Convention, but also include indicators of voluntary measures.
4. The EE process must include a scientifically defensible mechanism(s) to attribute changes in mercury exposures to Convention measures.
5. Ongoing participation by civil society in the EE process, as observers to the EE Committee, is crucial to its legitimacy.
6. Given the gaps that have been identified in data needed to support EE, especially in the global South, the COP should support the development of additional data needed.

#### ***ZMWG RECOMMENDATION ON HARMONIZED CUSTOMS CODES***

COP3<sup>lxiv</sup> requested that intersessional work continue towards drafting a guidance document for consideration at COP 4 that includes enhancing harmonized customs codes to better identify mercury added products.

Up to the six-digit level, Parties typically use the Harmonized System nomenclature to identify commodity imports. However, six digits are not sufficient to distinguish most mercury-added products from other products within the particular product category. Significantly, customs codes with more than six digits may be revised or created unilaterally by any country according to its own procedures. Eight-digit codes are typically used for tariff purposes and ten digits (and above) are typically used for statistical purposes. To arrive at codes of eight digits and more, governments generally build on existing six-digit HS codes.

A draft guidance document (UNEP/MC/COP.4/27) and an information document (UNEP/MC/COP.4/INF/5) on the use of more mercury-specific customs codes have been



developed as requested at COP3.<sup>lxv</sup> This guidance document builds on a previous document submitted to COP-3<sup>lxvi</sup> and, pursuant to the discussion of the Parties at COP-3, is intended to provide a mechanism, once it has been finalized, for countries wishing to use common mercury-specific customs codes for the implementation of Article 4 of the Convention to do so.

Based on the submissions of national experts and stakeholders, as well as additional codes in cases where none had been indicated by Parties, proposed 10-digit codes for mercury-added products are organized under the following categories: Batteries; Switches and relays; Thermostats; Compact fluorescent lamps; Linear fluorescent lamps; High pressure mercury vapor lamps; Cold cathode fluorescent lamps; External electrode fluorescent lamps; Cosmetics; Pesticides, biocides (including their use in paints) and topical antiseptics; Measuring devices; and Dental amalgam.

Of the options presented in the document, ***we support the option for a Party to voluntarily utilize 8 or 10-digit customs codes presented to better distinguish mercury-added from non-mercury products. We recommend this option because it can be implemented quickly, and we urge governments to do so.***

***We also recommend that the Secretariat continue work on HS Codes after COP4 to address any outstanding issues, including but not limited to creating custom codes for products to be added to Annex A as well as addressing issues that arise as countries implement these new codes.***

## ATTACHMENT 1 – NATIONAL THRESHOLD VALUE EXAMPLES

<b>Country</b>	<b>Regulatory Context</b>	<b>Exposure Pathway(s)</b>	<b>Mercury Concentration</b>
United Kingdom	Soil Guideline Values	Inhalation	1 ppm (residential)
Switzerland	Threshold for certain reuses		1 ppm
South Korea	Threshold for certain reuses		2 ppm
Switzerland	Thresholds for landfilling		2-5 ppm for various Category C wastes
Denmark, Germany, Australia	Thresholds for sewage sludge landspreading		0.8-5.0 ppm
Japan (recalculated to reflect childhood exposure only)	Soil standard	Ingestion	3.43 ppm
South Korea	Threshold for fill materials		4 ppm
Iran	National soil standard	Various, including ingestion, drinking water, etc.	5 ppm (residential, agriculture, pH <7)
United States	Soil screening level	Ingestion	7.8 ppm methylmercury Hg – HQ of 1
United States	Soil screening level	Inhalation	11 ppm elemental Hg – HQ of 1
Japan (lifetime exposure)	Soil standard	Ingestion, drinking water	15 ppm
Iran	Threshold for pollutants added to soils	Various, including ingestion, drinking water, etc.	16 ppm (public places, agriculture)
Iran	Threshold for mercury waste in soil reclamation	Various, including ingestion, drinking water, etc.	20 ppm

---

<sup>i</sup> See

[https://www.mercuryconvention.org/sites/default/files/documents/working\\_document/compilation\\_01\\_batteries.pdf](https://www.mercuryconvention.org/sites/default/files/documents/working_document/compilation_01_batteries.pdf), p. 3.

<sup>ii</sup> See

[https://www.mercuryconvention.org/sites/default/files/documents/working\\_document/compilation\\_01\\_batteries.pdf](https://www.mercuryconvention.org/sites/default/files/documents/working_document/compilation_01_batteries.pdf), pp. 2-3.

<sup>iii</sup> See

[https://www.mercuryconvention.org/sites/default/files/documents/submission\\_from\\_government/compilation\\_09\\_satellite\\_propulsion.pdf](https://www.mercuryconvention.org/sites/default/files/documents/submission_from_government/compilation_09_satellite_propulsion.pdf), p. 2.

<sup>iv</sup> Fourie et al. (2019). Are mercury emissions from satellite electric propulsion an environmental concern?

Published in Environmental Research Letters. Available online at <https://iopscience.iop.org/article/10.1088/1748-9326/ab4b75/pdf>.

<sup>v</sup> See

[https://www.mercuryconvention.org/sites/default/files/documents/submission\\_from\\_government/compilation\\_09\\_satellite\\_propulsion.pdf](https://www.mercuryconvention.org/sites/default/files/documents/submission_from_government/compilation_09_satellite_propulsion.pdf), p. 4.

<sup>vi</sup> See <https://www.nytimes.com/2021/11/16/business/indonesia-spaceport-elon-musk.html?searchResultPosition=1>.

<sup>vii</sup> See

[https://www.mercuryconvention.org/sites/default/files/documents/submission\\_from\\_government/compilation\\_02\\_switches\\_and\\_relays.pdf](https://www.mercuryconvention.org/sites/default/files/documents/submission_from_government/compilation_02_switches_and_relays.pdf), pp. 1-5.

<sup>viii</sup> See <http://www.balancemasters.com/>.

<sup>ix</sup> See

[https://www.mercuryconvention.org/sites/default/files/documents/working\\_document/compilation\\_06\\_other\\_non\\_electronic\\_products.pdf](https://www.mercuryconvention.org/sites/default/files/documents/working_document/compilation_06_other_non_electronic_products.pdf), pp. 2-5.

<sup>x</sup> <https://www.mercuryconvention.org/en/implementation/intersessional-work#sec966>.

<sup>xi</sup> UNEP, *Lessons from Countries Phasing Down Dental Amalgam Use* (2016), <https://wedocs.unep.org/handle/20.500.11822/31212>

<sup>xii</sup> Czech Republic National Plan (2019), <https://mercuryfreedentistry.files.wordpress.com/2020/03/czech-republic-national-plan-2019.pdf>

<sup>xiii</sup> Department of Health, *Ireland's National Plan for Phase-down to Phase-out of Amalgam towards 2030* (2019), <https://mercuryfreedentistry.files.wordpress.com/2020/03/irelands-national-plan-for-phase-down-to-phase-out-of-amalgam-towards-2030.pdf>; Department of Health, *National Plan for Phase-down to Phase-out of Amalgam towards 2030* (1 July 2019), <https://health.old.gov.ie/blog/publications/national-plan-for-phase-down-to-phase-out-of-amalgam-towards-2030/>

<sup>xiv</sup> Ministero della Salute (Italy), *Piano nazionale per l'eliminazione dell'utilizzo dell'amalgama dentale*, [http://www.salute.gov.it/portale/documentazione/p6\\_2\\_2\\_1.jsp?lingua=italiano&id=3022](http://www.salute.gov.it/portale/documentazione/p6_2_2_1.jsp?lingua=italiano&id=3022), [http://www.salute.gov.it/imgs/C\\_17\\_pubblicazioni\\_3022\\_allegato.pdf](http://www.salute.gov.it/imgs/C_17_pubblicazioni_3022_allegato.pdf)

<sup>xv</sup> Republica Moldova Parlamentul, LEGE Nr. LP277/2018, *Privind Substantele Chimice* (29 Nov. 2018), [https://www.legis.md/cautare/getResults?doc\\_id=112668&lang=ro](https://www.legis.md/cautare/getResults?doc_id=112668&lang=ro) (“(2) În contextul alin. (1) și pentru executarea prevederilor tratatelor internaționale la care Republica Moldova este parte, se interzice producerea, plasarea pe piață și utilizarea mercurului și a compușilor acestuia:.... 9) în amalgame dentare.”)

<sup>xvi</sup> Government of Nepal Ministry of Health and Population, *Regarding Mercury based Equipments and Dental Amalgam* (2019), <https://mercuryfreedentistry.files.wordpress.com/2020/03/government-of-nepal-ministry-of-health-and-population-mohp-decision-on-mercury-amalgam-ban-in-nepal.pdf>, <https://mercuryfreedentistry.files.wordpress.com/2020/03/notary-translation-copy-of-government-of-nepal-decision-on-ban-mercury-dental-amalgam-19-sep-2019-17-37-44.pdf> (notary translation)

<sup>xvii</sup> <https://mercuryfreedentistry.files.wordpress.com/2020/06/administrative-order.pdf>

- 
- <sup>xviii</sup> WHO, *Report of the Informal Global WHO consultation with policymakers in dental public health, 2021. Monitoring country progress in phasing down the use of dental amalgam*. Geneva: World Health Organization ,p. 12
- <sup>xix</sup> Ministry of Health of the Slovak Republic, *National Plan of Measures in Connection with the Phasing Out of Dental Amalgam*, <https://circabc.europa.eu/ui/group/19e66753-84ca-4e4e-a4a1-73befb368fc2/library/495d3d0f-e927-42d7-a1e0-db31b9da4641/details>
- <sup>xx</sup> WHO, *Report of the Informal Global WHO consultation with policymakers in dental public health, 2021. Monitoring country progress in phasing down the use of dental amalgam*. Geneva: World Health Organization ,p. 12
- <sup>xxi</sup> Republic of Suriname, *Measures to Implement the Minamata Convention*, [http://www.mercuryconvention.org/Portals/11/documents/Notifications/Suriname\\_30-4.pdf](http://www.mercuryconvention.org/Portals/11/documents/Notifications/Suriname_30-4.pdf), pp.2-3
- <sup>xxii</sup> Regulation (EU) 2017/852, <https://op.europa.eu/en/publication-detail/-/publication/687ef0ed-4045-11e7-a9b0-01aa75ed71a1/language-en>
- <sup>xxiii</sup> Regulation (EU) 2017/852, <https://op.europa.eu/en/publication-detail/-/publication/687ef0ed-4045-11e7-a9b0-01aa75ed71a1/language-en>
- <sup>xxiv</sup> Czech Republic National Plan (2019), <https://mercuryfreedentistry.files.wordpress.com/2020/03/czech-republic-national-plan-2019.pdf>
- <sup>xxv</sup> Ministry of Environment and Food of Denmark, *Overview of Danish legislation and actions in connection with the phasing out of dental amalgam*, <https://circabc.europa.eu/ui/group/19e66753-84ca-4e4e-a4a1-73befb368fc2/library/67c149f5-c04a-4310-a828-42f0fdf78e71/details>
- <sup>xxvi</sup> Ministry of Social Affairs and Health, *Plan for the Abolition of Dental Amalgam by 2030* (2019), [http://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/161728/STM\\_rap\\_59\\_19\\_Plan%20for%20the%20abolition%20of%20dental%20amalgam%20by%202030.pdf?sequence=1&isAllowed=y](http://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/161728/STM_rap_59_19_Plan%20for%20the%20abolition%20of%20dental%20amalgam%20by%202030.pdf?sequence=1&isAllowed=y)
- <sup>xxvii</sup> Department of Health, *Ireland's National Plan for Phase-down to Phase-out of Amalgam towards 2030* (2019), <https://mercuryfreedentistry.files.wordpress.com/2020/03/irelands-national-plan-for-phase-down-to-phase-out-of-amalgam-towards-2030.pdf>; Department of Health, *National Plan for Phase-down to Phase-out of Amalgam towards 2030* (1 July 2019), <https://health.old.gov.ie/blog/publications/national-plan-for-phase-down-to-phase-out-of-amalgam-towards-2030/>
- <sup>xxviii</sup> Ministero della Salute (Italy), *Piano nazionale per l'eliminazione dell'utilizzo dell'amalgama dentale*, [http://www.salute.gov.it/portale/documentazione/p6\\_2\\_2\\_1.jsp?lingua=italiano&id=3022](http://www.salute.gov.it/portale/documentazione/p6_2_2_1.jsp?lingua=italiano&id=3022), [http://www.salute.gov.it/imgs/C\\_17\\_pubblicazioni\\_3022\\_allegato.pdf](http://www.salute.gov.it/imgs/C_17_pubblicazioni_3022_allegato.pdf)
- <sup>xxix</sup> UNEP, *Lessons from Countries Phasing Down Dental Amalgam Use* (2016), <https://wedocs.unep.org/bitstream/handle/20.500.11822/11624/Dental.Amalgam.10mar2016.pages.WEB.pdf>; Mercury Policy Project Report to the United Nations Environment Program Chemicals Branch Division of Technology, Industry and Economics (UNEP) on "Phasing Down Dental Amalgam: Country Case Studies"; Project Account Number: MC/4030-09-04-2204, December 30, 2012.
- <sup>xxx</sup> UN Environmental Programme, *Promoting Dental Amalgam Phase-Down Measures Under the Minamata Convention and Other Initiatives, For "Especially Women, Children and, Through Them, Future Generations", Workshop Report* (2018), <https://mercuryfreedentistry.files.wordpress.com/2018/06/workshop-report.pdf>, pp.29-29; *Inventory of Mercury Releases in Mauritius* (2014), [http://health.govmu.org/English/Departments-Hospitals/Departments/Documents/Hg%20Inventory%20Report%20\(1\).pdf](http://health.govmu.org/English/Departments-Hospitals/Departments/Documents/Hg%20Inventory%20Report%20(1).pdf), p. 19.
- <sup>xxxi</sup> Republica Moldova Parlamentul, LEGE Nr. LP277/2018, *Privind Substantele Chimice* (29 Nov. 2018), ("(2) În contextul alin. (1) și pentru executarea prevederilor tratatelor internaționale la care Republica Moldova este parte, se interzice producerea, plasarea pe piață și utilizarea mercurului și a compușilor acestuia:.... 9) în amalgame dentare.")
- <sup>xxxii</sup> Government of Nepal Ministry of Health and Population, *Regarding Mercury based Equipments and Dental Amalgam* (2019), <https://mercuryfreedentistry.files.wordpress.com/2020/03/government-of-nepal-ministry-of-health-and-population-mohp-decision-on-mercury-amalgam-ban-in-nepal.pdf>, <https://mercuryfreedentistry.files.wordpress.com/2020/03/notary-translation-copy-of-government-of-nepal-decision-on-ban-mercury-dental-amalgam-19-sep-2019-17-37-44.pdf> (notary translation)
- <sup>xxxiii</sup> UNEP, *Lessons from Countries Phasing Down Dental Amalgam Use* (2016), <https://wedocs.unep.org/bitstream/handle/20.500.11822/11624/Dental.Amalgam.10mar2016.pages.WEB.pdf>

---

B.pdf; Mercury Policy Project Report to the United Nations Environment Program Chemicals Branch Division of Technology, Industry and Economics (UNEP) on “Phasing Down Dental Amalgam: Country Case Studies”; Project Account Number: MC/4030-09-04-2204, December 30, 2012.

xxxiv Personal communication, email from Eirik H. Steindal, Senior Advisor, Norwegian Climate and Pollution Agency, 13 December 2012

xxxv <https://mercuryfreedentistry.files.wordpress.com/2020/06/administrative-order.pdf>

xxxvi WHO, *Report of the Informal Global WHO consultation with policymakers in dental public health, 2021. Monitoring country progress in phasing down the use of dental amalgam*. Geneva: World Health Organization ,p. 12

xxxvii WHO, *Report of the Informal Global WHO consultation with policymakers in dental public health, 2021. Monitoring country progress in phasing down the use of dental amalgam*. Geneva: World Health Organization ,p. 12

xxxviii Ministry of Health of the Slovak Republic, *National Plan of Measures in Connection with the Phasing Out of Dental Amalgam*, <https://circabc.europa.eu/ui/group/19e66753-84ca-4e4e-a4a1-73befb368fc2/library/495d3d0f-e927-42d7-a1e0-db31b9da4641/details>

xxxix BIO Intelligence Service (2012), *Study on the potential for reducing mercury pollution from dental amalgam and batteries*, Final report prepared for the European Commission-DG ENV, [https://ec.europa.eu/environment/chemicals/mercury/pdf/mercury\\_dental\\_report.pdf](https://ec.europa.eu/environment/chemicals/mercury/pdf/mercury_dental_report.pdf), p.58.

xl Republic of Suriname, *Measures to Implement the Minamata Convention*, [http://www.mercuryconvention.org/Portals/11/documents/Notifications/Suriname\\_30-4.pdf](http://www.mercuryconvention.org/Portals/11/documents/Notifications/Suriname_30-4.pdf), pp.2-3

xli Ministry of Health, Community Development, Gender, Elderly and Children, *The Second Guidelines for Provision of Oral Health Services in Tanzania* (Jan. 2020)

xliv Ministry of Health's Health Service Administration Department, Directive No: 261/KCB - QLCL&CĐT (25 March 2019), <https://mercuryfreedentistry.files.wordpress.com/2020/03/vietnam-ministry-of-health-re-children-etc..png> (unofficial translation available at [https://mercuryfreedentistry.net/directive-no-261-of-moh-on-dental-amalgam\\_mar-25/](https://mercuryfreedentistry.net/directive-no-261-of-moh-on-dental-amalgam_mar-25/))

xlvi <https://www.fda.gov/medical-devices/safety-communications/recommendations-about-use-dental-amalgam-certain-high-risk-populations-fda-safety-communication>

xlvi [https://www.mercuryconvention.org/sites/default/files/documents/submission\\_from\\_government/US\\_dental\\_measures.pdf](https://www.mercuryconvention.org/sites/default/files/documents/submission_from_government/US_dental_measures.pdf)

xlv Link to Dentsply's annual report: <https://investor.dentsplysirona.com/static-files/89f1f08d-3eac-439b-9e93-7e0bfe2893b1>

xlvi <https://www.clasp.ngo/research/all/mercury-free-alternatives-to-certain-fluorescent-lamps-a-report-to-the-european-commissions-committee-on-the-regulation-of-hazardous-substances/>  
<https://www.clasp.ngo/updates/report-shows-market-readiness-to-eliminate-mercury-based-lighting/>  
<https://www.clasp.ngo/research/all/mercury-in-fluorescent-lighting-unnecessary-health-risks-actionable-solutions/>

xlvi <https://www.clasp.ngo/updates/report-shows-market-readiness-to-eliminate-mercury-based-lighting/>

xlvi 48 countries in total: 27 countries in the European Union, 16 countries in the Southern African Development Community and 6 countries in the East African Community. (note: Tanzania is in both SADC and EAC). Canada is also expected to publish legislation to ban fluorescent lamps in early 2022.

xlvi <https://www.ecee.org/all-news/news/eu-commission-adopts-regulation-to-ban-fluorescent-lighting-by-september-2023/>

<sup>1</sup> <https://edisonreport.com/global-phase-out-of-fluorescents-presents-opportunity-to-rapidly-accelerate-the-adoption-of-led-lighting/>

<sup>ii</sup> <https://www.ledvance.com/professional/products/product-stories/led-tubes-online-special>

<sup>iii</sup> See

[https://www.mercuryconvention.org/sites/default/files/documents/information\\_document/4\\_INF3\\_AnnexAB\\_Compilation.English.pdf](https://www.mercuryconvention.org/sites/default/files/documents/information_document/4_INF3_AnnexAB_Compilation.English.pdf), pp. 145-6.

<sup>iv</sup> Information from the Compilation on Processes -

<https://www.mercuryconvention.org/en/implementation/intersessional-work>

---

liv See

[https://www.mercuryconvention.org/sites/default/files/documents/working\\_document/4\\_8\\_Waste.English.pdf](https://www.mercuryconvention.org/sites/default/files/documents/working_document/4_8_Waste.English.pdf), p. 11.

lv See

[https://www.mercuryconvention.org/sites/default/files/documents/information\\_document/4\\_INF27\\_Waste.English.pdf](https://www.mercuryconvention.org/sites/default/files/documents/information_document/4_INF27_Waste.English.pdf), p. 2.

lvi See

[https://www.mercuryconvention.org/sites/default/files/documents/working\\_document/4\\_8\\_Waste.English.pdf](https://www.mercuryconvention.org/sites/default/files/documents/working_document/4_8_Waste.English.pdf), p. 8.

lvii See United Nations, Globally Harmonized System of Classification and Labeling of Chemicals (GHS), Fourth

Revised Edition, 2011, Section 1.1.2.6.1 ("The GHS is not intended to harmonize risk assessment or risk management decisions"), available at [https://unece.org/DAM/trans/danger/publi/ghs/ghs\\_rev04/English/ST-SG-AC10-30-Rev4e.pdf](https://unece.org/DAM/trans/danger/publi/ghs/ghs_rev04/English/ST-SG-AC10-30-Rev4e.pdf).

lviii See

[https://www.mercuryconvention.org/sites/default/files/documents/working\\_document/4\\_8\\_Waste.English.pdf](https://www.mercuryconvention.org/sites/default/files/documents/working_document/4_8_Waste.English.pdf), p. 9.

lix See e.g., South Africa Department of Environmental Affairs, State of Waste Report, 2018, available at

[https://soer.environment.gov.za/soer/UploadLibraryImages/UploadDocuments/141119143510\\_state%20of%20Waste%20Report\\_2018.pdf](https://soer.environment.gov.za/soer/UploadLibraryImages/UploadDocuments/141119143510_state%20of%20Waste%20Report_2018.pdf), Toxics Link, On the Edge: Potential Hotspots in Delhi, 2014, available at

<http://toxicslink.org/docs/Report-On-the-Edge.pdf>, UNEP, Africa Waste Management Outlook, 2018, available at

<https://wedocs.unep.org/handle/20.500.11822/25514>, UNEP, Waste Management Outlook for Latin America and the Caribbean, 2018, available at [file:///C:/Users/dlennett/Downloads/Residuos\\_LAC\\_EN%20\(2\).pdf](file:///C:/Users/dlennett/Downloads/Residuos_LAC_EN%20(2).pdf).

lx See

[https://www.mercuryconvention.org/sites/default/files/documents/working\\_document/4\\_8\\_Waste.English.pdf](https://www.mercuryconvention.org/sites/default/files/documents/working_document/4_8_Waste.English.pdf), p. 10.

lxi See

[https://www.mercuryconvention.org/sites/default/files/documents/working\\_document/4\\_8\\_Waste.English.pdf](https://www.mercuryconvention.org/sites/default/files/documents/working_document/4_8_Waste.English.pdf), pp. 11-12.

lxii See

[https://www.mercuryconvention.org/sites/default/files/documents/working\\_document/4\\_8\\_Waste.English.pdf](https://www.mercuryconvention.org/sites/default/files/documents/working_document/4_8_Waste.English.pdf), p. 12.

lxiii See

[https://www.mercuryconvention.org/sites/default/files/documents/working\\_document/4\\_7\\_Releases.English.pdf](https://www.mercuryconvention.org/sites/default/files/documents/working_document/4_7_Releases.English.pdf)

lxv <https://www.mercuryconvention.org/en/meetings/cop4#sec966>

lxvi "Background information on possible approaches to identifying and distinguishing non-mercury-added products and mercury-added products listed in Annex A on the basis of the Harmonized System framework," UNEP/MC/COP.3/INF/12.