Compiled Comments from the Arctic Monitoring and Assessment Programme (AMAP) to:

Minamata Convention on Mercury - DRAFT Report on the work of the ad hoc technical group on effectiveness evaluation

AMAP welcomes the updated draft proposals and offers the following comments/suggestions. Because of the nature of AMAPs work, our comments relate mainly to the sections concerned with monitoring and interpretation/assessment of monitoring data (i.e. levels 1-4 in the proposed information flow), but some additional general comments are also offered.

Please note: these compiled comments reflect the views of some members of the AMAP mercury expert group, some AMAP HoDs responsible for tracking mercury issues, and AMAP Secretariat staff. They have not been reviewed or endorsed by all members of the AMAP community and should be considered additional to any comments provided through national reviews conducted by AMAP member and observer countries.

Comments are referred to sections in the attached document (and line numbering indicated therein).

Effectiveness evaluation framework (line 32)

It would be useful in this preamble to include some reference to the fact that mercury in the environment arises from three main sources, 'fresh' emissions/releases, natural sources, and recycling of mercury previously emitted/released. The primary goal of the Convention is to target and track developments in 'fresh' emissions/releases. Natural sources will continue regardless. However, in the Global Mercury Assessment (GMA) report we have been keen to stress in this connection that turning off the tap on 'fresh' emissions/releases is the key to also reducing the amount of mercury present in the environment that is available to be recycled until such time as it is slowly removed by natural processes.

In addition to the above, it would be useful if the preamble makes reference (perhaps by inserting the following text) to the fact that:

Climate change will likely affect natural processes that will in turn influence sources associated with recycling (potentially increasing or decreasing levels depending on the media concerned) and that this is an important factor that will need to be taken into account in some parts of the proposed effectiveness evaluation process, in particular in connection with interpretation of monitoring data.

In relation to evaluating casual pathways (between emissions/releases and levels in the environment, biota and humans) there are also other factors that are important to consider in the effectiveness evaluation process; one example would be changing dietary habits.

Monitoring arrangements (line 122)

AMAP welcomes the inclusion of a concept whereby the effectiveness evaluation will be based on a broad range of monitoring matrices as reflected in line 128. We appreciate the desire to identify a core set of matrices in a global monitoring plan but would like to emphasise some important considerations:

(1) A monitoring programme defined on a 'one size fits all' basis risks eliminating a large amount of (monitoring) information that would be potentially very useful and relevant in a Minamata effectiveness evaluation process; this includes results from long-term established monitoring programmes that it could be argued represent the best data that will be available – at least in the initial rounds of the effectiveness evaluation work.

(2) Practical factors, including cultural differences, will determine the extent to which a given monitoring matrix is appropriate for monitoring in any given geographical region. Again, a too rigid definition of a global programme risks eliminating important information from the effectiveness evaluation process.

(3) In many cases, monitoring mercury is not an activity that is carried out in isolation. The ability of programmes to sample and analyze media that can be used to support multiple objectives (including for example, sampling and analyses of POPs in connection with the Stockholm Convention work) is central to decisions on cost-effective implementation of monitoring. Selection of matrices therefore needs to consider such synergies – and it is not apparent in some of the proposals that this has been adequately taken into account.

Our proposal would be that the texts in the three points noted above might be introduced into the document.

Atmospheric models have been extensively evaluated ... (line 144)

Many of the atmospheric transport/deposition models currently evaluated rely on the availability of spatially distributed data on emissions, which themselves rely on availability and access to a wide range of information and data. If appropriate arrangements are not included to secure continued availability of spatially distributed emissions datasets (including addressing their consistency over time), the proposed components of the effectiveness evaluation based on modelling work (identified as a key element in the monitoring arrangements) may well be compromised.

… combine with natural sources and other factors … (line 322)

We believe here that it is *natural processes* rather than *natural sources* that should be referred to. Natural sources vary from year to year but would not be expected to change (systematically) over time due to e.g. climate change; natural processes, however, are expected to be affected by climate change and will influence e.g. environmental mercury recycling. In the GMA we have made an effort to try to clarify the concepts of natural sources, sources associated with natural processes (that affect recycling) and 'fresh'

anthropogenic sources, to support the rationale for concerted action on current day anthropogenic sources.

It would be relevant in this paragraph also to mention 'dietary change' (including also dietary change in response to food advisories) that can confound interpretation of monitoring data from human biomonitoring studies – especially as dietary advisories often specifically target some of the vulnerable groups that are identified as central to some of the proposed core monitoring. Climate change impacts on ecosystem and food-web structures will also lead to changes in diet that may need to be taken into account when interpreting biota monitoring data. Indigenous knowledge such as than utilized in AMAP assessments can play a role in elucidating such confounding factors.

Information and analysis flow for the proposed effectiveness evaluation (line 383)

To ensure synergy – the monitoring activities should build on existing structures – in particular established national and regional monitoring programmes, and the regional structures that support the Stockholm convention and centres, including centres that handle data from existing monitoring programmes. For example, mercury monitoring data reported to a number of regional programmes (AMAP, OSPAR, EMEP, HELCOM, etc.) are compiled in data centres (e.g. EBAS-NILU for air; ICES for marine data) that also provide assessment tools and routines that would be applicable to Minamata work.

New initiatives under Minamata would preferably take advantage of existing (regional) systems and will hopefully not introduce competing systems but rather utilize limited resources to build capacity and fill gaps where these exist. This principle seems to be well-recognized in some parts of the document, but less so in some of the other proposals that are being made.

Level 2 – Compilation: … (line 410)

AMAP's experience is that compiling information and monitoring data from diverse sources is far more complex than the text in the draft document seems to imply. In particular, with reference to the proposal to establish global databases, the challenges should not be underestimated.

Pre-requisites for such data management systems include not only access to appropriate IT and scientific expertise in the subjects concerned but also the need to avoid disruption of existing reporting systems, and not least the financial considerations associated with establishing and securing sustainable operations over periods of decades. In discussions with UN Environment, AMAP has previously also noted the particular issues associated with international exchange and compilation of sensitive data in connection with human biomonitoring.

We would therefore like to suggest that such considerations are better recognized in the document, and that the proposal includes a process whereby consultations are undertaken with established international data centres that serve regional and global monitoring programmes (such as the NILU-EBAS atmospheric data centre and ICES marine data centre, and others) to scope out the requirements of such systems.

A possible inclusion could read:

Decisions on establishing new databases should be preceded by a review of relevant existing regional/global databases and data management systems to assess the requirements of such systems in terms of, inter alia, access to appropriate IT and scientific expertise, avoiding duplications and disruption of existing reporting systems, and their potential to serve the effectiveness evaluation process; as well as mechanisms for securing the financial resources needed to operate such databases over periods of decades.

Level 4 – Integrated Assessment Report … (line 435)

A phased approach to preparing integrated assessment reports should be considered; with the first phase including an evaluation of whether sufficient data and information will exist to prepare an integrated assessment report.

Development of indicators ... (line 465 and further)

In points 44 and 45, again, our impression is that the challenges associated with developing and producing indicators, especially indicators that can be compared over many years, are not realistically represented in the document. For some of the listed indicators it may be true that information can be collected in a cost-effective, practical, feasible and sustainable manner, but experience not only under AMAP but also in work connected with the production of the GMAs has shown that this is definitely not the case for all the proposed indicators (especially some of those listed for Articles 1, 4, 8, 9 and 16). Some relevant issues are referred to in subsequent paras. (47-58) but assumptions regarding meeting some of the challenges and their implications for the overall proposed effectiveness evaluation process/timeline are not addressed.

We would therefore suggest including a text along the lines of:

A process should be initiated to review the proposed indicators in terms of their associated information needs to ensure that core data and information underpinning the indicators are and can be made available in a in a manner commensurate with the proposed timeline for the effectiveness evaluation, including evaluation of the mechanisms for ensuring that such data are standardised over the period of successive effectiveness evaluation cycles.

Suggested action by the Conference of the Parties (line 801)

The draft decisions for the COP do not mention securing the provision of funding to realize the proposed work, only the establishment of groups that would work in the period up until COP5. Is this an oversight?

Human Exposure para 13 (line 900):

We would suggest that this paragraph be reformulated as:

Human biomonitoring to assess general population exposure to mercury (i.e. background level rather than “hot spots”) provides information on global trends. In the general population, assessment of mercury concentrations in hair and blood are recommended.

Where feasible, a focus should be given to prenatal exposure because the fetus is the most vulnerable to methyl mercury exposure.

Human Exposure para 14 (line 904):

We would suggest that this paragraph be reformulated as:

There are two main biomarkers:

- Total mercury in scalp hair (3 cm hair strand from the scalp).
- Total mercury in blood and/or cord blood.

Human exposure para 16 (line 910

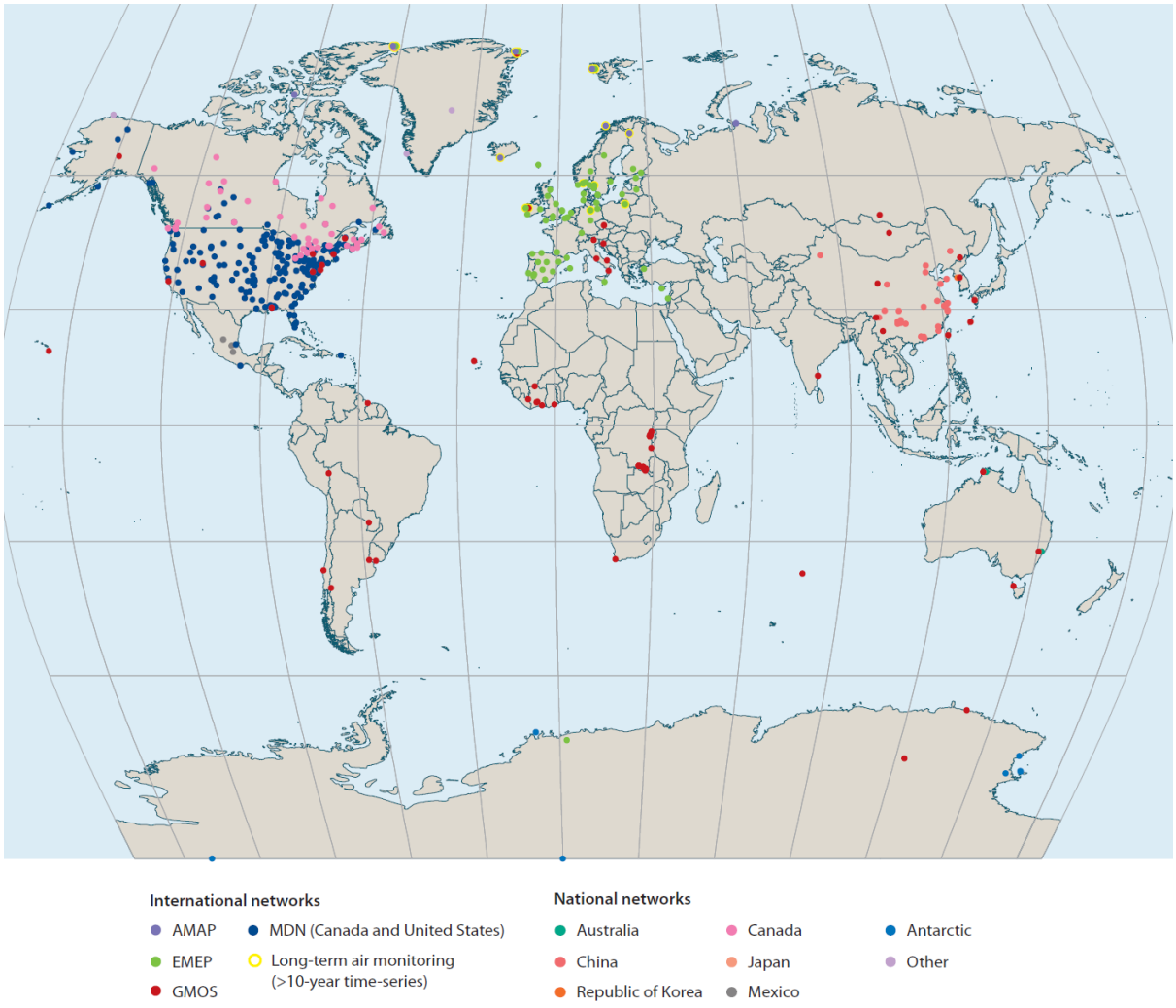
We would suggest that this paragraph be reformulated as:

16. Blood is an alternative matrix to hair. In addition to venous blood, inclusion of cord blood in a survey can also be used to demonstrate pre-natal exposure to mercury (cord blood analysis characterizes both exposure of a mother and a child to mercury during pregnancy).

[Rational for the three above suggestions on paras 13/14/16: Established monitoring programmes use both blood (often maternal blood) and cord blood. Blood, cord blood and hair all have associated advantages/disadvantages. Hair mercury is easy, non-invasive, and cheap. In some situations hair may be difficult to collect due to due to cultural, ethical, religious specificities, but in other situations the same applies to blood; cord blood can be more difficult to collect/access and has additional complexities when it comes to shipping logistics than blood samples. New techniques for blood monitoring are under development that may soon become available and will considerably simplify blood collection (make it cheaper and less invasive). In summary it is preferable to retain a flexibility in monitoring that maximises the chances of good geographical coverage and can address exposure in general populations that include males as well as females/fetus than implement rigid requirements that may inhibit data availability, and also allow established programmes to continue to support the Minamata effectiveness evaluation work]

Figure 1 (line 1027)

The current figure has a number of missing stations and errors in plotted locations. We would propose that the figure being developed for the GMA technical report be used instead. The latest draft of this figure is copied below:



Humans para 34 (line 1079) and 37 (line 1095)

With reference to previous comments, other human monitoring matrices with established protocols are used in other human biomonitoring programmes; these should be recognized and other relevant protocols included in the options presented.

[END OF AMAP COMMENTS]

Minamata Convention on Mercury

DRAFT Report on the work of the ad hoc technical group on effectiveness evaluation

Open for comment: 1 August to 5 September 2019

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Executive Summary

Introduction

This report proposes a framework for the effectiveness evaluation and monitoring arrangements under the Minamata Convention on Mercury. The report was developed by the ad hoc technical expert group based on mandates provided in decisions MC-1/9 and MC-2/10, and information contained in submissions by Parties, stakeholders and other information. The report represents the outcome of consultations and review performed by experts, including two meetings of the ad hoc group in 2018 and 2019 respectively, with follow-up drafting and reviewing by experts and commentators.

Building on the identification of elements for the effectiveness evaluation framework and review of monitoring activities included in the first report from the ad hoc group to COP-2, this report proposes a framework setting out arrangements, information flows, and the required reports on which the Effectiveness Evaluation Committee will base its consideration of the effectiveness of the Convention for presentation to the Conference of the Parties.

Effectiveness evaluation framework

In sections II and III, the report elaborates on the proposed organization of the effectiveness evaluation framework.

The effectiveness evaluation is based on four policy questions that will allow the Conference of the Parties to consider whether the Convention will achieve its objective of protecting human health and the environment from the anthropogenic emissions and releases of mercury and mercury compounds. The policy questions are:

1. Have the Parties taken actions to implement the Minamata Convention?
2. Have the actions resulted in changes in emission and releases of mercury to the environment?
3. Have these changes in emission and releases resulted in changes in levels of mercury in the environment, biota and humans attributable to the Convention?
4. Will existing measures under the Minamata Convention be sufficient to meet its objectives of promoting human health and environment from mercury?

The framework relies on evaluating evidence along the causal pathway linking actions to implement the Convention, associated changes in emissions and releases, and resulting changes in levels and trends in the global environment, biota, and humans. The ad hoc group proposes sets of indicators on process, outcome and monitoring to inform these policy questions. The proposed indicators draw on previous work on elements of the effectiveness evaluation framework and the review of monitoring capacities and abilities.

Numerous indicators, developed following an article-by-article review, are clustered to enable synthesized analysis for an integrated picture. Specific articles of central or crosscutting importance to the overall provisions are not clustered (such as Art 1 and 16). The following articles and indicators are clustered:

- **Supply cluster:** supply, storage and waste (Art 3, 10, 11);
- **Demand cluster:** products, processes and ASGM (Art 4,5,7);
- **Pressures cluster:** emissions, releases and contaminated sites (Art 8, 9, and 12),
- **Support cluster:** financial and technical assistance (Art 13 and 14), and
- **Information and research cluster:** information exchange, public information, research (Art 17, 18 and 19).

Article 22, paragraph 3 indicates that the evaluation shall be conducted using available scientific, environmental, technical, financial and economic information. Two streams of information are referred to in this regard: (i) information provided by Parties based on Article 21 reporting, and (ii) information and knowledge that is scientific, peer-reviewed and publicly available.

Based on such information the framework foresees five reports to be produced (see description in Section III and Annex 4). The following four synthesis reports are to be prepared:

1. The state of global mercury levels in the environment, biota and humans, as well as trends over time, that is a **Global Monitoring Report;**
2. **Emissions and Releases** – modelled after the *Global Mercury Assessment* (2018)
3. **Trade, Supply and Demand** – modelled after the report on *Global Mercury: Supply, Trade and Demand* (2017);
4. **Waste Management** – building on the *Global Mercury Waste Assessment* (2018).

The framework presents a flow of information from level 1 to level 6, namely starting from collecting information, to compiling information, to analysing and synthesizing information (levels 1 to 3). The framework then foresees an integrating function (level 4) before reaching the Effectiveness Evaluation Committee (level 5) and the Conference of the Parties (level 6).

The framework identifies different entities that have different roles in the process. While some entities already exist (i.e. those for administrative and programme support, compilation of data for synthesis reports, etc.) there are others who are to perform vital scientific and technical analyses to implement the framework, but they are not in place yet.

The framework foresees two scientific and technical functions to perform analysis, synthesis and interpretation at levels 3 and 4: The first function (level 3) is to synthesise mercury information collected and compiled. This function foresees a role for the secretariat, for scientists and experts, and for organisations. The second function (level 4) is to interpret the information and knowledge collected and synthesised, to interpret the linkages between policy actions, emission reductions and resulting mercury levels, using available data sources, modelling techniques and analytical tools drawn from natural and social sciences. The function foresees the production of the **Integrated Assessment Report** for the Effectiveness Evaluation Committee. This report is to be science-based but should be accessible to non-technical readers.

The Effectiveness Evaluation Committee (see its Terms of Reference in Annex II of the report) will consider all the reports produced to consider the policy questions outlined above

and derive conclusions about the effectiveness of the Convention for its report to the Conference of the Parties.

Thereafter, the Conference of the Parties receives and reviews the report of the Effectiveness Evaluation Committee, and considers the conclusions and recommendations for the Convention.

The framework is submitted to the third meeting of the Conference of the Parties for adoption, and foresees a timeline for the first cycle of the effectiveness evaluation where the fourth meeting of the Conference of the Parties establishes the Effectiveness Evaluation Committee, and the fifth meeting of the Conference of the Parties considers the findings of that Committee.

The report also outlines in Section IV further issues for the Conference of the Parties to consider at its third meeting, including a proposed draft decision.

Monitoring arrangements

The report addresses the task outlined in decisions MC-1/9 and MC-2/10 in relation to monitoring, by reviewing available monitoring data, identifying gaps, examining modelling capabilities, and outlining global monitoring arrangements.

In considering monitoring information data, the ad hoc group considered matrices mentioned in MC-2/10: air, humans, biota and water. The ad hoc group concluded that data on levels of mercury in air, biota and humans either are available or would be able to be obtained and comparable on a global basis.

Levels of mercury and mercury compounds in water are collected in relation to water quality issues in a number of countries. These data may be useful in tracking mercury resulting from local activities which release mercury; however, it will not provide overall trends on a global basis. Levels of mercury in ocean water could be comparable on a global basis and collected by existing networks and ad hoc research programmes, but currently such work is done through research-based activities and not dedicated long-term monitoring programmes

The global modelling capabilities have been reviewed in order to understand availability of tools for the use in the effectiveness evaluation. The models complement monitoring data with estimation based on scientific understanding of mechanisms affecting mercury behaviour. Models for different media (air, water, land, biota) vary in their ability and state of development. Atmospheric models have been extensively evaluated and can be applied to assess spatial gradients in atmospheric mercury concentrations and deposition, as well as temporal changes. By contrast, models for other media such as land are still mainly used in research applications. Integrated models that work across media drawing on expertise that bridges natural science, social science, and engineering, are undergoing rapid development in the scientific and academic community and are expected to be available by 2023 for policy-relevant analyses.

In the consideration of the monitoring arrangements, the following key elements were identified:

- Mercury data and their availability from human health and environmental monitoring programmes that achieve global coverage and contain at least core representative data from all regions,
- Tools supporting data harmonization such as standard operating procedures and monitoring guidance document,
- Expertise necessary for gathering and consolidating harmonized information that ensures comparability and consistency in monitoring data over the long-term,
- Modelling capabilities, and
- Development of a global periodic report to support the effectiveness evaluation.

In line with the proposal to perform scientific functions and to carry out tasks related to work with monitoring indicators identified in the effectiveness evaluation framework, scientific expertise and qualifications are required to oversee the gathering and consolidation of monitoring data. It is proposed that this task should be overseen by an expert body whose terms of reference are proposed in Annex 3.

NOTE: In addition to this report, the ad hoc group developed a complementing information document. Part 1 of that document provides a more detailed review of available monitoring data and background on the proposal for monitoring activities with further scientific and technical details. Part 2 of the information document contains a proposal for elements of the guidance document for mercury monitoring that will be developed under the monitoring arrangements to be established by the Conference of the Parties.

I. Introduction

1. At the first and second meetings, the Conference of the Parties tasked an ad hoc expert group to consider the arrangements to be put in place to provide the Conference of the Parties with the required information to conduct an effectiveness evaluation of the Minamata Convention on Mercury. [1] The effectiveness evaluation is to be conducted at regular intervals, with the first taking place within six years after the entry into force of the Convention.[2] This report is the outcome of the consultation and deliberations of the ad hoc expert group to put in place arrangements to conduct an effectiveness evaluation.

2. Article 22 of the Minamata Convention in paragraph 2 stipulates that the Conference of the Parties, shall initiate the establishment of arrangements for providing itself with comparable monitoring data on the presence and movement of mercury and mercury compounds in the environment, as well as the trends in the levels of mercury and mercury compounds as observed in biotic media and vulnerable populations. Paragraph 3 of that article further stipulates that the evaluation shall be conducted based on available scientific, environmental, technical, financial and economic information, including:

    (a) Reports and other monitoring information provided to the Conference of the Parties pursuant to paragraph 2;

    (b) Reports submitted pursuant to Article 21;

    (c) Information and recommendations provided pursuant to Article 15; and

    (d) Reports and other relevant information on the operation of the financial assistance, technology transfer and capacity building arrangements put in place under this Convention.

3. The first meeting of the Conference of the Parties recognised the urgent need for a framework for the effectiveness evaluation that includes a strategic, cost-effective approach that provides appropriate and sufficient data, and further acknowledged publications such as UNEP's global mercury assessments, as well as the GEF-funded Minamata Initial Assessments, as important sources of information. The Conference of the Parties set out a roadmap which included the establishment of the ad hoc group

[1] MC-1/9 on the Establishment of arrangements in regard to effectiveness evaluation established the ad hoc group of experts on the arrangements for providing the Conference of the Parties with comparable monitoring data, and elements of an effectiveness evaluation framework under article 22 of the Minamata Convention (hereafter referred to as the ad hoc expert group). The decision also laid out a roadmap for establishing arrangements for providing the Conference of the Parties with comparable monitoring data, and elements of an effectiveness evaluation framework under article 22 of the Minamata Convention. The ad hoc expert group produced a report which was presented to the second meeting of the Conference of the Parties (See UNEP/MC/COP.2/13 and UNEP/MC/COP.INF/8).

Subsequently, MC-2/10 extended the terms of reference of the ad hoc technical expert group, adopted a roadmap for the subsequent work, requested the ad hoc expert group to develop the terms of reference for global monitoring arrangements, and requested the ad hoc expert group to report its progress to the third meeting of the Conference of the Parties.

[2] While the first effectiveness evaluation of the Minamata Convention on Mercury is to take place within six years of the entry into force of the Convention, the Conference of the Parties is to decide on the future interval of the effectiveness evaluations.

of experts on the arrangement for providing the Conference of the Parties with comparable monitoring data, and the elements of an effectiveness evaluation framework (see MC-1/9 Establishment of arrangement in regard to effectiveness evaluation).

4. For deliberation of these matters and based on the roadmap and terms of reference outlined in MC-1/9, the ad hoc group of experts began its work at its first meeting in Ottawa, Canada (5-9 March 2018). The outcome of the work of this first round of deliberations, reflecting comments received during the subsequent open comment period, was presented to the second meeting of the Conference of the Parties in Geneva in November 2018 (see UNEP/MC/COP.2/13 and UNEP/MC/COP.2/INF/8).

5. The second meeting of the Conference of Parties deliberated on the outcome of the ad hoc group of experts and decided to revise the Group's mandate and identify additional expertise needed to enable it to complete its work for presentation to the third meeting of the Conference of the Parties in November 2019. The Conference of the Parties in its decision 2/10 also requested the ad hoc expert group to undertake the following tasks:

    (a) Using the objective of the Minamata Convention, review and assess the detailed article-by-article process and outcome indicators presented in UNEP/MC/COP.2/INF/8, and elaborate on the sources of information and baselines for those indicators, considering cost-effectiveness, practicality, feasibility and sustainability, and, on that basis, provide detailed rationales for the recommended indicators;

    (b) Identify which recommended indicators require monitoring data, in particular in relation to the control measures and objectives set out in the articles of the Convention;

    (c) Develop a methodology for integrating the recommended indicators with a view to providing an integrative picture of the general effectiveness of the Convention, (e.g., by use of cross-cutting indicators); and

    (d) Amend the recommended draft terms of reference of the effectiveness evaluation committee and the schedule for the first effectiveness evaluation, if needed, on the basis of the outcome of the above.

6. Following its revised mandate, the re-named ad hoc technical working group met in Geneva in April 2019 to deliberate specifically on the requested report to be presented to the third meeting of the Conference of the Parties. The present report is the outcome of the work begun at that meeting[3] and completed in the subsequent months that included an open comment period from 1August to 5 September 2019.

7. Following the guidance of MC-2/10, this report is presented in four sections: Section I gives an introduction on the mandate of the work of the ad hoc technical expert group, and the report on its work on the arrangements the group proposes be put in place to provide the Conference of the Parties with the required information to conduct an

[3] At this meeting, the ad hoc technical group had before it a compilation of comments on the effectiveness evaluation framework (UNEP/MC/EE.2/5), submitted information (UNEP/MC/EE.2/3) and the compilation of comments on the report of the group submitted to the Conference of the Parties at its second session (UNEP/MC/EE.2/4).

effectiveness evaluation of the Minamata Convention on Mercury. Section II provides an overview description of the proposed effectiveness evaluation framework including laying out four key policy question identified to be used to evaluate the effectives of the Convention. Section III lays out the constituent elements of the framework in detail by describing the proposed methodology to conduct the effectiveness evaluation. This section also puts forward the proposed schedule. Section IV outlines further issues for the consideration by the Conference of the Parties, including as suggested action a draft decision to operationalise the proposed framework.

8. The report further contains four annexes. The first annex outlines technical information related to monitoring. The second annex presents the terms of reference of the Effectiveness Evaluation Committee. The third annex outlines the terms of reference of the global monitoring arrangements. And the fourth annex gives a description of the reports that are to be prepared for the Effectiveness Evaluation Committee.

9. The ad hoc technical expert group proposes that the Conference of the Parties at its third meeting adopts the framework, adopts the proposed timeline for the first cycle of the effectiveness evaluation, and at its fourth meeting establishes the Effectiveness Evaluation Committee. This will enable the fifth meeting of the Conference of the Parties to consider the findings and conclusions of the Effectiveness Evaluation Committee. A draft decision has been prepared for consideration in this regard.

II. Overview description of the effectiveness evaluation framework

10. The objective of the Minamata Convention, per Article 1, is "*to protect the human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds*."

11. The goal of an effectiveness evaluation is to consider the extent to which the Convention is achieving this objective. To analyse its effectiveness is to consider whether measures taken by Parties in response to the Convention have resulted in reductions in emissions and releases that have, in turn, led to lower risks to human health and the environment (compared with what would have occurred if the Convention would not have been implemented).

12. The framework for the effectiveness evaluation of the Minamata Convention, as proposed by the ad hoc technical expert group, relies on evaluating evidence along the causal pathways linking actions to implement the Convention, associated changes in emissions and releases, and resulting changes in levels and trends in the global environment, biota, and humans. [4]

13. Based on the information collated, and through proposed indicators on process, outcome and monitoring, an assessment will be made of whether changes in mercury levels attributable to the Convention are significant and sufficient in relations to four policy questions.

Policy Questions

14. **First Policy Question: Have the Parties taken actions to implement the Minamata Convention?** The framework contains a succinct set of "process" indicators intended to reflect the level of implementation of the Convention by Parties. These indicators can be used to evaluate whether implementation of Convention measures can be credibly linked to changes in emissions and releases. They can also be used to identify common challenges in implementation that may undermine the Convention effectiveness. The process indicators are based primarily on reporting mandated by the Convention, supplemented by other available scientific, environmental, technical, financial and economic information as per Article 22, paragraph 3.

15. **Second Policy Question: Have these actions resulted in changes in emissions and releases of mercury to the environment?** The framework also contains a set of "outcome" indicators that reflect estimated changes in supply, demand and emissions and releases of Hg due to Convention measures, as reported by Parties under the Convention. The framework suggests supplementing these data with context provided by comprehensive estimates of global mercury supply, demand, emissions and releases.

16. **Third Policy Question: Have these changes in emissions and releases resulted in changes in levels of mercury in the environment, biota and humans attributable to the Convention?** Article 22 of the Convention specifies that monitoring data on

"the presence and movement of mercury and mercury compounds in the environment as well as trends in levels of mercury and mercury compounds observed in biotic media and vulnerable populations," should be used in the effectiveness evaluation. Attributing changes in human and environmental levels of mercury to Convention measures is challenging, but possible. Past and present emissions from human activities combine with natural sources and other factors affecting mercury cycling, such as atmospheric and ecosystem characteristics, which may evolve, inter alia, due to climate change. The framework outlines how global mercury measurements can be used to assist in the assessment of how successful the implementation measures of the Convention have been.

17. This complex system results in the observed levels of mercury in the environment, biota and humans. As scientific knowledge is still developing to better directly link sources to these receptors, integrated modelling approaches are needed to estimate how changes of emissions and releases from sources covered by the Convention contribute to changes in levels in the environment, biota and humans. The ongoing development and validation of such integrated models relies on monitoring data as well as scientific knowledge of environmental processes and will assist in attributing mercury changes in the environment, to change in mercury emissions and releases.

18. **Fourth Policy Question: Will existing measures under the Minamata Convention be sufficient to meet its objectives of protecting human health and the environment from mercury?** The response to the third policy question will tell us to what extent the Convention is affecting levels and trends of mercury in the environment, biota and humans. The fourth policy question will look at whether the measures under the Convention is significant and sufficient. Is the Convention delivering reduced emissions and releases to its full potential? If not, why? Would delivering at full potential prevent the majority or only a small part of anthropogenic emissions and releases of mercury? Furthermore, are management measures to address residual risk adequate and sufficient in addressing the exposure of people to mercury?

Expert-led integrated assessment for consideration by the Effectiveness Evaluation Committee

19. The proposed framework envisions the synthesis of information and knowledge in **synthesis reports**, and based on these reports and additional information, the preparation of an **integrated assessment report** that provides a scientific and technical perspective on the four policy questions articulated above. The integrated assessment report will interpret the linkages between policy actions, emissions reductions and resulting mercury levels, using available data sources, modelling techniques, and analytical tools drawn from natural and social sciences, and other relevant knowledge.

20. Present science has not yet developed reliable models for forecasting long-term changes in mercury levels resulting from emissions reductions that take into account the full complexities of mercury in the environment. Pending the availability of suitable confirmed multi-media models, the integrated assessment report for the first evaluation may or may not include the use of forecasting models. Therefore, earlier evaluations on the effectiveness of the Minamata Convention may have greater

uncertainty than later evaluations when improvements to such forecasting models become available.

21. The Effectiveness Evaluation Committee will use the expert-led scientific and technical integrated assessment report, and supplemented as necessary by the other synthesis reports, to consider the policy questions and to draw conclusions about the effectiveness of the Convention. Based on this evaluation, the Effectiveness Evaluation Committee is to make recommendations to the Conference of the Parties as required.

22. Table 1 below gives an overview of the construction of the overall effectiveness evaluation framework from the above-mentioned four policy questions, to indicators proposed for evaluation, to the required synthesis reports and the integrated assessment report that will be prepared for the Effectiveness Evaluation Committee, for its consideration and report to the Conference of the Parties. The constituent elements of the framework are explained in detail in Section II.

Table 1: Construction of the effectiveness evaluation framework from policy questions, to indicators and to required reports for consideration by the Effectiveness Evaluation Committee

<table>
<tr><td>Policy Questions</td><td><u>First Policy Question:</u> Have the Parties taken actions to implement the Minamata Convention?</td><td><u>Second Policy Question:</u> Have these actions resulted in changes in emissions and releases of mercury to the environment?</td><td><u>Third Policy Question:</u> Have these changes in emissions and releases resulted in changes in levels of mercury in the environment, biota and humans attributable to the Convention?</td><td><u>Fourth Policy Question:</u> Will existing measures under the Minamata Convention be sufficient to meet its objectives of protecting human health and the environment from mercury?</td></tr>
<tr><td>Indicators</td><td>Process indicators (para 46)</td><td>Outcome indicators (para 46)
Monitoring indicators (para 46)</td><td>Monitoring indicators (para 52)</td><td rowspan="5">Level 5

The Effectiveness Evaluation Committee will use the <u>Integrated Assessment Report</u> supplemented by the <u>synthesis reports*</u> to consider the policy questions posed in the framework, and from that derive conclusions about the effectiveness of the Convention.

*Synthesis reports:
1. Emissions and Releases
2. Trade, Supply and Demand
3. Waste Management
4. Global Monitoring Report</td></tr>
<tr><td>Indicator Clusters</td><td>1. Supply Cluster
2. Demand Cluster
3. Pressure Cluster
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4. Support Cluster
5. Info and Research Cluster</td><td>1. Supply Cluster
2. Demand Cluster
3. Pressure Cluster
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4. Support Cluster
5. Info and Research Cluster</td><td>1. Pressure Cluster</td></tr>
<tr><td>Information Sources</td><td>Parties: Article 21 reports (main source)</td><td>Parties: Article 21 reports (main source)</td><td>- Parties: Article 21 reports
- Existing/proposed monitoring networks and models</td></tr>
<tr><td>Secretariat documents to COP, according to Article 22</td><td>- ICC reports
- Financial mechanism reports
- Report on Capacity-building and technical assistance</td><td>n/a</td><td>n/a</td></tr>
<tr><td>Reports prepared for the Effectiveness Evaluation Committee</td><td colspan="2">Level 1 – 3

1. Emissions and Releases (Pressure Cluster) “Mercury to the environment”
2. Trade, Supply and Demand (Supply and Demand Clusters) “Intended/economic movement of mercury”
3. Waste Management (Supply, Demand and Pressure Clusters)</td><td>Level 3

4. Global Monitoring Report

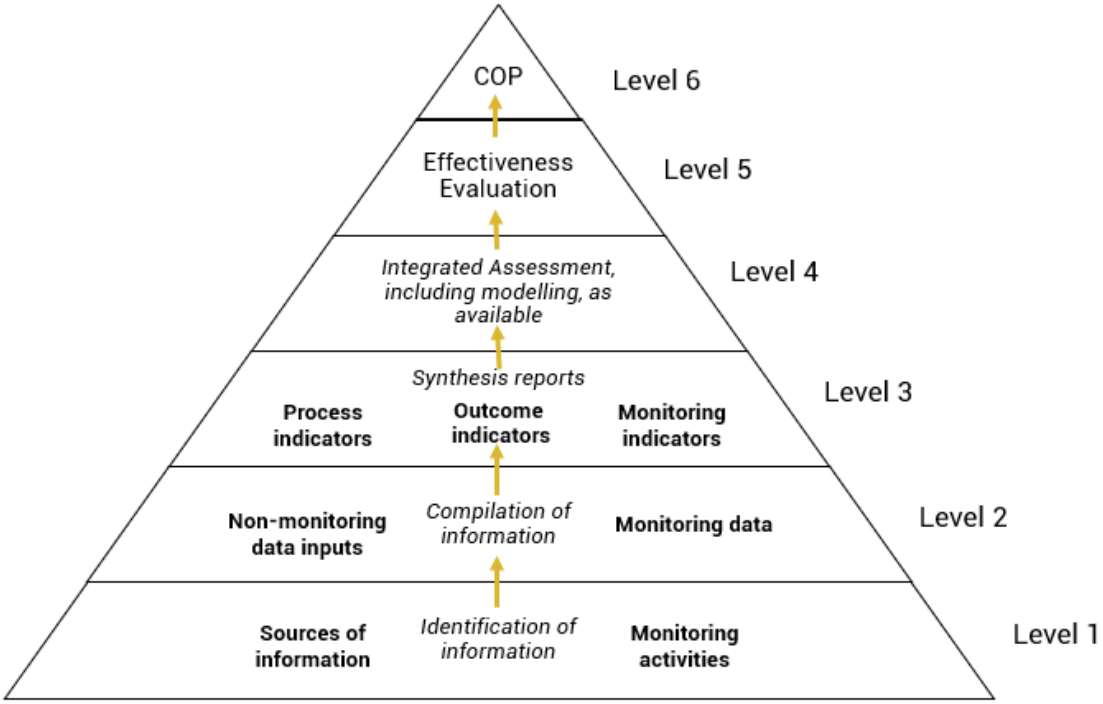
Level 4
5. Integrated assessment Report</td></tr>
<tr><td></td><td colspan="3">Report of the Effectiveness Evaluation Committee is considered by the Conference of the Parties</td><td>Level 6</td></tr>
</table>

III. Proposed methodology and schedule for the evaluation

1. Information and analysis flow for the proposed effectiveness evaluation

23. The effectiveness evaluation will be carried out through a series of sequential steps of data identification and collection, compilation of information, assessment, analysis and synthesis. The framework presents the flow of information, beginning with identifying and collecting information, to compiling information, to synthesises information (levels 1 to 3). The framework then foresees an integration function (level 4), before reaching the Effectiveness Evaluation Committee (level 5) and the Conference of the Parties (level 6).

24. The flow of information and analysis is represented in Diagram 1 below, and explained in more detail thereafter:



25. **Level 1 – Information:** As a first step, information resources available to support the effectiveness evaluation will be identified and amassed. This will include information from reports mandated by the Convention (e.g., implementation reports per Article 21; compliance information and recommendations per Article 15; reports on effectiveness of financial mechanisms per Article 13; emission inventories under Article 8 and release inventories under Article 9; ASGM National Action Plans (NAP) progress reports under Article 7), as well as the Secretariat's Capacity Building and Technical Assistance report.

26. Such reporting may be incomplete, and thus these reports will be supplemented by other available scientific, environmental, technical, financial and economic information per Article 22 paragraph 3 and Article 19.

27. Clear criteria for this data collection should be established (e.g. including peer-reviewed research articles and official publications such as national reports). The monitoring arrangements are specified in Annex 3 and will determine which monitoring resources will be included in the effectiveness evaluation.

28. **Level 2 – Compilation:** Relevant data for the effectiveness evaluation will be extracted from the selected resources and compiled into a format that will enable their use in the subsequent assessment and evaluation stages. Quality control of data should be conducted at this stage. For monitoring data, this may include the compilation of monitoring data into a global/central database with a consistent format, common quality control/quality assurance procedures, assessment of confidence, and other relevant elements.

29. **Level 3 – Synthesis reports:** The amassed and compiled data will be used to create a set of reports that synthesize the information. These reports are to inform the four policy questions. Responding to the request from the Conference of the Parties that the evaluation is to provide for an integrative picture of the general effectiveness of the Convention, the ad hoc technical expert group lays out that the following synthesis reports will be required (see Annex 4 for descriptions of the synthesis reports):

    1. The state of global mercury levels in the environment, biota and humans, as well as trends over time – **Global Monitoring Report**;
    2. **Emissions and Releases Report** – modelled after the *Global Mercury Assessment* (2018);
    3. **Trade, Supply and Demand Report** – modelled after *Global Mercury: Supply, Trade and Demand* (2017);
    4. **Waste Management Report** – building on *Global Mercury Waste Assessment* (2018).

30. The reports will inform on the process, outcome and monitoring indicators, to facilitate the Effectiveness Evaluation Committee's consideration of the four policy questions. These reports will include scientific and technical background, as well as accessible visual presentations.

31. **Level 4 – Integrated Assessment Report:** The synthesis reports (and, where needed, the underlying and/or additional data) on Convention actions, emissions and releases, and monitoring data, etc. will be used for the fifth, the **Integrated Assessment Report**. This integrated assessment report will distinguish between the process, outcome and monitoring indicators to facilitate the Effectiveness Evaluation Committee's efforts to address the four policy questions. The report will take into account other information (information such as socio-economic information, technology innovation, climate data, key global policies, etc.) as necessary. (See annex 4 for a further description of the Integrated Assessment Report).

32. The analyses will likely also include modelling to estimate how changes in emissions and releases due to Convention measures have contributed to changes in mercury levels in the environment, humans and biota.

33. The integrated assessment will also seek to evaluate long-term trends to interpret the relevance of social, technical and economic data in the context of effectiveness the Convention vis-à-vis its objective.

34. While the Integrated Assessment Report is to be an evidence-based science and technical report, it is also to be accessible to non-technical readers and include visual representations.

35. **Level 5 – Effectiveness Evaluation:** The Integrated Assessment Report supplemented, as necessary, by the above-mentioned synthesis reports, will be submitted to the Effectiveness Evaluation Committee. The Committee will use this information to consider the four policy questions to derive conclusions about the effectiveness of the Convention. The Committee may include in its report suggestions for improving the effectiveness evaluation framework. The Committee may also highlight areas that the Conference may wish to consider for the effectiveness of the Convention.

36. **Level 6 – Conference of the Parties:** The Conference of the Parties receives and reviews the report of the Effectiveness Evaluation Committee and considers the conclusions and recommendations of the Committee. The Conference makes its determinations regarding actions or mechanisms to improve the effectiveness of the Convention.

2. Development of indicators

37. The Minamata Convention includes a number of measures that seek to control, reduce or eliminate the major sources and uses of mercury, as well as a set of further stipulations that oblige Parties to work together to support each other in the overall endeavour to protecting people and the environment from the adverse effects of mercury.

38. To provide an integrative picture of the general effectiveness of the measures and provisions of the Convention, the ad hoc technical expert group used an integrative approach to identify indicators.

39. A set of indicators on process, outcome and monitoring to inform the policy questions are proposed. The proposed indicators draw on previous work on elements for the effectiveness evaluation framework, and the review of monitoring capacities and abilities.

40. Numerous indicators, developed following an article-by-article review, are clustering to enable synthesised analysis in the proposed reports. The following articles and indicators are clustered for evaluative purposes:

    (a) **Supply cluster:** supply, storage and waste (Art 3, 10, 11);
    (b) **Demand cluster:** products, processes and ASGM (Art 4,5,7);
    (c) **Pressures cluster:** emissions, releases and contaminated sites (Art 8, 9, and 12),
    (d) **Support cluster:** financial and technical assistance (Art 13 and 14), and
    (e) **Information and research cluster:** information exchange, public information, research (Art 17, 18 and 19).

41. Furthermore, recognising the central nature of some articles, such as Article 1 (setting out the objective of the Convention) or the crosscutting nature, such as Article 16 (on the

health aspects) key articles were not clustered but kept separate for the purposes of identifying indicators.

42. The rationale underlying the proposed indicators is as follows: (a) Process indicators are required to answer the first policy question (Have the Parties taken actions to implement the Minamata Convention?). (b) Outcome indicators are required to address the second policy question (Have the actions resulted in changes in emission and releases of mercury to the environment?). For each cluster of articles, the ad hoc expert group followed the formulation of identification of how many parties are taking action on a key policy measure, and what is the outcome of those actions. (c) Monitoring indicators are needed to provide validated, scientific information to inform and support policy and decision-making.

43. The indicators were largely developed keeping in mind data and reports required by the Convention's reporting requirements or related bodies (including, for example, reports of the Global Environment Facility). These reports will be supplemented by other available and compiled data in the synthesis reports, and in the Integrated Assessment Report. By using the data available, the indicators are therefore cost effective. Further, the data will be produced on a recurrent basis for the life of the Convention, and thus are sustainable.

44. The indicators are formulated in a way that can be practical and feasible. The indicators are designed to be easily counted and calculated, and to be easily understood (they do not represent complex functions). If Article 21 reporting data is submitted electronically to the Secretariat, their calculation should be especially straight forward.

45. Baselines are considered fundamental to undertake an effectiveness evaluation, so that indicators can be evaluated over time. There is no formal process under the Convention to establish baselines. There are two approaches to establish baselines. One is a "before-after" baseline, another is "with-without" baseline. The former is suitable for the indicators that are relatively stable, so that a time value from before the Convention can be used throughout the evaluation process. The latter type is suitable for indicators that fluctuate over time by some factors other than the interventions made due to the provisions of the Convention. Socio-economic and demographic aspects can play a role, as can climate change, ongoing initiatives, as well as shifts in life style. These will impact baseline value in the medium and longer term.

46. Table 2 below presented the proposed indicators, that are to be read in compliment to the specific monitoring indicators identified in paragraph 52:

Table 2: Proposed indicators to evaluate the effectiveness of the Minamata Convention			
A: Minamata Convention Article 1: (Objective) Protecting human health and the environment **		**Source of information on indicator**	**Baseline for the indicator**
A1. Cross-cutting monitoring indicator	Levels of mercury in the environment and in humans due to anthropogenic emissions and releases	- Integrated modelling	Baseline amount in the first evaluation (if models are available)
Notes	▪ Attribution to be estimated using modelling to be developed ▪ In case of non-availability of such information from models, levels of mercury and trend in mercury (changes over time) will be used. ▪ The indicator for Article 1 is to be read with the relevant monitoring indicator indicated in Table 4, paragraph 52.		

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B: Supply Cluster of Articles: Mercury supply sources and trade (Article 3), Environmentally sound interim storage of mercury other than waste mercury (Article 10), Mercury waste (Article 11)		**Source of information on indicator**	**Baseline for the indicator**
B1. Overall process indicator for Articles 3, 10 and 11	Share of Parties that have implemented key provisions under this cluster (encompassing all process indicators below, i.e. B5, B6, B7, B9 and B12)	- Article 21 reporting	Baseline amount in the first evaluation
B2. Additional Cross-cutting outcome indicator for Articles 3, 10 and 11	Estimated global supply of mercury, in tonnes per year	- Synthesised information from individual indicators for Art 3, 10 and 11	Baseline amount in the first evaluation
Article 3			
B3. Outcome indicator for Article 3	Total amount of Hg mined from primary mercury mines	- Global Mercury Trade, Supply, Demand (2017) - ASGM NAP reports	Baseline amount in the first evaluation
B4 Outcome indicator for Article 3	Amount of Hg traded - broken down for specific purposes	- Article 3 forms	Baseline amount in the first evaluation
B5. Process indicator for Article 3	Number of parties that have developed an inventory of stocks and sources of supply	- Article 21 reporting	Baseline number in the first evaluation
B6. Process indicator for Article 3	Share of parties that have excess Hg from Chlor Alkali that have taken measures that such mercury is subject to final disposal	- World Chlorine Council Reports	Baseline % in the first evaluation
B7. Process indicator for Article 3	Number of parties trading in mercury	- Article 3 forms	Baseline amount in the first evaluation
Article 10			
B9. Process indicator for	Number of parties that have taken measures to ensure sound	- Article 21 reporting	Baseline amount in the

Article 10	interim storage		first evaluation
B10. Outcome indicator for Article 10	Amount of Hg stored in an environmentally sound way as identified in the inventory of stocks	- Article 21 reporting	Baseline amount in the first evaluation
Article 11			
B11. Outcome indicator for Article 11	Amount of mercury/mercury compound waste subjected to final disposal	- Article 21 reporting	Baseline amount in the first evaluation
B12. Process indictor for Article 11	Number of parties that have measures in place to manage mercury waste in an environmentally sound manner	- Article 21 reporting	Baseline amount in the first evaluation
Notes	▪ Data from non-Parties is important too.		

522

C: Demand Cluster of Articles: Mercury-added products (Article 4), Manufacturing processes in which mercury or mercury compounds are used (Article 5), and Artisanal and small-scale gold mining (Article 7)		**Source of information on indicator**	**Baseline for the indicator**
C1. Cross-cutting process indicator for Articles 4, 5 and 7	Share of Parties that have implemented key provisions under this cluster	- Synthesised information from individual indicators for Art 4, 5 and 7	Baseline % in the first evaluation
C2. Cross-cutting outcome indicator for Articles 4, 5 and 7	Global use of Hg product or process in tonnes per application	- Information from industry stakeholders	Baseline amount in the first evaluation
Article 4			
C3. Process indicator for Article 4	Number of parties having appropriate measures to not allow the manufacture, export or import of mercury-added products listed in Part I of Annex A	- Article 21 reporting	Baseline number in the first evaluation
C4. Process indicator for Article 4	Number of exemptions per product category which are still valid	- Registry of exemptions	Baseline number in the first evaluation
C5. Process indicator for Article 4	Number of parties that have taken two or more measures for the mercury-added products listed in Part II of Annex A	- Article 21 reporting	Baseline number in the first evaluation
C6. Additional outcome indicator for Article 4	Volume tonnes of mercury added products (a) imported and (b) exported, in units per year for each product category in Annex A Part 1	- Trade and customs data	Baseline amount in the first evaluation
Article 5			
C7. Process indicator for Article 5	Number of parties with exemptions for Annex B Part 1 processes, which are still valid	- Registry of exemptions	Baseline number in the first evaluation
C8. Process indicator for Article	Number of parties having measures in place to not allow the	- Article 21 reporting	Baseline number in the

5	use of mercury or mercury compounds in manufacturing processes listed in Part I of Annex B		first evaluation
C9. Process indicator for Article 5	Share of the parties that have processes subject to Article 5 para 3, that have taken all the measures for the respective processes listed in Annex B, Part II	- Article 21 reporting	Baseline % in the first evaluation
Article 7			
C11. Outcome indicator for Article 7	Total amount of Hg used in ASGM globally, in tonnes per year	- Article 21 reporting - NAPs and its review - Notifications	Baseline amount in the first evaluation
C12. Process indicator for Article 7	Share of parties declaring more than insignificant ASGM that have submitted NAP	- Notifications	Baseline % in the first evaluation
C13. Process indicator for Article 7	Share of parties that have submitted a NAP and have reviewed it	- Article 7 review	Baseline % in the first evaluation
Notes	▪ Some data on products may not be obtainable from public sources.		

523

D: Pressure Cluster of Articles: Emissions (Article 8), Releases (Article 9) and Contaminated Sites (Article 12)		**Source of information on indicator**	**Baseline for the indicator**
D1. Overall process indicator for Articles 8, 9 and 12	Share of Parties that have implemented key provisions under this cluster	- Article 21 reporting	Baseline % in the first evaluation
D2. Cross-cutting outcome indicator for Articles 8, 9 and 12	Total amount of Hg emitted and released	- Global Mercury Assessment - Inventories - MIAs	Baseline amount in the first evaluation
Article 8 **			
D3. Outcome indicator for Article 8	Total amount of Hg emitted from each of point source categories in Annex D (Article 21 report, inventories)	- Article 21 reporting	Baseline number in the first evaluation
D4. Process indicator for Article 8	Number of parties that have enacted appropriate laws and regulations to require BAT/BEP for new sources	- Article 21 reporting	Baseline number in the first evaluation
D5. Process indicator for Article 8	Number of parties that have put in place control measures for existing sources (per each of the measures set out in Article 8, para 5)	- Article 21 reporting	Baseline number in the first evaluation
Article 9 **			
D6. Outcome indicator for Article 9	Total amount of Hg releases in the inventory from relevant sources (Article 21 report, inventories)	- Article 21 reporting	Baseline number in the first evaluation

D7. Process indicator for Article 9	Number of parties that have identified relevant sources	- Article 21 reporting	Baseline number in the first evaluation
D8. Process indicator for Article 9	Number of parties that have established inventory of releases from relevant sources	- Article 21 reporting	Baseline number in the first evaluation
Article 12			
D9. Process indicator for Article 12	Number of parties that have developed strategies for identifying and assessing sites contaminated by mercury or mercury compounds	- Article 21 reporting	Baseline number in the first evaluation
D10. Process indicator for Article 12	Number of parties that have developed the inventory of contaminated sites	- Article 21 reporting	Baseline number in the first evaluation
Notes	▪ The indicators for Article 8 and 9, are to be read with the relevant monitoring indicators indicated in Table 4, paragraph 52.		

524

E: Support Cluster of Articles: Financial resources and mechanism (Article 13), and Capacity-building, technical assistance and technology transfer (Article 14)		**Source of information on indicator**	**Baseline for the indicator**
Article 13			
E1. Process indicator for Article 13	Number of Parties: o that have contributed to the financial mechanism referred to in paragraph 5 of Article 13 o that have received GEF resources o that have received SIP resources o that have mobilised national resources for implementing the Convention	- Article 21 reporting	Baseline number in the first evaluation
E2. Process indicator for Article 13	Amount of resources provided by: o Global Environment Facility o Specific International Programme o Bilateral support	- Article 21 reporting	Baseline number in the first evaluation
E3. Additional Process indictor for Article 13	Number of recommendations from the financial review reflected in the GEF/SIP policy documents	- Information from policy documents	Baseline: zero
Article 14			
E4. Process indicator for Article 14	Number of Parties: o that have cooperated for providing capacity building and technical assistance to another party o that have requested technical assistance o that have received capacity building or technical	- Article 21 reporting	Baseline number in the first evaluation

	assistance o that have promoted or facilitated technology transfer		
Notes	▪ The cycle of review of the Financial Mechanism may well not align with the effectiveness evaluation cycle.		

525

F: Minamata Convention Article 15: Implementation and Compliance Committee		**Source of information on indicator**	**Baseline for the indicator**
F1. Process indicator	Proportion of issues that the Committee was able to resolve, including indications of systemic issues, if any	- ICC report, as referred to in Art 21	Baseline number in the first evaluation
Notes	▪ The expert group could not complete its deliberations in the indicator, as the ICC had not yet finalised its terms of reference. Their terms of reference are to be considered by COP3.		

526

G: Minamata Convention Article 16: Health aspects **		**Source of information on indicator**	**Baseline for the indicator**
G1. Monitoring indicator	Mercury levels in selected human populations (as defined by the monitoring arrangements)	- Existing monitoring data and activities	Baseline number in the first evaluation
G2. Process indicator	Number of parties that have taken measures, such as fish advisories, to provide information to the public on exposure to mercury in accordance with paragraph 1 of article 16	- Article 21 reporting	Baseline number in the first evaluation
G3. Process indicator	Number of parties that have taken measures to protect human health in accordance with article 16	- Article 21 reporting - Submissions to the secretariat	Baseline number in the first evaluation
Notes	▪ The indicator for Article 16 is to be read with the relevant monitoring indicators indicated in Table 4, paragraph 52. ▪ Mercury levels in biota also to be considered.		

527

H: Information and Research Cluster of Articles: Information exchange (Article 17), Public information, awareness and education (Article 18), Research, development and monitoring (Article 19)		**Source of information on indicator**	**Baseline for the indicator**
Article 17			
H1. Process indicator for Article 17	Number of parties with designated national focal points	- Article 21 reporting	Baseline number in the first evaluation
H2. Process indicator for Article 17	Number of parties that have established information exchange mechanisms related to mercury	- Submissions to the secretariat	Baseline number in the first evaluation
Article 18			
H3. Process indicator for Article 18	Number of parties that have taken measures to implement article 18	- Article 21 reporting	Baseline number in the first evaluation

H4. Process indicator for Article 18	Average number of measures under paragraph 1 of Article 18 that are being implemented by parties	- Derived from Article 21 reporting	Baseline number in the first evaluation
H5. Process indicator for Article 18	Number of parties that have public information on mercury levels in air, humans and biota	- Article 21 reporting	Baseline number in the first evaluation
H6. Process indicator for Article 18	Number of parties undertaking risk communication relating to mercury consumption	- Article 21 reporting	Baseline number in the first evaluation
Article 19			
H7. Process indicator for Article 19	Number of parties that have undertaken research, development and monitoring in accordance with paragraph 1 of article 19	- Article 21 reporting	Baseline number in the first evaluation
H8. Process indicator for Article 19	Number of parties contributing data and knowledge to integrated assessments	- Existing monitoring networks, databases, scientific data and literature	Baseline number in the first evaluation
H9. Additional process indicator for Article 19	Number of regions contributing to a regional dataset	- Existing monitoring networks, databases, scientific data and literature	Baseline number in the first evaluation
Notes	▪ Submissions to the Secretariat that supplement article 21 reporting.		

528

I: Minamata Convention Article 20: Implementation Plans		**Source of information on indicator**	**Baseline for the indicator**
I1. Process indicator	Number of parties submitting implementation plans	- Secretariat report to the COP submissions	Baseline: zero
Notes	▪ Parties do not have the obligation to prepare implementation plans. Some Parties found it useful to prepare such a plan nevertheless, and submit it to the Secretariat.		

529

J: Minamata Convention Article 21: Reporting		**Source of information on indicator**	**Baseline for the indicator**
J1. Process indicator	Proportion of parties reporting on time	- Article 21 reporting	Baseline: % of the first submission on time
J2. Process indicator	Proportion of parties indicating that information is not available for specific questions	- Article 21 reporting	Baseline: % not available in the first reports
Notes	▪ Parties are to report every two years.		

K: Minamata Convention Article 22: Effectiveness evaluation		Source of information on indicator	Baseline for the indicator
K1. Process indicator	Evidence of implementation of recommendations from effectiveness evaluation through decisions and actions of the Conference of the Parties	- COP report	Baseline: zero
Notes	▪ This article will not be evaluated in the first evaluation.		

3. Data sources

47. The availability of information sources from which to derive these indicators, as well as supplementary relevant and comparable scientific, environmental, technical, financial and economic information on which to base the effectiveness evaluation, is driven by a number of factors.

48. First, different articles of the Convention have different time lines for implementation. Some of these deadlines fall within the first cycle of effectiveness evaluation (2017-2023), but some do not. Moreover, even if a measure is implemented within the deadline, evidence of its impact and therefore effectiveness may not be available for some time or not directly measurable. This presents some challenges on how to attribute effect. Table 3 below gives a short overview of phase-out dates and time-bound articles of the Minamata Convention and their time lines.

Table 3: Minamata Convention Timelines

Date	Article	Description
2018	Art 5, para 2, Annex B	Acetaldehyde production in which mercury or mercury compounds are used as a catalyst to be phased out
2020	Art 4, para 1, Annex A	Manufacture, import or export of various mercury-added products shall not be allowed (including of batteries, switches and relays, compact and linear fluorescent lamps, high pressure mercury vapour lamps, cold cathode fluorescent lamps and external electrode fluorescent lamps for electronic displays, cosmetics, pesticides and topical antiseptics, as well as barometers, hygrometers, manometers, thermometers and sphygmomanometers)
	Art 5, para 3, Annex B	In vinyl chloride monomer production, reduce the use of mercury in terms of per unit production by 50 per cent by the 2020 against 2010 use.
		For sodium or potassium methylate or ethylate reduce emissions and releases in terms of per unit production by 50 per cent by 2020 compared to 2010
2025	Art 5, para 2, Annex B	Chlor-alkali production to be phased out
2027	Art 5, para 3, Annex B	For sodium or potassium methylate or ethylate, reduce the use of mercury aiming at phase-out of its use as fast as possible and within 10 years of entry into force of the Convention
2035	Art 3, para 4	Primary mining of mercury that was conducted within a Party's territory at the date of entry, is to cease 15 years after that date
2020	Art 5	Submit to the secretariat information on the number and types of facilities covered under Annex B, and the amount of mercury or mercury compounds used
	Art 7	Submit NAP to secretariat if developed
	Art 9	Identify relevant point source categories
2021	Art 8 and 9	Submit National Implementation Plan if one has been developed

2022	Art 8	Require BAT/BEP for new facilities
	Art 8	Develop and maintain an inventory of emissions sources
	Art 9	Develop and maintain an inventory of release sources
2017	Art 8	Require measures for control on existing facilities

548

549 49. Second, various important identified data sets and information sources that have been
550 produced in the past are not required under the Convention, and thus the production of
551 similar reports in the future is not assured or governed by Convention requirements.
552 These include Minamata Initial Assessment, as well as the Global Mercury Assessment
553 (produced 2002, 2008, 2013 and 2018), and the reports on Global Mercury: Supply,
554 Demand and Trade (2006 and 2017).

555 50. Third, some information sources differ in frequency. The ASGM National Action Plans
556 due 3 years after the entry into force of the Convention for that party (or three years after
557 its declaration to the Secretariat that it has more than insignificant ASGM) and must be
558 reviewed every three years thereafter. The regular reports under Article 21 are to be
559 completed every two years for specified questions, with the first short reports due at the
560 end of 2019, and the first full reports that respond to all reporting requirements due at the
561 end of 2021.

562 51. Last, is the consideration of the availability of relevant and comparable scientific and
563 environmental monitoring data. On the one hand, mercury is one of the longest studied
564 chemicals. On the other hand, in considering the available monitoring information and
565 available data on mercury and mercury compounds, the ad hoc technical expert group
566 noted that not all data and matrices are suitable for direct comparison or analysis at the
567 global level, and modelling will be critical to shape our fuller understanding of the
568 presence of mercury and its trends in our environment, as well as to attribute changes in
569 mercury levels to Convention measures.
570

571 52. The current mercury monitoring arrangements and modelling frameworks are outlined in
572 more detail in Annex I on Technical Information on Monitoring and Annex 3 on the
573 Global Monitoring Arrangements. Table 4 below given an indicative overview of
574 selected monitoring indicators and how they can contribute to the overall effectiveness
575 evaluation. They are to be read in complement with the indicators presented in Table 2 in
576 paragraph 46:
577
578

Table 4: Monitoring indicators by media		
Overall media	**Indicator**	**Source of info**
1. Air	M1. Total gaseous mercury/gaseous elemental mercury in the ambient air	Existing/expanded monitoring activities and networks

	M2. Mercury level in precipitation	Existing/expanded monitoring activities and networks
2. Human	M3. Mercury level in hair as primary matrix	Epidemiological studies by Parties
	M4. Mercury level in blood as alternative	International and national biomonitoring programme Longitudinal birth cohort and cross-sectional studies
3. Biota	M6. Mercury levels in biota	Continental network
	M7. Mercury levels in biota	Oceanic framework
Water as a separate media is included to inform modelling (attribution).		
4. Water	M8. Mercury levels in sea water covering horizontal and vertical distribution	Existing/expanded monitoring activities and networks

4. Use of modelling in the effectiveness evaluation

53. Models provide for the integration of mechanisms and observations and use that to assess projections for future source apportionment. It can be said, that models therefore formalise the scientific understanding of mechanisms affecting mercury behaviour. One critical source of models is to provide a tool for linking and spatially/temporally extrapolating monitoring data collected globally as part of ongoing research programmes, policy activities and data provided by civil society, in order to provide a comprehensive picture of the state of mercury pollution globally. Moreover, integrating modelling frameworks provide a tool to work across media, i.e. for linking releases of mercury to the atmosphere, land and water to methylmercury in fish and wildlife, as well as exposure of human populations.

54. Another critical use of models in effectiveness evaluation is to attribute changes to levels in mercury to Convention measures.

55. Models for different media (air, human, biota, water, and soil) vary in their ability and state of development. For example, for air and atmosphere, many monitoring groups have developed global modelling tools that can be used to assess the impact of changes in anthropogenic mercury emissions and releases on global atmosphere concentrations, and mercury inputs to terrestrial ecosystems and the ocean. Atmospheric models have been extensively evaluated and can be applied to assess spatial gradients in atmospheric mercury concentrations and deposition, as well as temporal changes. By contrast, models for other media such as land, are still mainly used in research applications.

56. To bridge linkages across different media, integrated model frameworks seek to link various models used for different media. In this way integrated modelling frameworks

provide a tool for linking emissions of mercury to the atmosphere and releases to land and water, to methylmercury in fish and wildlife, and to exposure of some fish-consuming human populations. It is to be noted that a difficult link in integrated modelling frameworks is to human exposure and health outcomes due to the diversity of dietary preferences, food consumption patterns and individual variability in toxicokinetics affecting methylmercury uptake and elimination.

57. In addition to models that describe behaviour of mercury in the environment and receptors, a variety of models and quantitative techniques can simulate socio-economic systems to forecast where mercury is present in society and where it might eventually enter the environment. In this way models can be used to develop scenarios that represent baseline and different policy alternatives. Inputs to these models include commercial data (e.g. amount of mercury in products), technological performance, economic information, energy data, demographic information, policy specifications, and institutional analysis. Outputs can include emissions and releases of mercury, and socio-economic parameters. Other types of models that are relevant to understanding socio-economic systems of relevance to mercury include life-cycle analysis, materials flow analysis, input-output, and economic models.

58. Developing and evaluating integrated models draws on expertise that bridges natural science, social science, and engineering. The components for an integrated modelling framework are currently undergoing rapid development in the scientific and academic community and should be available for our greater understanding of mercury cycling and its impacts in the near future. It is expected such models will available by 2023 for policy-relevant analyses.

5. Scientific and technical functions

59. The framework foresees two scientific and technical functions to performed for the effectiveness evaluation, namely a synthesis function, and an integration function. These function at different levels of the framework.

    a. **Synthesis function:** The first function is to synthesise mercury information collected and compiled by the level 1 to 3 activities. Two streams of information are referred to in this regard: (i) information provided by Parties based on Article 21 reporting, and (ii) information and knowledge that is scientific, peer-reviewed and publicly available. The information is used to respond to the first three policy questions, and the indicators identified, to prepare the four synthesis reports. This function foresees a role for the secretariat, for scientists and experts, and for organisations. This function foresees the production of four synthesis reports, one of which is the Global Monitoring Report, for which a specific expert group is foreseen.

    b. **Integration function:** The second function, which occurs at level 4, is to interpret the information and knowledge collected, compiled and synthesised by the level 1 to 3 activities to interpret the linkages between policy actions, emission reductions and resulting mercury levels, using available data sources, modelling techniques and analytical tools drawn from natural and social sciences. Further this function

included also the collection of additional non-mercury information for further analysis that will include, but is not limited to, data on socio-economic and demographic information such as global population trends, trade and industry trends, mitigation and adaptation policies, or on technological innovation information such as alternative products, communication and transport technologies. The intent of this function is to provide an integrative picture through the contextualisation of information for that evaluation cycle of the Convention. The function foresees the production of the Integrated Assessment Report, and the establishment of a specific integrated assessment group of expertise.

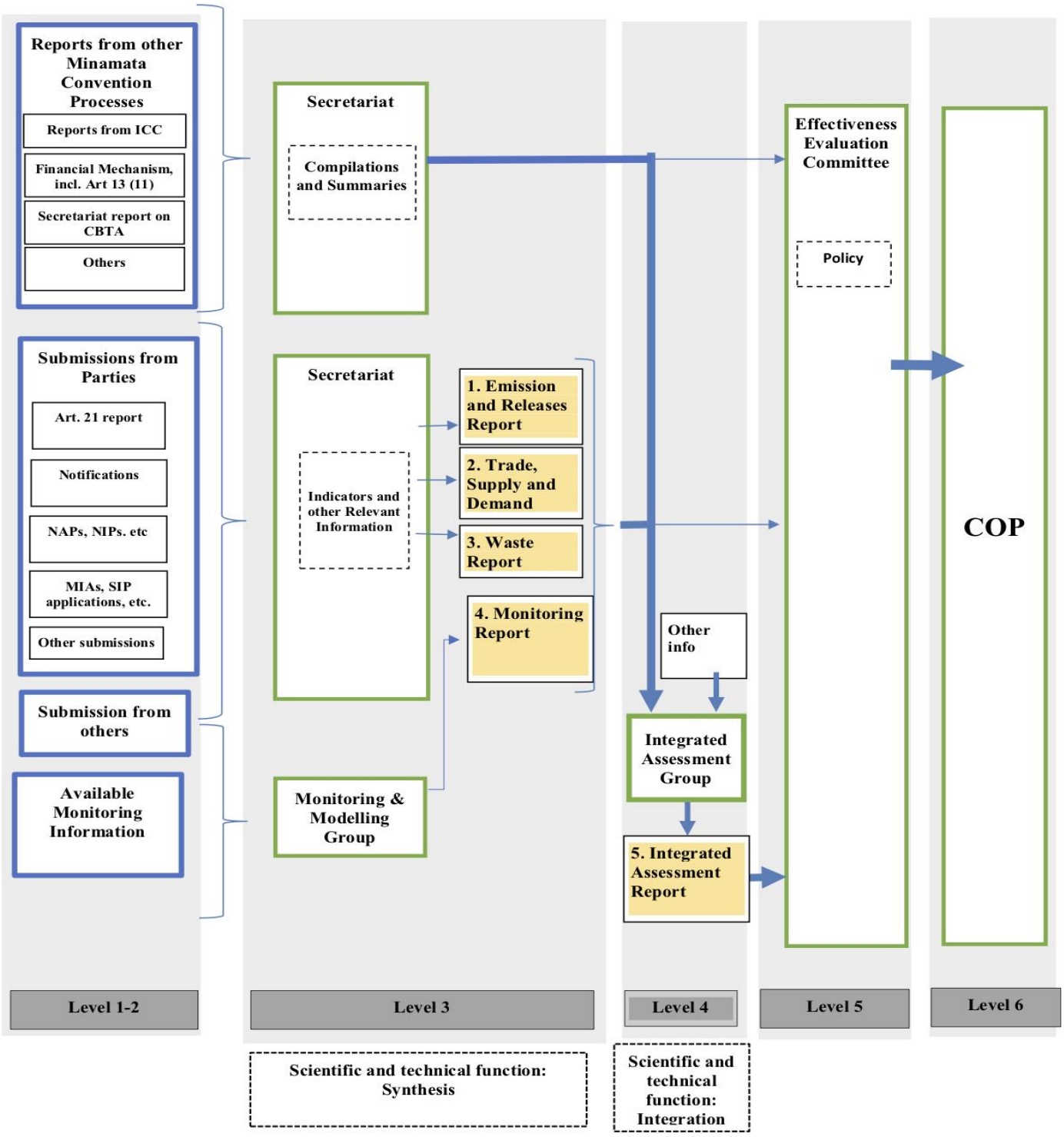
60. The framework also differentiates between input from the following two:

a. **Monitoring:** Compiling, assessing and summarizing available monitoring data, per the monitoring arrangements in Annex III, to describe the current state of mercury concentrations, as well as trends in the environment, humans and biota, and working with modelling experts as appropriate. The global monitoring report developed at level 3 will be the input to the integrated assessment at level 4, and also submitted to the Effectiveness Evaluation Committee.

b. **Modelling:** Analysing the contribution of emissions and releases covered by the Convention to overall mercury concentrations in the environment, and where possible, in humans and biota. Modelling conducted during level 4 will estimate future mercury concentrations that reflect the overall impacts of mercury emissions and releases, from legacy emissions and releases to those predicted in the future under various scenarios, based on the reports made available in the effectiveness evaluation process, as well as available relevant socio-economic information.

6. Institutional Arrangements for the Effectiveness Evaluation

61. To implement the effectiveness evaluation process described thus far, the framework identifies different entities that may deliver the tasks to compile, summarize and integrate data and knowledge, and to perform relevant scientific and technical analyses. Diagram 2 below displays the activities, outputs and flow of information and knowledge among entities potentially responsible for these tasks.


Reports from other Minamata Convention Processes
Reports from ICC
Financial Mechanism, incl. Art 13 (11)
Secretariat report on CBTA
Others
Submissions from Parties
Art. 21 report
Notifications
NAPs, NIPs. etc
MIAs, SIP applications, etc.
Other submissions
Submission from others
Available Monitoring Information
Secretariat
Compilations and Summaries
Secretariat
Indicators and other Relevant Information
1. Emission and Releases Report
2. Trade, Supply and Demand
3. Waste Report
4. Monitoring Report
Monitoring & Modelling Group
Other info
Integrated Assessment Group
5. Integrated Assessment Report
Effectiveness Evaluation Committee
Policy
COP
Level 1-2
Level 3
Level 4
Level 5
Level 6
Scientific and technical function: Synthesis
Scientific and technical function: Integration

Minamata Convention Secretariat

62. The Secretariat will play a role in collecting, compiling, summarizing and synthesizing available data. The Secretariat already has a role, prescribed by the Convention, to act as the mechanism through which Parties submit reports under Article 21, which in turn will contain references to progress reports on the NAPs, under Article 7, to inventories under Articles 8 and 9; and voluntary NIPs under Article 20. The Secretariat may, as appropriate, be assisted by groups of experts or hired experts, conduct literature reviews, produce datasets for further analysis or organize synthesis and peer review.

63. These datasets will be processed at level 3 for calculating/ tabulating process and outcome indicators. The Secretariat will also become responsible for facilitating synthesis reports that combine these indicators with other relevant information, including commissioning external expertise where necessary, as UNEP has done in previous efforts – for example, under the Global Mercury Assessment (2018), the report on Global Mercury Supply, Trade and Demand (2017) and the Global Mercury Waste Assessment (2018).

64. The Secretariat will also compile summaries and synthesis reports resulting from other processes mandated by the Convention, such as reports from the Implementation and Compliance Committee under Article 15, reports from bodies implementing the financial mechanism, the report on the effectiveness of the finance mechanism, required under Article 13, paragraph 11 (which will draw inter alia on reports such as GEF report and the SIP report) and the Secretariat's report on Capacity Building and Technical Assistance. All synthesis reports and summary documents will be eventually submitted to the Effectiveness Evaluation Committee as supplementary information for their consideration at level 5. These reports (and underlying data where needed) will be transmitted for integrated assessment at level 4.

Delivery of the scientific and technical functions

65. The framework puts forward that the scientific and technical functions can be delivered as follows:
    a. **Scientific and Technical Expertise:** A scientific and technical grouping comprising of individuals with extended expertise on monitoring, scientific and technical assessment, and natural and social sciences and research relevant to mercury, is to deliver the activities of level 1 to 3, to produce the four synthesis reports. For this purpose, there are roles for the secretariat, for scientists and experts, and for organisations. This group will include a specific group of monitoring and modelling experts to coordinate monitoring and modelling activities that produces the Global Monitoring Report (a synthesis report).

    b. **Integration Assessment Group:** A small separate group is required, at level 4, to produce the Integrated Assessment Report for the Effectiveness Evaluation Committee. Specific chapter and section authors led by a chief author will be identified to comprise this group. The group will necessarily be multi-disciplinary in nature, and authors will be identified according to their most suitable expertise. For attribution functions, the group will include modellers. Additionally, this group will also be supported by communication expertise to ensure the results of

this integrated assessment are summarised and presented in visual forms (e.g. a dashboard type score table summarising progress).

Effectiveness Evaluation Committee

66. The Effectiveness Evaluation Committee at level 5 will use the Integrated Assessment Report supplemented by the four synthesis reports to consider the policy questions posed in the framework, and from that derive conclusions about the effectiveness of the Convention. The Effectiveness Evaluation Committee will formulate recommendations aiming at improving the effectiveness of the Convention. The Committee may include in its report suggestions for improving the effectiveness evaluation framework. Terms of reference for the Committee are found in Annex II.

Conference of the Parties

67. The ultimate responsibility for evaluating the effectiveness lies with the Conference of the Parties at Level 6. In this framework, the intention is for the Conference to consider the recommendations of the Committee, and then make determinations about any needed changes to or strengthening of Convention measures. The Conference may also choose to mandate changes in the procedures for future effectiveness evaluation cycles.

Additional proposal to deliver scientific and expert functions

68. The implementing structure for the scientific and expert functions can also be delivered by an external entity following a bidding process. In this case, the Secretariat could be asked to call for proposals that include, but is not limited to, the approach to complete necessary tasks, structure to implement these tasks, associated costs, etc. Should an entity for delivery of this function be selected through a bidding process, full information on the process will be reported to the Conference of the Parties.

7. Schedule and timetable

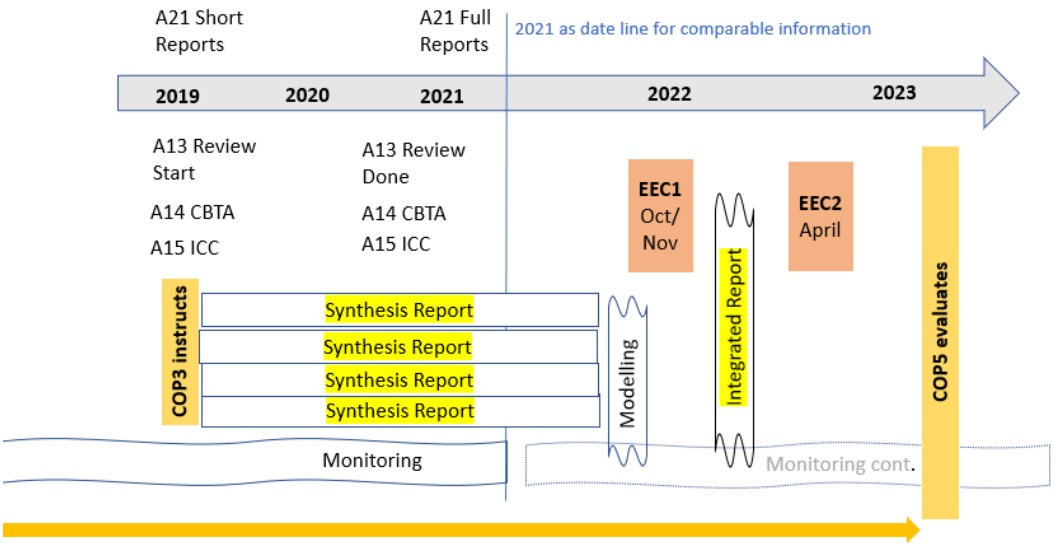
69. Paragraph 1 of Article 12, Effectiveness Evaluation, holds that the Conference of the Parties shall evaluate the effectiveness of the Convention no later than six years after the entry into force of the Convention, and periodically thereafter at intervals to be decided on.

70. As the Convention entered into force on 16 August 2017, the outcome of the first cycle of evaluation it to be submitted in 2023. The fifth meeting of the Conference of the Parties will convene in that year.

71. Taking into account the four-year cycle of reports under Article 21 (Reporting), the regular reports due to the Conference of the Parties on Article 13 (Financial resources and mechanism) and Article 14 (Capacity-building, technical assistance and technology transfer), as well as the monitoring data available, the date line for comparable information for this first cycle of evaluation is recommended to be set as 2021.

72. This allows 2022 and 2023 to be utilised by the Effectiveness Evaluation Committee for its review and analysis to be finalised to be presented to the fifth meeting of the Conference of the Parties.

73. The timeline for the first cycle of the effectiveness evaluation of the Convention is set out in Diagram 3 below:



First Cycle of Effectiveness Evaluation of the Minamata Convention from 2017 to 2023

74. As the Conference of the Parties from its fourth meeting onwards, is to convene every two years, the future effectiveness evaluations would follow this six-year cycle.

IV. Issues for further considerations

75. The ad hoc technical expert group proposes a framework for effectiveness evaluation that follows a flow of information from level 1 to level 6, and identifies different entities that fulfil different functions and roles in the process. While some of these entities already exist (i.e. those for administrative and programme support, compilation of data for synthesis reports, etc), there are others who are to perform vital scientific and technical functions to implement the framework, that are not in place yet.

76. The framework foresees two scientific and technical functions: (i) to produce four synthesis reports (one of which is the Global Monitoring Report), and thereafter, (ii) to produce the integrative picture (the Integrated Assessment Report). These reports are to inform the deliberations of the Effectiveness Evaluation Committee, which in turn reports the outcome of its evaluation to the Conference of the Parties.

77. To operationalise the all constituent elements of the framework, the Conference of the Parties will need put a number of entities into place. Most entities conducting the activities at the different levels are identifiable. They include, the Monitoring and Modelling Group (which is to produce the Global Monitoring Report), the Integration Assessment Group (which is to produce the Integrated Assessment report), and the Effectiveness Evaluation Committee (which is to present its evaluation report to the Conference of Parties). These can be put into place by the Conference of the Parties.

78. What is still to be clarified by the Conference of the Parties is which entities will produce the following reports: (i) Emissions and Releases Report, (ii) Trade, Supply and Demand Report, and (iii) Waste Management Report.

Suggested action by the Conference of the Parties

79. The Conference of the Parties may wish to consider the recommendations of the ad hoc expert group on the proposed framework for the effectiveness evaluation, and may wish to adopt a decision along the following lines:

The Conference of the *Parties,*

Welcoming the report on the proposed effectiveness evaluation framework and monitoring arrangements under the Minamata Convention on Mercury, and complementing information developed by the ad hoc technical expert group on the basis of mandates provided in decision MC-1/9 and decision MC-2/10;

Welcoming monitoring activities already in place and efforts of Parties and others to support the provision of monitoring data on mercury and their availability in the future;

Acknowledging the available modelling capacities for the use in the effectiveness evaluation;

1. *Adopts* the framework for the effectiveness evaluation proposed for the Minamata Convention, including its methodology, indicators, reports, schedule and timeline;

2. *Adopts* the terms of reference and mandate of the Effectiveness Evaluation Committee to perform the evaluation;

3. *Decides* to establish the committee at its fourth meeting;

4. *Establishes* a [scientific and technical group] [monitoring and modelling group] to perform the scientific and technical functions that enable the timely production of the required synthesis reports by its fourth meeting, to enable the integrative work to be done for the Effectiveness Evaluation Committee to convene ahead of its fifth meeting to complete the first evaluation of the Minamata Convention;

5. *Requests the Secretariat* to support the work of the effectiveness evaluation, and to continue to collect information relevant to the effectiveness evaluation including for the development of synthesis reports, working with relevant experts and organizations;

6. *Requests* the group on monitoring and modelling to work in line with its terms of reference including the finalization of monitoring guidance and develop a global monitoring report by COP4 to support the first effectiveness evaluation;

7. *Encourages* Parties to engage actively in the implementation of the effectiveness evaluation framework, in particular, to:

a) Continue to monitor mercury and to share the resulting monitoring data through the group established pursuant to paragraph 3;

b) Collaborate to develop and improve modelling as needed, and carry on geographically representative monitoring of mercury in the environment, in humans, and in biota;

c) Use tools supporting data harmonization identified such as standard operating procedures (SOPs), methodologies and techniques identified by the ad hoc expert group; and

d) Support the further development and long-term implementation of the global monitoring arrangements, if in a position to do so.

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Annex 1: Technical information on monitoring

1. Introduction

1. This annex summarizes the work done by the ad hoc group with regard to global monitoring arrangements at its two meetings in March 2018 and April 2019, and through electronic communication.

2. It starts in Section 2 with the identification of categories of the available comparable monitoring data most effective in providing information on global trends, monitoring data in air, water, biota, and humans that could be used to assess the impact on levels and trends of mercury, and the potential and limitations of the data identified. Section 3 further assesses the extent to which the information reviewed meets the needs for effectiveness evaluation, identifies major gaps, outlines options to enhance the comparability and completeness of the information, and compares these options for their cost-effectiveness, practicality, feasibility and sustainability, global coverage, and regional capabilities to identify opportunities for future enhancements to monitoring. Section 4 identifies available modelling capabilities to assess changes in global mercury levels within and across different media. Section 5 examines options and identifies sources of data that can be used for establishing a baseline for monitoring data. Further discussion on the development of guidance for monitoring and proposed monitoring arrangements is included in Annex 3 on terms of reference for global monitoring arrangements.

3. A large amount of other relevant technical information on monitoring complementing the proposal in this annex including an overview of available monitoring information, is available in a reference document as UNEP/MC/COP.3/INF/xx.

2. Identification of monitoring information/data

How monitoring activities may contribute to the development of the effectiveness evaluation framework

4. In considering monitoring information and data, the ad hoc group considered matrices outlined in MC-2/9: air, biota, humans and water. The ad hoc group concluded that data on levels of mercury and mercury compounds in air, biota and humans either are available or would be able to be obtained, and would be comparable on a global basis. Some experts were of the opinion that data on water are available on a global basis to some extent. The availability and comparability of monitoring data for each matrix are discussed below.

5. Mercury levels in the atmosphere is directly linked to the emissions from the anthropogenic sources identified by the Convention. The atmospheric monitoring activities will contribute to the evaluation of the effectiveness of the Convention by determining whether the levels of mercury are increasing or decreasing in the atmosphere as per changes in the emissions of mercury and enable the modelling results to define source-receptor relationships. Also, this data will contribute to the predictive capabilities of regional and global models of mercury impacting the environment, which may also be affected by other atmospheric chemistry issues.

6. Human biomonitoring has the following advantage in contributing to the effectiveness evaluation of the Convention: provides information on exposure to mercury from all types of sources; integrates the results of the different types of risk reduction measures, and provides information on geographical distribution enabling identification of areas and population groups requiring urgent support in terms of risk reduction measures.

7. Biota monitoring has an advantage in contributing to the effectiveness evaluation of the Convention by tracking changes of environmental mercury levels at regional and global levels to determine protection of human health and the environment.

Ambient air

8. Mercury levels in ambient air have been measured in some locations for a very long period. These data have contributed to the discussion on the global nature of the mercury issue. The current available data is collected by various national and global network owners using different sampling methods. It was recognized that none of the currently available data had global coverage, but that there are potential suitable methods to obtain such global data (as identified in GMA 2018). Overview of existing networks is available in the resource document (UNEP/MC/COP.3/INF/XX).

9. A number of suitable methods are available, and the available sampling techniques considered suitable to obtain globally comparable data were identified and reviewed. These include:

- Total Gaseous Mercury (TGM) or Gaseous Elemental Mercury (GEM) concentrations in air at background and impacted sites;
- Wet deposition.

9. TGM/GEM can be measured adopting active continuous monitoring, manual active air sampling and passive air sampling techniques. Active continuous techniques are in use at several sites of existing regional and global monitoring networks and provide continuous TGM/GEM concentrations, whereas manual active and passive sampling are used in locations where no monitoring infrastructure is available and provide average TGM concentrations as monthly (or at lower frequency) average.

10. The atmospheric deposition flux of mercury is considered the combination of wet and dry deposition of mercury to the surface. Measurements of wet deposition are done through the collection of rain samples and dry deposition either mathematically inferred or measured through tree debris. Several existing long-term networks collect wet deposition samples but, due to a lack of comparable standard procedures, dry deposition is not always measured. The amount of total mercury measured in atmospheric deposition samples is used as basis to calculate the total atmospheric deposition flux associated to a precipitation (rain or snow) event.

11. Validated atmospheric mercury models are needed to assess source-receptor relationships and evaluate the relative importance of each anthropogenic source and/or emission source-region in the global mass balance of mercury with changing mercury emission regime, meteorological conditions and climate forcing. Good global coverage of monitoring data of mercury in ambient air and deposition samples are also of fundamental importance to validate these atmospheric models. Further details are provided in UNEP/MC/COP.3/INF/XX.

Human exposure

12. All people are exposed to some amount of mercury. For many communities worldwide, dietary consumption of fish, shellfish, marine mammals, and other foods is arguably the most important source of methylmercury exposure. Exposures to elemental and inorganic mercury mainly occur in occupational settings (including artisanal and small-scale gold mining) or via contact with products containing mercury. There remains high concern for vulnerable groups including various indigenous populations with high dietary or occupational exposure to mercury.

13. Human biomonitoring to assess general population exposure to mercury (i.e. background level rather than "hot spots") provides information on global trends. In the general population, assessment of prenatal exposure is recommended because the fetus is the most vulnerable to methyl mercury exposure.

14. There are two main biomarkers:

- Total mercury in maternal scalp hair (3 cm hair strand from the scalp, to measure exposure during the 3rd trimester).
- Total mercury in cord blood.

15. Scalp hair is a preferable biological matrix. It is easily available, a non-invasive method, and there are no specific requirements for transportation and storage.

16. Cord blood can be alternative matrix to hair. Inclusion of cord blood in a survey provides several additional advantages such as: demonstration of pre-natal exposure to mercury (cord blood analysis characterizes both exposure of a mother and a child to mercury during pregnancy); possibility to get more reliable results and exclude influence of external factors (e.g. external contamination of hair by mercury, permanent hair treatment decreasing mercury in hair); being an alternative biological matrix to hair in locations where hair sampling is difficult due to cultural, ethical, religious specificities.

17. There are reliable, although variable, coefficients allowing comparability of results from the mercury measurements in hair and blood/cord blood.

18. Assessment of total mercury is sufficient for characterizing exposure, unless external exposure of scalp hair needs to be evaluated.

19. In addition to general population exposure, parties may conduct biomonitoring in other vulnerable populations including the occupationally exposed and in hot spot areas. These data may provide additional information of use for effectiveness evaluation, for example when repeated over time in the same populations.

20. The Global Mercury Assessment 2018 has identified currently available data on mercury exposure in regional and national human biomonitoring programmes, longitudinal birth cohort studies and cross-sectional information in specific populations including high exposure groups.

- In regional and national human biomonitoring programmes, some information may be comparable (depending on the ability to disaggregate data by sex and age within the programme). Such studies are only available in a very small number of countries,

primarily in the northern hemisphere. Such studies are expensive and therefore not feasible for the sole purpose of monitoring global mercury exposure.

- Comparable and high-quality data exists from a number of longitudinal birth cohort studies, including in groups consuming large amounts of seafood, freshwater fish and/or marine mammals. These are available only in a small number of locations, and are not globally representative.
- The GEF-funded project "Development of a Plan for Global Monitoring of Human Exposure to and Environmental Concentrations of Mercury" has generated comparable data in a small number of additional countries, using the WHO protocol.[5]

21. Total mercury in urine is relevant for populations with high exposure to elemental and inorganic mercury, and is not appropriate for assessment of methylmercury exposure. It may be useful for monitoring the impact of control actions taken by parties on mercury exposure in mining communities.

22. Human biomonitoring has a number of advantages for informing an assessment of the effectiveness evaluation of the Minamata Convention, including:

- Directly addressing the fundamental question as to whether enough is being done to protect human health (Article 1 of the Convention);
- Integrating information on exposure to mercury from different sources;
- Integrating the effects of the range of risk reduction measures taken.

23. In using human biomonitoring data, it should be noted that human mercury level is affected by many confounding factors such as fish consumption habit (species and amount), age, gender, alcoholic consumption, health condition, economic level, etc.

Biota

24. Biota samples can provide information for different outcomes. Three types of outcomes, namely human exposures, environmental health, and temporal trends are identified in relation to biota monitoring. There is enough biotic mercury data available regionally and globally to assess environmental exposure for spatial and temporal trends for many, but not all, ecosystems and biomes of geographic interest. Human exposure to dietary methylmercury can originate from fish, birds and marine mammals (with fish forming a major contribution, birds forming either a minor or a major component, depending on diets, and marine mammals which can form a major contribution in certain diets).

25. The following samples from four major biomarker groups (taxa) are considered the most relevant and are most frequently used for methyl mercury monitoring:

- Fish: muscle fillet, muscle biopsy, fin clips, blood
- Sea turtles: scutes, blood, muscle
- Birds: blood, feather, eggs, muscle, eggshells and membranes, liver and kidney

[5] Assessment of prenatal exposure to mercury: human biomonitoring survey (2018) - the first survey protocol http://www.euro.who.int/en/health-topics/environment-and-health/chemical-safety/publications/2018/assessment-of-prenatal-exposure-to-mercury-human-biomonitoring-survey-2018

- Mammals: skin, fur or hair, muscle, liver and kidney

26. In assessing samples, it is recommended to assess muscle tissues for fish and marine mammals. For birds, blood should be used for short term data, muscle or eggs should be used for medium term and feathers can be used for long term results. It is considered to be sufficient to assess total mercury for all tissues (assuming greater than 80 per cent methylmercury mean level) using either wet weight or dry weight. Samples should be georeferenced, with the level of detail varying according to the objective of the sampling. Standard operating procedures are available for example through national /regional monitoring programs, however additional more universal protocols may need to be agreed on for other sampling which is not covered by this process. Inter-tissue conversions are generally feasible to help provide a way to have standardized, and therefore comparable, tissue mercury concentrations.

27. Biodiversity Research Institute (BRI) has compiled mercury data from published literature into a single database, the Global Biotic Mercury Synthesis (GBMS) Database. This database includes details about each organism sampled, its sampling location, and its basic ecological data. From each reference, mercury concentrations are averaged (using weighted arithmetic means) for each species at each location. Data have been compiled from 1,095 different references, representing 119 countries, 2,781 unique locations, and 458,840 mercury samples from 375,677 total individual organisms (See UNEP/MC/COP.3/INF/XX[6].).

28. GBMS database was also the basis for the UN Environment's Global Mercury Assessment – 2018. Examples featured within the GBMS database include datasets for some geographic areas with extensive temporal and spatial information, including areas for freshwater lakes in the northern United States, much of Canada, and Scandinavia. These areas represent over 500,000 fish mercury concentrations over the past 50 years of data collection – sometimes with standard species. In order to potentially explain how the temporal trends of fish mercury concentrations change under influence of different drivers, including environmental/climate change in addition to deposition change, a set of minimum target information should be developed. For each location this should include lake (or river, estuary, sea etc.) catchment morphology, pollution deposition patterns, and local pollution history. For each biota species (here exemplified by fish) minimum data must include length, weight, sex, and sexual maturity. Samples (i.e. fish muscle) for determination of total mercury concentrations, may also be analysed for stable isotopes (at least nitrogen and potentially also carbon) for a better understanding of the food web processes. Many of these parameters are lacking from current databases. As an example, inter-annual and intra-annual variability is often much larger than long-term trends, making it difficult to relate temporal trend changes to large environmental drivers (including deposition). The spatial variation within the temporal trend must be considered when investigating convention effectiveness in years to come. To be able to document potential temporal trends changes, one need to lower the within-year variability, by improving the data adjustment, include more lake data and information, and collect data from the same lake over time.

[6] For more information, see also http://www.briloon.org/uploads/BRI_Documents/Mercury_Center/Publications/For%20Web%20GBMS%20Booklet%202018%20.pdf

Water and soil

29. Levels of mercury and mercury compounds in water are collected in relation to water quality issues in a number of countries. These data may be useful in tracking mercury resulting from local activities which release mercury; however, will not provide overall trends on a global basis. Levels of mercury in ocean water could be comparable on a global basis and collected by existing networks and ad hoc research programmes, but currently such work is done through research-based activities and not dedicated long term monitoring programmes.

30. Soil samples may be very useful in assessing the state of contamination of a particular site, but global comparability may not be feasible, given differences in soil types etc. Data on the levels of mercury in sediments are very relevant for the associated levels of mercury in biota; however sampling of sediment was considered not as widespread, nor as easily comparable on a global basis, at this time. Currently, this work is done through research-based activities and not dedicated long term monitoring programmes.

3. Comparability, gaps and options for filling gaps

Air

31. Figure 1 shows the current monitoring efforts for TGM/GEM. From this figure it can be seen that the gaps of TGM/GEM information could be filled by enhancing the current networks that are conducting atmospheric mercury monitoring. Such expansions would include areas within South America, Africa, the Caribbean, parts of Asia, Russia, and Oceania.

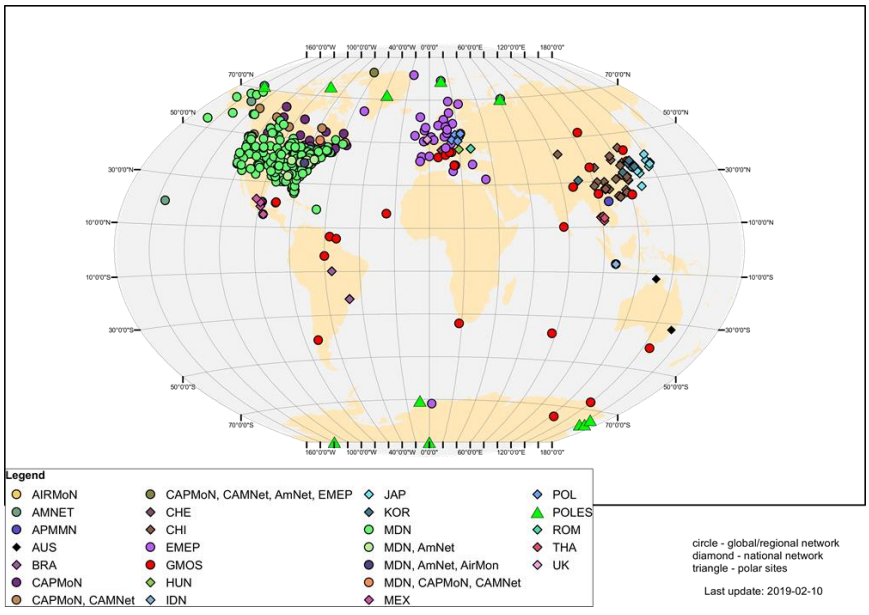

Figure 1 – Existing monitoring networks measuring Hg concentrations in air.

32. The following are recommended:

- Couple current monitoring of TGM/GEM with new technologies (including passive and active mercury sampling);
- Expand current monitoring networks, where possible, to full in data gaps;
- Employ currently-used standard procedures for data collection and treatments, where possible;
- Conduct intercomparisons of measurement technologies and data treatment among networks;
- Fill geographical data gaps of information using manual active or passive sampling methods;
- If feasible, couple manual active or passive air measurements with active and wet/dry deposition measurements;
- Conduct sampling at least on a quarterly basis (either averaged with active sampling data or integrate over 3 months with passive sampling) to assess seasonal variation;
- Prioritize gaps identified in the global mercury assessment and other literature for the establishment of new site locations.

33. In elaborating future strategies aiming to fill geographical gaps of atmospheric mercury monitoring data it is recommended to ensure the operation of about 30 monitoring sites with manual active or passive air sampling in large geographical areas such as Africa, Latin America and Russia placed in locations that may provide information on regional / local background Hg concentrations. The suggested number of sites is only indicative: a larger number of sites using manual active or passive air sampling in these areas would certainly allow to have a better geographical distribution and representativeness of the regional/local emission regimes, meteorology and transport/deposition patterns. A cost analysis for air monitoring including the proposed sampling can be found in UNEP/MC/COP.3/INF/XX Part I Section 4.

Humans

34. Studies using the WHO protocol for assessment of prenatal exposure to methylmercury are recommended to fill the data gaps in order to obtain a global picture necessary for effectiveness evaluation. The protocol enables collection of comparable data (e.g. hair samples from 250 people per study location with minimum diversity recommended). The studies are country-driven. Local ethical (Institutional Review Board) clearance is required and the studies are conducted within the health system, therefore country approval is a given. Each country owns its data and submission of results is voluntary.

35. Article 17 of the Minamata Convention on Mercury specifies in paragraph 1(d) that each party shall facilitate the exchange of epidemiological information concerning health impacts associated with exposure to mercury and mercury compounds, in close cooperation with the World Health Organization and other relevant organizations, as appropriate. The compilation and exchange of data on mercury levels obtained through human biomonitoring should be undertaken in line with this article of the Convention.

36. To facilitate the generation of globally representative data and trend information on human biomonitoring, which will be most relevant for effectiveness evaluation, an oversight body should be kept informed of the studies planned and carried out.

37. Data quality issues are covered by the WHO protocol. Results of the measurements must be analytically comparable between laboratories/different studies. To ensure

comparability, each national survey would need to follow the WHO harmonized SOPs for sampling and analytical methods, and develop procedures for quality assurance and quality control that cover the pre-analytical phase. The availability of appropriate reference materials (samples with a certain level of mercury)[7] supports internal quality assurance. External quality assurance should be done through international inter-laboratory comparison investigations. Coordination of the studies will contribute to ensure appropriate quality control measures.

38. The WHO protocol also covers data management, analysis and evaluation issues, including whether this should be done at the national and/or international level. It recommends that participating countries conduct statistical analyses at the national level and submit anonymized data for statistical analysis to a central database. The aim of a statistical analysis at the international level is to assess associations between biomarker values and predictors such as age, gender, fish consumption habits, etc. (collected via questionnaire) in a pooled dataset. Data communication issues are also addressed in the WHO protocol and particularly for indigenous peoples in AMAP Human Health Assessments. These communication issues include communication of the results within the country, to the individuals participating in the study and to policy makers. It should be noted that, in some countries, national guidelines relating to communication of results may already exist.

39. The UNEP/WHO GEF Global Monitoring Project demonstrated generation of data using the WHO Protocol in developing countries to be cost-effective, practical and feasible. The project built local capacities to conduct such studies, which can therefore be repeated over time and in a range of locations to fill gaps, as described in paragraph 20.

Biota

40. It has been recognized that there is a large amount of published data available, as well as unpublished data collected for commercial and governmental purposes. However, it is not clear to what extent published and other data reflect background information on mercury concentrations, or whether existing data emphasizes areas where high mercury concentrations are expected. As previously described, the large , biotic mercury concentration datasets from the northern United States, Canada and Scandinavia revealed that levels in freshwater fish from lakes with local mercury sources responded to regulation and management. Further evaluation work on existing data is required to gather all currently available globally representative biotic mercury data, to assess what data are relevant, comparable and able to be harmonized. This process has been started with the partly UNEP funded GBMS dataset, which will allow a clearer identification of data gaps, which may be geographic or taxonomic.

41. The Arctic Monitoring and Assessment Programme (AMAP) is one of the best examples of how to operate a long-term Hg biomonitoring field program for the benefit of both human and ecological health (AMAP 2011, 2015). Whereas, the WHO Global Environment Monitoring System - Food Contamination Monitoring and Assessment Programme, commonly known as GEMS/Food, has one of the best global systems for

[7] A list of existing reference materials can be found in UNEP/MC/COP.3/INF/XX Part II.

collecting fish Hg data through their network of collaborating centers and recognized national institutions (WHO 2018).

Cost analysis

42. A table summarizing the cost, practicality, feasibility, sustainability, comparability and coverage of currently-used monitoring methods for air, humans, biota and water is included in UNEP/MC/COP.3/INF/XX.

4. Available modelling capabilities to assess changes in global mercury levels within and across different media

43. Table 1 summarizes the capabilities of models to assess changes in global mercury levels within and across different media. Models for different media (air, water, land, biota) vary in their ability and state of development. Atmospheric models have been extensively evaluated and can be applied to assess spatial gradients in atmospheric mercury concentrations and deposition, as well as temporal changes. By contrast, models for other media such as land are still mainly used in research applications. Further explanation including reference to specific available models and example geographic presentation of calculations from existing models can be found in UNEP/MC/COP.3/INF/XX.

44. Integrated modeling frameworks can illustrate pathways by which primary releases of mercury to the atmosphere, land and water reach methylmercury in fish and wildlife as well as exposure of some fish consuming human populations. At present, integrated modeling frameworks are under development and available as a research product. Integrated models have not previously been applied or compared in global assessment efforts. Coupled atmosphere-ocean and atmosphere-terrestrial have been published in the peer-reviewed literature by a few research groups. With additional model evaluation, updates should be available to begin policy-relevant analyses by 2023. Models for food web bioaccumulation of methylmercury are also available from selected groups and can be used to describe accumulation patterns at the ecosystem scale (lakes, wetlands, estuaries, contaminated sites) and for global marine food webs. The most difficult link in integrated modeling frameworks is to human exposure and health outcomes due to the diversity of dietary preferences, food consumption patterns and individual variability in toxicokinetics affecting methylmercury uptake and elimination. All these components of integrated modeling frameworks are rapidly developing in the scientific community.

1172 **Table 1. Summary of available modeling capabilities for individual media**.
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Media/Availability	Indicators needed for model input	Output provided	Gaps still to be filled
Socio-Economic Modeling: Some Availability Global emission models (forecasting up to 2050)	**Inputs:** socio-economic activity data (production, population, GDP), material flow and policy specifications **Evaluation:** intercomparison and past performance, Anthropogenic material flow	Global demands, Emission and release scenarios	Mercury emission factors to be refined(regional, site, etc.), data on mercury content of commodities to be collected, consistency across sectors and non-mercury policies to be explored (e.g. energy)
Air: Widely Available	**Inputs:** Global emissions **Evaluation:** Atmospheric measurements; Wet and dry deposition data	Atmospheric concentration; deposition; temporal changes; attribution by source region	Harmonized emissions inventories to be established
Water: Research Product; Some Availability *Global Oceans* Global ocean models (MITgcm, NEMO model) *Estuaries (site specific); Freshwater/rivers (site specific*)	**Inputs**: Spatially resolved global atmospheric Hg inputs (wet + dry) – Concentrations of Hg and MeHg in rivers (globally) **Evaluation:** Measured seawater total and methylmercury, and Hg^0 concentrations; These are being collected through networks (GEOTRACES/CLIVAR)	Seawater MeHg in global oceans Total Hg concentrations in seawater globally for surface/deep ocean Temporal changes	Seawater Hg species data somewhat sparse but improving Data on Hg and MeHg in global rivers largely lacking
Soils/Land: Research Product – Some Availability *Global soils* Global terrestrial mercury model (GTMM)	**Inputs:** Atmospheric deposition (model input) Emissions releases to land/water (very preliminary and coarse spatial resolution) Few data on runoff from contaminated sites	Soil Hg concentrations globally Hg in global rivers "Hot spots" most	MeHg simulation for terrestrial environments other than site specific assessments still to be done. Ground truthing

ASGM/Contaminated sites (not yet integrated into global models but would be useful)	Global land cover data and atmospheric inputs **Evaluation:** Soil Hg data (good data for North America, parts of Europe)	sensitive to Hg inputs and likely to affect biota/human populations	global "hot spot" analysis is needed. Data on locations of ASGM and releases/ contaminated sites to be collected.
Biota: Research Product – Some Availability Food web bioaccumulation model for marine ecosystems (global models for plankton exist/fish under development) Food web model for freshwater ecosystems (site specific)	**Inputs**: MeHg seawater (model); Fisheries biomass production from primary productivity globally, trophic interactions (available through collaboration with NOAA/GFDL and UBC Nereus projects) **Evaluation**: Biotic mercury database Trophic level 3 for temporal trend, 4 for spatial gradient analysis	Concentrations of MeHg in fish consumed by human populations; Marine origin of MeHg and Attribution of Hg sources in fish (marine mammals?) by region; Changes due to emissions and climate	Global fish model under development; could link to marine mammals/birds Trophic level 4 data in Asia and Africa to be collected
Humans Exposures of marine fish consumers (globally) *Toxicokinetic model linking MeHg ingestion and blood/hair concentrations/ outcomes* Freshwater fish and rice consumers (site specific data, if applicable) – these may be highest risk populations	Inputs: Biomass and MeHg concentrations in fish consumed by different subsidence populations globally (**model**); Dietary intake data for different human populations National biomonitoring data (model evaluation)	Goal: Attribution of Hg source contributions to human populations	Mechanisms affecting relationships between external MeHg exposure and blood concentrations/ outcomes for different populations are uncertain (research evolving)

Occupational exposures at ASGM sites (site specific)			

5. Establishing a baseline for monitoring data

45. In the "before-after" approach where the mercury levels before and after the implementation of the Convention, monitoring data close to the beginning and the end of the evaluation period can be used. For the first effectiveness evaluation, monitoring data before the entry into force of the Convention may be used as baseline.

46. For air, historical monitoring data exist for some part of northern hemisphere. For human biomonitoring, data from a limited number of regional and national biomonitoring programmes and longitudinal studies may be used. For biota, historical data on mercury levels in freshwater fish in limited geographical areas are available. Work is underway to analyze available data on ocean fish species.

47. In the "with-without" approach to assess the change in mercury levels attributable to the measures taken to implement the Convention, mercury levels for the business-as-usual scenario need to be estimated using integrated modelling framework described above.

Annex 2: Draft terms of reference of the Effectiveness Evaluation Committee

A. Mandate

1. An Effectiveness Evaluation Committee (hereinafter, "the Committee") is established to perform the functions assigned to it by the Conference of the Parties.

B. Membership

2. The members of the Committee shall be appointed on the basis of equitable geographical distribution, taking into account gender and the need for a balance between types of expertise.

3. The Committee shall consist of twelve experts, as follows:

(a) Ten experts designated by parties representing the five United Nations regions, and confirmed by the Conference of the Parties;

(b) One expert representing the monitoring arrangement;

(c) One expert representing the implementation and compliance committee.

4. Experts designated by parties and confirmed by the Conference of the Parties shall have expertise in evaluation, reporting and national implementation, financial or technical assistance, or other expertise relevant to the evaluation.

5. Experts from the implementation and compliance committee shall be selected by and from among the members of its committee.

5a The expert representing the monitoring arrangement shall be selected from the members that take part in these arrangements.

5b Members shall provide their expertise in a neutral and impartial manner, and stand to the evidence presented to the committee.

6. The terms of office shall coincide with a cycle of evaluation as determined by the Conference of the Parties.

7. If a member is unable to complete his or her term of office, the region nominating that member shall nominate another person to complete the term.

C. Invited experts and observers

8. The Secretariat shall select two internationally recognized experts in effectiveness evaluation with due consideration to available expertise on the measures.

9. The Secretariat shall invite one representative of the World Health Organization as an observer.

10. The committee will invite the participation of up to five experts from civil society, indigenous organizations, intergovernmental organizations, industry and the UNEP Global Mercury Partnership as observers. The participation of observers will be balanced among the above-mentioned groups and gender.

11. The committee may allow additional observers within reasonable limits.

12. Observers shall provide their technical expertise that helps the committee members interpret the information provided.

D. Officers

13. The committee shall elect, from among its members, a chair and a vice-chair.

E. Administrative and procedural matters

14. The committee shall apply, mutatis mutandis, the rules of procedure of the Conference of the Parties, unless otherwise provided in these terms of reference.

15. The committee may establish such arrangements as are necessary to facilitate its work in line with the present terms of reference.

16. The committee members shall seek to reach agreement by consensus. Should consensus not be reached by members, the range of their views shall be reflected in any report to be submitted to the Conference of the Parties.

F. Meetings

17. The committee shall hold two face-to-face meeting, to review the information available for each evaluation cycle and to develop a report to the Conference of the Parties, subject to the availability of funds and work requirements. Based on the decisions of the Conference of the Parties, the frequency of committee meetings may be amended as necessary.

18. Documents to be transmitted to the Conference of the Parties shall be finalized by the committee at least four months before the meeting of the Conference of the Parties.

G. Language of meetings

19. The working language of the committee shall be English.

H. Budget

20. Except for members from developed country parties referred to in paragraph 4 of the present terms of reference, financial support for travel and daily subsistence allowance shall be made available to committee members, and invited experts and observers for participation in meetings of the committee according to United Nations rules and practice.

Annex 3: Draft terms of reference of the global monitoring arrangements

Introduction

1. This annex contains a proposal for global monitoring arrangements building on existing monitoring activities, knowledge, expertise and proposes the terms of reference for an expert group to [prepare a synthesis report on monitoring as identified in Section III of the report] [carry out tasks related to monitoring indicators identified in the effectiveness evaluation framework in Section III] in this Annex.

2. In the consideration of the monitoring arrangements, the following key elements were identified:

    a. Mercury data and their availability from human health and environmental monitoring programmes that achieve global coverage and contain at least core representative data from all regions,

    b. Tools supporting data harmonization such as standard operating procedures and monitoring guidance document,

    c. Expertise necessary for gathering and consolidating harmonized information that ensures comparability and consistency in mercury monitoring data over the long-term,

    d. Modelling capabilities, and

    e. Development of a global periodic report on levels and trends of mercury to support the effectiveness evaluation.

3. The text below further elaborates on the key elements identified, but a large amount of other relevant technical information on monitoring and background complementing the proposal below is available in a reference document as UNEP/MC/COP.3/INF.xx. Existing modelling capabilities are reviewed in detail in that INF document as well.

1. Mercury data and their availability from human health and environmental monitoring programmes

4. Regarding mercury data availability, a review presented in Annex I shows that even if mercury has one of the largest available collective data sets of recognized environmental contaminants, data gaps remain. These gaps could be efficiently covered with support of scientific activities and use of already developed materials.

5. By continuing existing mercury monitoring activities in a harmonized manner (see Tools supporting data harmonization below), supplementing them with actions to fill the geographical gaps, data on levels of mercury and mercury compounds in air, biota and humans either are available or would be able to be obtained, and would be comparable on a global basis.

6. Below is the proposal for mercury monitoring activities building on existing monitoring activities and knowledge organized by media. This information should be part of global mercury monitoring report.

Air

7. For air monitoring, it is proposed to continue monitoring activities by existing networks by active continuous monitoring and manual active and passive air sampling techniques and collect:

    - Total Gaseous Mercury (TGM) concentrations in air at background and impacted sites, and
    - Atmospheric deposition fluxes.

   for assessing spatial and temporal patterns of mercury concentrations in ambient air and deposition fluxes to terrestrial and aquatic ecosystems. Standard Operating Procedures (SOPs) suggest to monitor mercury deposition fluxes with samplers that are "Wet only" or Bulk.

8. To fill the geographical gaps in continents, samples should be collected to provide average TGM concentrations as monthly (or at lower frequency) average to cover Africa, Latin America and Russia and provide regional/local background TGM concentrations.

Human

9. For human biomonitoring for prenatal exposure in the general population the following biomarkers are recommended:

    - Total mercury in maternal scalp hair (3 cm hair strand from the scalp, to measure exposure during the 3rd trimester), and
    - Total mercury in cord blood – recent exposure to methyl mercury.

10. Maternal scalp hair is a preferable biological matrix to assess prenatal exposure. Cord blood can be an alternative matrix to hair. Human samples collected in approximately 5-year intervals are feasible for human biomonitoring surveys considering the aim to identify statistically significant differences as well as the time such studies take to implement (including adaptation of the master protocol to local circumstances, local ethical approval, training of staff etc.). Human samples should be accompanied by a series of attributes, e.g. age, gender as well as social/habitual information e.g. fish consumption pattern, economic level, etc.

11. It might be useful to coordinate the sample collection with the survey activities under the Stockholm Convention as the one ethical approval could be used.

12. The Global Mercury Assessment 2018 identified currently available data on mercury exposure in national human biomonitoring programmes, longitudinal birth cohort studies and cross-sectional information in specific populations including high exposure groups. These activities should be continued to provide a long-term information for subsequent effectiveness evaluation.

Biota

13. For biota monitoring, an important aspect in combining monitoring efforts for documentation of convention effectiveness would be to define biological species and proper tissue types for monitoring, to minimize the effects of species-specific physiological differences. Species that accumulate significant amounts of mercury pose a potential risk for human health, that are widely distributed over specific geographically areas, and that exist in numerous historical studies should be prioritized. Additionally, there is a need to normalize or account for mercury concentrations in biota by size, age and sex, and these data should be included in the data collection process. The choice of fish species for sampling should be based on the trophic level, with trophic level 4 (carnivores that eat other carnivores) being most appropriate for decisions related to human and ecological health assessments.

14. It is proposed that biotic monitoring be separated into two major approaches to account for major differences in exposure pathways: continental and oceanic frameworks. A large amount of relevant technical information on the frameworks is available in a reference document as UNEP/MC/COP.3/INF.xx. Continental framework aims at identifying ecosystem sensitivity spots that are able to methylate mercury and make it available in the food web. Oceanic Framework for mercury monitoring in biota covers oceanic areas. The outcome combines ocean basin, matrix of interest for human consumption that have global ranges to define spatial gradients (trends) of mercury level in biota.

2. Tools supporting data harmonisation

15. Tools supporting data harmonization regarding comparability represent in particular standard operating procedures, guidance on global monitoring document, and inter-calibration studies.

16. Document UNEP/MC/COP.3/INF/XX contains a more detailed information on standard operation procedures (SOPs) already available and their use is encouraged. Review of data availability therein also comprises information on other available tools for maintaining data comparability including inter-calibration studies.

17. Further, to maintain harmonized information on mercury levels in environment, existence of a global mercury monitoring guidance document would be very useful. While development of such a document is included in the ad-hoc expert group`s mandate, the group felt that such document can only be prepared once monitoring arrangements for mercury are agreed. Guidance document could then be prepared swiftly on the basis of core matrices and available knowledge.

18. Nevertheless, experts prepared elements for the guidance on global monitoring (available monitoring activities organized per matrix, state of science for monitoring, procedures on sampling, sample handling, chemical analyses of samples) that is contained in UNEP/MC/COP.3/INF/XX part two that presents a draft structure of the guidance document and other relevant information.

3. Development of a global periodic report

19. It is proposed that a global mercury monitoring report on status of the environment and occurrence of mercury is developed in regular and suitable intervals to support the effectiveness evaluation.

20. Available globally representative monitoring data would be compiled, assessed and summarized by relevant experts performing scientific function in this field (see below).

21. Global report would be organized by media and show available monitoring data and trends in the environment, humans and biota. Global monitoring report would also use models to predict further trend development.

22. Information from the global report would then be also used for contextualization of information in a multi compartment model to capture the socio-economic scenario, baseline and different policy alternatives.

23. The first global report on monitoring and modelling to the effectiveness evaluation committee on state of the environment needs to become available for the first meeting of the effectiveness evaluation committee.

4. Expertise necessary for synthesizing monitoring data

24. During the discussions of the effectiveness evaluation framework`s science and technical functions, it became clear that information on the status of the environment and occurrence of mercury is to be synthesized by an expert body with extended research expertise to oversee the gathering and consolidation of monitoring data.

25. The group would be assigned to gather information from existing monitoring activities and compile them into a global synthesis report and assess mercury levels and trends through the use of models, and thus prepare a global monitoring report as referred to in Section II of this report. Proposed terms of reference of the group are shown below.

Draft ToR of the monitoring and modelling group

Mandate

A monitoring and modelling [task] group (hereinafter, “the group”) is established to perform the functions assigned to it by the Conference of the Parties in support of the effectiveness evaluation including:

a. Gathering of information from mercury monitoring activities and compilation of the relevant information including national and scientific data on changes in levels of mercury in core media taking into account the work already achieved and drawing on experience from existing monitoring networks on mercury. Changes include spatial and temporal trends including contextualization through use of models.

b. Preparation of a global monitoring report on mercury for effectiveness evaluation committee meetings.

c. Development of a monitoring guidance document to provide the COP with comparable monitoring data on the presence and movements of mercury and mercury compounds in the environment as well as trends in levels of mercury and mercury compounds observed in biotic media and vulnerable populations, organize data gathering and visualization of information. The group should start its work on this task immediately so that the documents is available for COP4.

d. Update of a monitoring guidance document in line with the latest scientific knowledge, modelling capabilities and ongoing monitoring activities.

e. Identification of gaps in information/knowledge and development of proposals for bridging the gaps as a part of the report prepared for consideration by the effectiveness evaluation committee.

Membership

The group members shall be appointed on the basis of equitable geographical distribution, taking into account gender and the need for a balance between types of expertise.

Each region should nominate four experts for monitoring and modelling (up to three representatives with expertise on mercury monitoring in core media or participating in existing monitoring networks on mercury and at least one representative with expertise on modelling environmental trends/multicompartment models)

The group will invite the participation of up to 10 experts from civil society, indigenous communities, intergovernmental organizations, industry and "global modelling" experts. The participation of these experts as observers will be balanced among the above-mentioned groups.

The group will invite relevant experts from research communities, Global Mercury Partnership and existing monitoring networks to assist them in their work and supplement the most up to date information and scientific knowledge to produce a global report.

The terms of office shall coincide with a cycle of the effectiveness evaluation as determined by the Conference of the Parties. To maintain continuity, the COP may renew terms of office of the members for subsequent evaluations. If a member is unable to complete his or her term of office, the region/sector nominating that member shall nominate another person to complete the term.

Officers

Two co-chairs will be elected by the group to facilitate its meetings.

Secretariat

The secretariat will provide administrative and programmatic support to the group of experts.

Meetings

The group on monitoring and modelling will meet face-to-face at least three times during an effectiveness evaluation cycle to coordinate monitoring activities on mercury and to deliver a

global report on monitoring and modelling to the effectiveness evaluation committee on state of the environment.

Language

English will be the working language of the group.

Annex 4: Description of the reports to be prepared for the Effectiveness Evaluation Committee

1. The framework foresees five reports being prepared for consideration by the Effectiveness Evaluation Committee (see Section III of the Report).

Synthesis Reports

2. Four synthesis reports are to be prepared (level 1 to 3) to respond to the first three policy questions. Two streams of information feed into these reports: (i) information provided by Parties based on Article 21 reporting, and (ii) information and knowledge that is scientific, peer-reviewed and publicly available.

3. The content envisaged under each synthesis report is set out below, as are the tasks that need to be completed, and the expertise required.

   i. The **Emissions and Releases Report** is to gather, analyse and synthesise relevant information on emissions and releases inventories from relevant sources, as specified in Article 8 and 9, as well as information on the measures taken by Parties to control mercury emissions and releases, and relevant changes in emissions and releases. The expertise required for this task includes emissions/releases inventories, developing or implementing measures to control mercury emissions and releases from relevant sources, including best available techniques and best environmental practices, modelling and inventories on temporal and spatial trends and variability.

   ii. The **Trade, Supply and Demand Report** is to gather, analyse and synthesise relevant information on the mercury flows and social stocks, on trends in trade, supply and demand for mercury, and on regulatory frameworks and implementation. The expertise required for this task includes: trade analytics, sectoral analysis, ASGM expertise, use, changes and alternatives to mercury in products and processes.

   iii. The **Waste Management Report** is to gather, analyse and synthesise relevant information on mercury waste flows and stocks, track mercury waste management practices and recycling, and on regulatory frameworks and implementation, as well as gaps. The expertise required for this task include: inter-industry relation analysis, waste management policy and practices, and waste disposal engineering.

   iv. The **Global Monitoring Report** is to gather information from mercury monitoring activities and compile relevant information including national and scientific data on changes in levels of mercury, taking into account the work already achieved, and drawing on the experience of existing networks on mercury, trends and models. (See Annex III for detailed information).

Integrated Assessment Report

4. Based on the synthesis reports and other information linkages need to be made between policy actions, emission reductions and resulting mercury levels, using available data sources, modelling techniques and analytical tools drawn from natural and social sciences. This will be done in the **Integrated Assessment Report**.

5. It is to be noted that the integrated assessment function will evolve as our understanding of mercury improves over time. For the first round of the effectiveness evaluation, when no previous assessment is available, several ground studies to provide the basis of the evaluation, will need to be conducted.

6. With this as background, the content of the integrated assessment report is expected to contain:

    a. The examination of time lags between actions and outcomes observed by the subsequent evaluations: Significant time lags for years or even decades due to the slow pace of change in socio-economic systems, and in the physical and biological dynamics of the Earth system will need to be discussed.
    b. The examination of the baseline scenario, which draws on a hypothetical 'business as usual' setting for when the Convention had not been implemented: The hypothesis will employ assumptions and interpretations that could go beyond the factual presentation. As far as practical, different scenarios will be developed for future forecasting, given that it is expected that population growth, economic development, and global warming will alter the mercury baseline due to the changes in consumption patterns and global material flows.
    c. The assessment of the four policy questions, that could go as far as forecasting based on appropriate extrapolation: Several types of modelling can help such an assessment. (It has to be noted, however, that present science has not yet developed reliable models to forecast long-term changes in mercury levels resulting from emissions reductions that take into account the full complexities of mercury in the environment.) Therefore, earlier evaluations on the effectiveness of the Minamata Convention must rely on simpler forecasting methods and will have greater uncertainty than later evaluations when improvements to such forecasting models become available.
    d. The comprehensive analysis of the interaction between different indicators for identifying important synergies and trade-offs: Understanding the relationship between indicators is important for improving implementation efficiency.

7. The following chapters are suggested for the Integrated Assessment Report:

    Assumptions and baseline scenario setting for the integrated assessment
    Assessment of the policy questions
    Policy question 1: Have the Parties taken actions to implement the Minamata Convention?
    Policy question 2: Have these actions resulted in changes in emissions and releases of mercury to the environment?
    Policy question 3: Have these changes in emissions and releases resulted in changes in levels of mercury in the environment, biota and humans attributable to the Convention?
    Policy question 4: Will existing measures under the Minamata Convention be sufficient to meet its objectives of protecting human health and environment from mercury?

Synergies and trade-offs between indicators for improving implementation efficiency

Time lags between actions and outcomes

Conclusions

Appendix: Result "Dashboard" - progress of the indicators in the evaluation framework