



**Conference of the Parties to the
Minamata Convention on Mercury
Fifth meeting**

Geneva, 30 October–3 November 2023

Item 4 (k) of the provisional agenda*

**Matters for consideration or action by the
Conference of the Parties: effectiveness evaluation**

**First effectiveness evaluation of the Minamata Convention on
Mercury (article 22)**

Addendum

Progress report of the Open-ended Scientific Group

Note by the secretariat

The progress report of the Open-ended Scientific Group established to support the first effectiveness evaluation of the Minamata Convention on Mercury is set out in the annex to the present note.

* UNEP/MC/COP.5/1.

Annex

Progress report of the Open-ended Scientific Group

I. Summary

1. At its fourth meeting, in decision MC-4/11, the Conference of the Parties to the Minamata Convention on Mercury agreed to begin the first effectiveness evaluation of the Minamata Convention and established the Open-ended Scientific Group to develop a scientific report and draw conclusions thereon for the consideration of the Effectiveness Evaluation Group.
2. At the time of writing, the Open-ended Scientific Group had met online eight times since June 2022 and once face to face, from 27 to 31 March 2023, in Geneva.
3. The present document contains the progress report of the Open-ended Scientific Group to the Conference of the Parties at its fifth meeting. Section II provides background information on the effectiveness evaluation process and the mandate of the Open-ended Scientific Group. Section III provides an overview of the work carried out by the Open-ended Scientific Group during the intersessional period between the fourth and fifth meetings of the Conference of the Parties. Section IV briefly summarizes the emerging and forward-looking observations of the Open-ended Scientific Group. Sections V and VI describe the expected results of the work of the Open-ended Scientific Group to support the first effectiveness evaluation and the schedule for further work.

II. Background

4. Article 22 of the Minamata Convention states that the Conference of the Parties will evaluate the effectiveness of the Convention, beginning no later than six years after the Convention's entry into force and periodically thereafter at intervals to be decided by the Conference of the Parties.¹ The effectiveness evaluation is to be conducted on the basis of available scientific, environmental, technical, financial and economic information, including reports and other information pursuant to 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.
5. The need for an effectiveness evaluation framework that included a strategic, cost-effective approach to providing appropriate and sufficient data was recognized by the Conference of the Parties at its first meeting and further discussed at its second meeting. At its third meeting, the Conference of the Parties considered the report of the ad hoc technical expert group for effectiveness evaluation, which included a description of a proposed effectiveness evaluation framework, as well as the following policy questions aimed at supporting an assessment of whether the control measures, as implemented, would lead to the achievement of the Convention's objective:
 - (a) Have the parties taken actions to implement the Minamata Convention?
 - (b) Have the actions taken resulted in changes in mercury supply, use, emissions and releases into the environment?
 - (c) Have those changes resulted in changes in levels of mercury in the environment, biotic media and vulnerable populations that can be attributed to the Minamata Convention?
 - (d) To what extent are existing measures under the Minamata Convention meeting the objective of protecting human health and the environment from mercury?
6. The report of the ad hoc technical expert group also contained technical information on monitoring and a proposal for monitoring arrangements pursuant to article 22; proposed reports for an effectiveness evaluation body to use in formulating findings/recommendations for the consideration of the Conference of the Parties; and a set of indicators, developed based on an article-by-article review, for assessing the progress and impact of the implementation of the control measures. In decision MC-3/10, the Conference of the Parties advanced preparations for the first effectiveness evaluation by requesting the secretariat to secure services for drafting of guidance on monitoring and a report on trade, supply and demand of mercury and mercury compounds, and by inviting further discussion on effectiveness indicators.

¹ The Minamata Convention entered into force on 16 August 2017.

7. At its fourth meeting, in decision MC-4/11, the Conference of the Parties agreed to begin the first effectiveness evaluation of the Convention and to further consider the timeline of the evaluation at its fifth meeting, and decided to adopt the framework for the first effectiveness evaluation as outlined in annex I to the decision. The Conference of the Parties also requested the secretariat to support an intersessional process to refine the list of indicators to be used in the effectiveness evaluation process, with a view to providing a final list for consideration and possible adoption by the Conference of the Parties at its fifth meeting.

8. In the same decision, the Conference of the Parties established the Open-ended Scientific Group with a mandate to develop a scientific report in which it would compile, analyse and synthesise comparable mercury monitoring data on changes in mercury concentrations in environmental media, biotic media and the human population, including vulnerable populations over time; the availability of scientific information on mercury levels in the environment and human populations; and the interactions between scientific data and financial assistance, technology transfer, and capacity-building. The Open-ended Scientific Group would also evaluate the impact on mercury levels in the environment and humans of the measures taken under the Minamata Convention, and draw conclusions thereon for the consideration of the Effectiveness Evaluation Group.²

9. The Open-ended Scientific Group's scientific report will be composed of the following elements, built in a two-stage process: the plan for the monitoring data compilation and summary, and the plan for data analysis consistent with the monitoring guidance (stage 1); and the monitoring data compilation and summary, and the data analysis addressing the guiding questions outlined in the monitoring guidance (stage 2).

10. In addition, the Open-ended Scientific Group will (i) provide an analysis of data gaps, including the identification of existing gaps as well as potential scientific actions to address identified gaps in information and knowledge related to monitoring, and lessons learned; (ii) develop, with the support of the secretariat, a plan and a summary of available emissions and releases data, including available emissions and releases data from national inventories, and estimates of emissions and releases data not available from national inventories; (iii) assess the data and coordinate the analysis to be included in the scientific report, taking into consideration the monitoring guidance and its guiding questions as set out in UNEP/MC/COP.4/18/Add.2 and UNEP/MC/COP.4/INF/12,³ as well as differences in scientific capacities, national circumstances, environmental conditions and demographic characteristics across parties and regions; (iv) make the documents available for review by parties; and (v) respond to comments by parties and integrate responses into plans and final products for review by the Effectiveness Evaluation Group and submission to the Conference of the Parties six months in advance of its meeting.

11. Furthermore, according to its terms of reference, the Open-ended Scientific Group will be composed of experts identified and nominated by parties – one nominated by each party. Five experts from among them will be nominated by the five United Nations regions – one nominated by each region – taking into account the need for gender balance and different types of expertise. Regionally nominated experts from developing countries and countries with economies in transition will receive funding through the budget of the Convention to participate in the face-to-face meetings of the Open-ended Scientific Group. The Open-ended Scientific Group may invite scientific and technical contributions from a roster of additional experts identified by parties, to work through electronic means and communication, as appropriate. Experts will also be invited from among the following groups, as appropriate: civil society, indigenous organizations, local community organizations, intergovernmental organizations, research organizations and academia, the Global Mercury Partnership and existing monitoring networks. During the effectiveness evaluation cycle, the Open-ended Scientific Group will meet face to face no more than twice and will work by electronic means.

III. Overview of the work carried out during the intersessional period

12. With a view to implementing decision MC-4/11, the secretariat invited parties to each nominate one expert to participate in the Open-ended Scientific Group. Parties and relevant

² The terms of reference of the Effectiveness Evaluation Group, as set out in an annex to a conference room paper circulated at the resumed fourth meeting of the Conference of the Parties, were the outcome of the contact group on effectiveness evaluation at that meeting. That text is reproduced in annex II to the report of the Conference of the Parties on the work of the in-person segment of its fourth meeting (UNEP/MC/COP.4/28/Add.1). All the elements of the terms of reference were agreed, with the exception of the membership of the Effectiveness Evaluation Group.

³ Reproduced in the appendix to the present report for ease of reference.

organizations were invited to nominate experts to be part of a roster of scientific and technical experts to support the work of the Open-ended Scientific Group. Nominations to the Open-ended Scientific Group and the roster of experts are still being accepted.

13. A total of 43 experts have been nominated by parties to the Convention to take part in the Open-ended Scientific Group. Furthermore, 82 experts have been nominated to the roster of scientific and technical experts and are supporting the work of the Open-ended Scientific Group. The lists of Open-ended Scientific Group members and roster experts who are supporting the Open-ended Scientific Group are available through the Convention's website.

14. At the time of writing, the Open-ended Scientific Group had held eight online meetings, on 22 June, 8 September, 6 October, 3 November and 6 December 2022 and 6 February, 17 May and 7 June 2023, as well as one face-to-face meeting, in March 2023.

15. At its first meeting, the Open-ended Scientific Group elected its two co-chairs; agreed to invite the experts in the roster to participate and contribute to its subsequent meetings, including the face-to-face meeting; established six small working groups, consisting of four small groups on monitoring of mercury in air, biota, humans and other matrices and two small groups on emissions and releases; and issued a call for volunteers to join the small groups. In accordance with its terms of reference, the Open-ended Scientific Group also agreed on a timeline for the delivery of the following expected outputs:

Stage 1:

- (a) Plan for the monitoring data compilation and summary;
- (b) Plan for the summary of available emissions and releases data;
- (c) Plan for data analysis;

Stage 2:

- (a) Monitoring data compilation and summary;
- (b) Summary of available emissions and releases data;
- (c) Data analysis addressing the guiding questions outlined in the monitoring guidance.

16. During its subsequent meetings, the Open-ended Scientific Group and the experts in the roster worked on the development of the expected outcomes for stage 1.

17. On 3 February 2023, parties and other relevant stakeholders were invited to provide feedback on the drafts of the first two plans.

18. The Open-ended Scientific Group held its first face-to-face meeting in Geneva from 27 to 31 March 2023. The objectives of the meeting were:

- (a) To consider and provide responses on how to address the comments submitted by parties and other stakeholders on the draft plans developed by the Open-ended Scientific Group;
- (b) To derive operational questions to facilitate and guide the development of the plan for data analysis using the guiding questions in the monitoring guidance as a basis;
- (c) To discuss and develop an outline for a progress report on the work of the Open-ended Scientific Group (this document), to be submitted to the Conference of the Parties at its fifth meeting.

19. The working documents for the face-to-face meeting, the meeting report and the list of participants are available online in the [Open-ended Scientific Group meeting folder](#).

20. A brief summary of the results achieved to date by the Open-ended Scientific Group with the support of rostered experts and considerations regarding the schedule for further work and the expected outputs from that work are provided in the subsequent sections of this progress report. An update to the report will be made available prior to the fifth meeting of the Conference of the Parties.

A. Plan for the monitoring data compilation and summary

21. The purpose of the plan for the monitoring data compilation and summary is to structure and guide the process for the submission, collection, quality control check, management and accessibility of existing data on mercury levels in humans and the environment, to inform the first effectiveness evaluation of the Minamata Convention. In accordance with decision MC-4/11, the monitoring data that is compiled through the process set out in the plan will subsequently be compared and analysed in

accordance with a separate plan for data analysis, for consideration by the Effectiveness Evaluation Group.

22. The work being done by the Open-ended Scientific Group to inform the first effectiveness evaluation will focus on existing sources of monitoring data, while an analysis of data gaps, including the identification of existing gaps as well as potential scientific actions to address identified gaps in information and knowledge related to monitoring, will be included in the Group's scientific report. Mercury observations in the different matrices, ancillary observations and metadata will be collected from a broad range of sources and the quality of the collected data will be assessed (more details below). The main available sources of mercury monitoring data for air, biota, humans and "other matrices" (soil, water and sediment) have been identified and include monitoring programmes, both ongoing and completed, as well as independent studies.

23. The general characteristics and type of information contained in each identified set of data were compiled in spreadsheets that include a snapshot of the type of mercury measurements in each data set and examples of the available metadata, such as the type of data collected, geographic coverage, the monitoring period and relevant publications. In addition, summaries of the available sources of data for each matrix are presented as addenda to the plan for the monitoring data compilation and summary.

24. The identified sources of monitoring data will serve as a starting point for the collection of data through an invitation to parties and other data providers to submit their data sets containing observational mercury data and metadata. The identified data gaps will be summarized in the Group's final report to inform future effectiveness evaluation cycles.

25. A data dictionary was developed to facilitate the work of the Open-ended Scientific Group in collecting, comparing and analysing mercury levels in air, humans, biota and other matrices. The data dictionary, which is set out in annex 2 to the plan for the monitoring data compilation and summary, lists possible descriptors that can be used to describe each data set and identifies the minimum required data elements.

26. The objective of the data dictionary is to assist those wishing to contribute to the first effectiveness evaluation in identifying and structuring the necessary mercury observations, ancillary observations, and descriptive elements (or metadata). To support the Open-ended Scientific Group's analysis of comparable mercury monitoring data, data formats adapted for each matrix will facilitate standardization across data sets by documenting common data structures and providing the precise definitions, agreed nomenclature, units of measurement, time scales and formats, as well as further information and external references, that are needed to compare and analyse mercury measurements.

27. Several types of data elements are included in the data dictionary: the mercury observations, ancillary observations of other relevant contaminants or environmental parameters, and the descriptive data elements (or metadata) that are necessary for interpretation of the observations. The data elements contained in the data dictionary are grouped into nine sections, from A to I. Sections A–C, H and I contain categories of data elements that are common to all monitoring matrices, whereas sections D–G contain data elements that are specific to each matrix. The data elements are further grouped by category and, where relevant, by sub-category.

28. The data dictionary will be used to develop matrix-specific standardized formats to facilitate harmonized submission of data. The standardized formats will indicate the minimum required data elements to be submitted. The Scientific Group recognizes that many of the existing monitoring data sets may lack some of the elements identified in the data dictionary and that data providers may not be able to provide all the data elements in the proposed data dictionary, particularly during the first effectiveness evaluation cycle. Nevertheless, the data dictionary may prove useful for guiding future data generation with the aim of having more comparable, detailed data for future effectiveness evaluation cycles.

29. Once the data dictionary has been finalized, standardized data formats for data collection will be developed for each matrix to facilitate data submission and subsequent comparison and analysis. The standardized formats will be aligned, to the extent possible, with existing formats in use by established monitoring programmes, to minimize the workload and facilitate the use of existing data. The plan over the long term is to cooperate with established monitoring programmes for the generation of data in formats that can best respond to the needs of the Open-ended Scientific Group. Matrix-specific standard formats will be used to structure data sets, including those from different sources, to ensure that they share a consistent structure (for example, share the same sequence of data fields). It will also be possible to harmonize the units of measurement, the time and the location to enable the comparison of multiple sets of data.

30. Parties and other data holders will be invited to submit monitoring data using the standardized formats. Data sets submitted in their native nomenclature and formats will also be accepted and will be included in the compilation. Data sets from all sources will be welcome during the data collection phase but during the analysis phase prioritization and/or weighting of data to support the effectiveness evaluation will likely be necessary. Active searching for relevant and publicly available data may also be carried out, where necessary, in an attempt to improve the quality and the temporal and spatial coverage of the data available for analysis.

31. Data providers or copyright holders will retain the ownership of and rights over their data, including mercury and ancillary observations and metadata. For data sets that are not publicly available or that have use restrictions, the secretariat will establish data use agreements with the individual data providers, as appropriate, and guidance will be provided to the Open-ended Scientific Group members and the experts in the roster to ensure that the data is used only for the purpose of supporting the effectiveness evaluation. The original sources of all data used by the Open-ended Scientific Group will be duly acknowledged in the Group's outputs. Lessons learned about data ownership and data use licensing will be summarized in the Scientific Group's final report to inform future effectiveness evaluation cycles.

32. The secretariat intends to engage and supervise one or more data management consultants to support the collection and compilation of available monitoring data. The data management consultant(s) will be responsible for the day-to-day tasks of collecting, organizing and storing data in accordance with the guidance provided by the Open-ended Scientific Group.

33. As part of the quality check, the collected data will first be evaluated for completeness, followed by a quality control process that will include an assessment of the reliability and relevance of the data. A set of data quality flagging criteria will be developed by the Open-ended Scientific Group once a preliminary analysis of the collected metadata has been performed. This will be done, for example, on the basis of the documentation related to sampling and analytical methods; the quality assurance and quality control (QA/QC) measures that were applied; and the generalizability or representativeness of the data (e.g. whether samples were randomly selected or there is some bias; considerations of the sample size). Data quality flags will be added to help the Open-ended Scientific Group, during the analysis phase, to assign different weights to the various data sets depending on the purpose of the analysis or questions being addressed.

34. The Open-ended Scientific Group will prioritize the use of data that have been subjected to QA/QC protocols. Data without proper QA/QC and flagged as such may be included on a case-by-case basis. How data will be prioritized or weighted in specific analyses as a result of the data quality flags will be discussed during the analysis phase and documented in the draft and final versions of the Open-ended Scientific Group's scientific report.

35. To enable analysis of the data, the Open-ended Scientific Group members and rostered experts should be able to access the compiled data sets remotely. A range of possible options for data storage were considered during plan development. For the first effectiveness evaluation, a simple data management system will be implemented (e.g. with manual input of data and without machine-to-machine data transfer protocols between repositories). With an eye to improving the data management infrastructure for future effectiveness evaluations, the Open-ended Scientific Group will continue to explore best practices for data providers who make their data accessible electronically for analysis, to facilitate submission of data to regional or global repositories that can make the data available electronically, and to facilitate the implementation of common machine-to-machine data transfer protocols between existing national, regional or global data repositories. Lessons learned from those efforts will be included in the Open-ended Scientific Group's final report.

36. The complete plan for the monitoring data compilation and summary will be available to the Conference of the Parties at its fifth meeting, as annex 1 to document UNEP/MC/COP.5/INF/24.

B. Plan for the summary of available emissions and releases data

37. The purpose of the plan for the emissions and releases data summary is to structure and guide the process for the collection, management and compilation of data on the emissions and releases of mercury and mercury compounds to the environment, in support of the first effectiveness evaluation of the Minamata Convention.

38. The work being done by the Open-ended Scientific Group to inform the first effectiveness evaluation will focus on existing sources of monitoring data, while an analysis of data gaps, including the identification of existing gaps as well as potential scientific actions to address identified gaps in

information and knowledge related to monitoring, will be included in the Scientific Group's scientific report.

39. Available emissions and releases data will support the effectiveness evaluation in multiple ways through two sets of tasks that will proceed mostly in parallel. One set of tasks will look into whether and to what extent the actions taken to implement the Minamata Convention have resulted in changes in mercury emissions and releases. This plan is intended primarily to provide a structure and process on which to build a summary of available emissions and releases data over the period beginning prior to the Convention (circa 2010) and extending up until as close as possible to the present in support of this first set of tasks.

40. A second set of tasks involves the use of emissions and releases data to examine whether and to what extent the changes in emissions and releases have resulted in changes in levels of mercury in the environment, biotic media and vulnerable populations. How emissions and releases data will be used in such analyses will be addressed in the separate forthcoming plan for data analysis.

41. The compilation and comparison of available data for emissions and releases from anthropogenic sources is the main focus of the releases and emissions data plan. For the purposes of the effectiveness evaluation, sources that are specifically addressed by articles of the Convention (including articles 4, 5, 7, 8 and 9) are to be distinguished from the sources that are not addressed by the Convention. The Open-ended Scientific Group will also consider the influence of natural and legacy emissions and releases based on available information in the forthcoming plan for data analysis.

42. Sources of available emissions and releases data include:

- (a) National reports under article 21 of the Convention;
- (b) National action plans for artisanal and small-scale gold mining;
- (c) Minamata Initial Assessment reports;
- (d) Pollutant release and transfer registers;
- (e) Emissions database under the Convention on Long-range Transboundary Air Pollution;
- (f) National emissions and releases inventories;
- (g) Scientific assessments and research articles.

43. Based on an initial review of those data sources, a draft format to facilitate data comparison will be developed. The data format and an initial list of available data sets collected will be circulated to parties and other data providers, along with an invitation to submit additional data sets for consideration by the Open-ended Scientific Group. The emissions and releases data, including the available data from the initial list of sources and the submission by parties and other data providers, will be stored in open-source databases on a data server that will be accessible by the Open-ended Scientific Group and rostered experts.

44. Data providers or copyright holders will retain the ownership of and rights over their data, including mercury and ancillary observations and metadata. The original sources of all data used by the Open-ended Scientific Group will be duly acknowledged in the Group's outputs. Lessons learned about data ownership and data use licensing will be summarized in the Group's final report to inform future effectiveness evaluation cycles.

45. The secretariat intends to engage and supervise one or more data management consultants to support the collection and compilation of available emissions and releases data. The data management consultant(s) will be responsible for the day-to-day tasks of collecting, organizing and storing data in accordance with the guidance provided by the Open-ended Scientific Group.

46. Based on the compiled data, the Open-ended Scientific Group will develop an emissions and releases data summary that describes the following:

- (a) Summary of available emissions and releases data for the period from circa 2010 to the present, with consideration of their comparability;
- (b) Challenges in obtaining the data;
- (c) Perceived data gaps within and across data sets;
- (d) Potential for supplemental data to be added to the existing information;
- (e) Data inconsistencies and the work needed to resolve them for future effectiveness evaluation.

47. The complete plan for the summary of available emissions and releases data will be made available to the Conference of the Parties at its fifth meeting as annex 2 to document UNEP/MC/COP.5/INF/24.

C. Plan for data analysis

48. In accordance with the terms of reference of the Open-ended Scientific Group, the purpose of the plan for data analysis is to structure and guide the process for the analysis of data to address the guiding questions related to six objectives of the monitoring guidance (see appendix to the present report).

49. The first step in the planning for the analysis of data was to develop more detailed, specific questions for which answers would be obtained. Using the guiding questions of the monitoring guidance as the starting point, the small groups of the Open-ended Scientific Group developed operational questions for each of the monitoring matrices and for emissions and releases. For each operational question, the following observations were also made:

(a) *Relevant versus available data* – to determine the type of “relevant and applicable” data that might be used to answer the operational questions, whether the data is accessible in a usable form, and the sources and formats of data readily accessible to the Open-ended Scientific Group;

(b) *Methodological approach* – to identify an appropriate methodological approach for answering the operational question, taking into account the relevant data that are readily accessible to the Open-ended Scientific Group and whether the approach involves statistical modelling or mechanistic modelling;

(c) *Form of the answer/output* – to identify how the answer to the operational question might be expressed (for example, as a map, a time series, a figure, a table of quantitative metrics or a narrative);

(d) *Anticipated result* – to describe, based on published literature, what the answers to the operational questions might look like;

(e) *Confidence* – to assess, based on the identified methodological approach, the level of confidence in the answer (qualitative or quantitative) to the operational question; to identify quality assurance measures applicable to the data and the analysis method; and to identify the most important sources of uncertainty and potential sources of bias;

(f) *Lead responsibility* – to identify who, within the Open-ended Scientific Group or roster of experts, could take primary responsibility for performing the analysis to arrive at an answer to the operational question;

(g) *Contributors* – to identify who, within the Open-ended Scientific Group or roster of experts, could contribute to performing the analysis to arrive at an answer to the operational question;

(h) *Identifying gaps* – to identify gaps in the existing data, knowledge and tools that might prevent analysis of the operational question;

(i) *Capacity needs* – to determine the capacity needs to fill the identified gaps;

(j) *Indigenous knowledge or traditional knowledge* – to identify Indigenous knowledge and traditional knowledge that might be used in the analysis.

50. A draft of the plan for data analysis, including a complete set of operational questions, will be made available to the Conference of the Parties at its fifth meeting as annex 3 to document UNEP/MC/COP.5/INF/24.

IV. Emerging and forward-looking observations

51. The following are some of the observations that emerged during the face-to-face meeting of the Open-ended Scientific Group and that will be taken into consideration in future discussions regarding expected outputs:

Monitoring data compilation and summary

(a) During the first effectiveness evaluation cycle, the Open-ended Scientific Group will need to work in a stepwise manner that will entail a manual effort to collect, harmonize and manage monitoring observations, ancillary observations and metadata from different sources. In future cycles of effectiveness evaluation, however, the use of automated systems to collect data could become more feasible.

(b) While data providers will be encouraged to grant permission to make their data sets publicly available, it is to be expected that some will wish to keep a level of restriction regarding access to and use of their data. As a result, data use agreements with individual data providers will be needed to establish the conditions under which their data sets will be used, including whether access to the data sets should be restricted to Open-ended Scientific Group members and experts in the roster for use in support of the effectiveness evaluation, or whether their data sets could be made publicly available as part of the Open-ended Scientific Group processes. A set of questions should be annexed to the data submission format to set the specific conditions of data use and serve as a formal data use agreement between data providers and the secretariat. In all cases, the data providers would be acknowledged and would retain the ownership of the data they provide.

(c) Monitoring data for the different matrices will be collected from a broad range of sources and the quality of the collected data will be assessed. Data sets that have been subjected to the appropriate QA/QC protocols will be prioritized during data analysis. In the absence of such data, such as for areas where no other data is available, data sets without proper QA/QC and flagged as such could be included on a case-by-case basis in an analysis of mercury levels and the identification of data gaps. One Open-ended Scientific Group member noted that monitoring data that have not been published or been through a peer-review process or that originate from sources other than governments may be of poor quality and of limited use for analysis; such data should therefore only be included in the compilation after careful consideration of their quality, and data submitted by parties should be prioritized.

(d) Including considerations regarding data quality and uncertainty in the submission of data to the Open-ended Scientific Group would help to determine whether individual data sets are fit for purpose and flag them accordingly. There are well-established systems for evaluating data quality and the Open-ended Scientific Group may choose to build on them. Once the monitoring data from different sources have been compiled, a preliminary analysis will be necessary before a data quality flagging system is used and a decision can be made on which data sets will be included in the final analysis and how they will be included. The current exercise by the Open-ended Scientific Group may also provide information on whether to limit the submission and compilation of data during future effectiveness evaluation cycles to data sets that have been through the appropriate QA/QC protocols.

(e) Data formats in use by well-established monitoring programmes could provide a basis for the Open-ended Scientific Group to build on in developing matrix-specific formats for data submission and compilation. The format for each matrix should be simple, and there will be a need for flexibility to consider data sets that do not contain all the required data elements, particularly for regions that do not have more complete data sets. Not all data sets will be submitted in the matrix-specific formats that will be used by the Open-ended Scientific Group and a significant part of the data to be compiled is expected to come from published sources and in other formats. The Open-ended Scientific Group should therefore adopt a hybrid approach of inviting the submission of data using its matrix-specific formats while remaining prepared to restructure or convert, to the extent possible, data obtained in other formats. One person per small group could be assigned to work closely with the consultant or consultants to be hired by the secretariat to carry out the compilation of existing monitoring data.

Emissions and releases data summary

(f) The Open-ended Scientific Group will not have enough time to present “best” estimates of emissions and release data. Work on emissions and releases to respond to the guiding questions in the monitoring guidance will therefore need to be based on the comparison of existing emissions and releases data, while taking into account the fact that different inventories use different categorizations of emissions and release sources, and comparing the various inventories will be challenging.

(g) Regarding the scope of the work on emissions and releases, one Open-ended Scientific Group member noted that data compilation should be limited to the sources of emissions and releases covered in articles 8 and 9 of the Convention. Other members noted that including only the sources of emissions and releases covered in the Convention would lead to a disconnect between the plan for the emissions and releases data summary and the plan for data analysis, where information about all sources will be needed to draw conclusions about the contribution of the Convention to any observed changes.

(h) The challenges associated with differentiating anthropogenic emissions and natural emissions or re-emissions, including those driven by climate change, were noted. Furthermore, estimating future emissions will be challenging, given that parties to the Minamata Convention have no obligation to forecast such emissions.

(i) Capacity-building and knowledge-sharing will be important for obtaining future emissions and releases data. It might be helpful to establish a group of national and international bodies working on emissions and releases inventories and to offer online training opportunities.

Data analysis

(j) Based on the framework that was agreed upon at the fourth meeting of the Conference of the Parties, the Open-ended Scientific Group has been working under the assumption that the effectiveness evaluation would be completed at the sixth meeting of the Conference of the Parties, which is expected to take place in 2025. That is a very ambitious timeline, however, especially because this is the first time that existing data from numerous data providers will be collected and harmonized through a process that will take several months and will likely require the establishment of data use agreements with individual data providers. This lengthy process must be completed before data analysis can even begin. Moreover, with limited financial resources, the Open-ended Scientific Group has been restricted to two face-to-face meetings and is almost entirely dependent on the in-kind contributions of its members and the rostered experts and their home institutions to fund data management and analysis efforts. Consequently, it has been noted that while the Open-ended Scientific Group will endeavour to deliver on its full mandate, the level of ambition will need to be conducive to the time and resources available. One member suggested that the Effectiveness Evaluation Group will need to be established by the Conference of the Parties before the Open-ended Scientific Group can start implementing its plans for data collection and data analysis. He also noted that Open-ended Scientific Group members and rostered experts have different roles and responsibilities. Further, he recalled that, in accordance with paragraph 17 of the terms of reference, if the Open-ended Scientific Group is unable to reach consensus, a factual report containing the various views expressed is to be prepared and submitted to the Effectiveness Evaluation Group. Other members suggested that plan development and implementation should continue as planned by the Open-ended Scientific Group, with opportunities provided for parties to comment on each work product. Once the Effectiveness Evaluation Group is created, it could be informed of the plans and progress of the Open-ended Scientific Group and invited to provide comments for the consideration of the Open-ended Scientific Group, following which the Open-ended Scientific Group could adjust its plans as appropriate.

(k) Regarding the temporal scope of the analysis, the end point will correspond to the most recent available data but the starting year on which to base the analysis is less clear. There is emerging agreement that the starting date for the collection and analysis of data should be informed by the historic milestones in the negotiations of the Minamata Convention, and specifically the first meeting of the intergovernmental negotiating committee in 2010, which led to the adoption of the Convention in 2015. Ultimately, however, the starting date for the collection and analysis of data to inform the first effectiveness evaluation will be determined by the availability and quality of existing data, as well as the geographic and temporal distribution of the available data, for the different matrices and emissions and releases inventories. In practice, the starting date for data analysis will need to be justified scientifically, and an attempt will be made to correlate any changes in the observed trends to the timeline of the Convention. To the extent possible, a rolling average of at least five or six years should be used to establish trends. For types of data that are more closely correlated, such as air emissions and air monitoring, the timelines for data analysis would need to be considered together.

(l) A system for classifying data into geographic regions will be needed. The classification system should aggregate countries into larger regions and also capture regionally relevant information related to mercury, such as large local sources of emissions, such as artisanal and small-scale gold mining and land cover. Regional classification systems that are potentially suitable for the Open-ended Scientific Group's data analysis purposes include systems developed or adopted by the Intergovernmental Panel on Climate Change, the United States Geological Survey and the Global Mercury Assessment, among others. Those systems can be tested with a small subset of data to determine their applicability to the work of the Open-ended Scientific Group and the need, if any, to adapt them.

(m) Defining the seasons will also be an important aspect in the analysis of monitoring data from certain matrices, such as air. Knowing the month of sampling would provide important information to account for seasonal variability during the data analysis and the impact of precipitation on mercury deposition. It will also be important to take into account the geographic variations at the different times of the year (e.g. within northern and southern hemispheres, wet/dry seasons).

(n) The attribution of mercury observations to sources of emissions that are difficult to measure under the Convention (e.g. coal burning) may become particularly challenging.

(o) Data analysis is expected to reveal important gaps in the availability of monitoring data for some or all matrices in certain geographic regions. In developing countries in particular, capacity-building and technical assistance and cooperation will be needed to fill the gaps in data and provide more comprehensive results at the global level. Identification and mitigation of gaps are important matters that must be revisited once the analysis of data is underway, with a view to identifying and recommending possible actions to fill the identified gaps in information, knowledge and capacity.

Preliminary draft indicators related to the work of the Open-ended Scientific Group to support the effectiveness evaluation

(p) The list of original indicators to support the effectiveness evaluation, which was contained in document UNEP/MC/COP.4/INF/11 and considered by the Conference of the Parties at its fourth meeting, included two indicators related to monitoring of mercury and mercury compounds, namely A1, “levels of mercury in the environment and in humans due to anthropogenic emissions and releases”, and G1, “mercury levels in selected human populations (as defined by the monitoring arrangements)”. Because those two indicators were understood as “placeholders” pending more in-depth discussion and further elaboration by the Open-ended Scientific Group, they are not included in the refined list of draft indicators prepared by the secretariat in consultation with parties, as contained in document UNEP/MC/COP.5/16/Add.1, which does not include indicators related to the work of the Open-ended Scientific Group.

(q) In planning for data analysis to address the guiding questions outlined in the monitoring guidance, the Open-ended Scientific Group has grouped the expected information outputs into six themes, taking into account the fact that the outputs may not all be achievable during the first effectiveness evaluation, owing to gaps in information and limited resources. As the Group progresses in the analysis of data, the information outputs may be used to derive, as appropriate, a set of draft indicators to support the Effectiveness Evaluation Group. The six themes and related information outputs are shown below.

<i>Themes</i>	<i>Information outputs</i>
Current levels	Current levels of mercury emissions and releases and current levels of mercury observed in air, biota, humans and other media
Temporal trends	<ul style="list-style-type: none"> • Changes over the timeline of the Minamata Convention in the levels of mercury emissions and releases and mercury observed in air, biota, humans and other media • Specific mitigation measures that have contributed to changes in emissions and releases • Expected changes in the levels of mercury emissions and releases and mercury observed in air, biota, humans and other media
Spatial patterns	Geographic variation at the global scale of current mercury levels and temporal trends
Source or process attribution	<ul style="list-style-type: none"> • Changes over the timeline of the Minamata Convention in the fractional contribution of contemporary anthropogenic emissions and releases to current mercury levels observed in air, biota, humans and other media • Geographic variation at the global scale of contribution levels and their trends • Contribution of drivers other than changes in emissions and releases to the trend in observed mercury levels
Health and environmental impacts	Changes over the timeline of the Minamata Convention between current observed levels of mercury in air, biota, humans and other media in relation to (i) the levels established in health guidelines and (ii) observed and expected impacts on humans, other living organisms and biodiversity based on recent research and knowledge
Process understanding	Consistency in the observed levels, temporal trends and spatial patterns of mercury emissions and releases and mercury levels in air, biota, humans and other media in relation to estimates from current mechanistic models

V. Expected results of the work of the Open-ended Scientific Group to support the first effectiveness evaluation

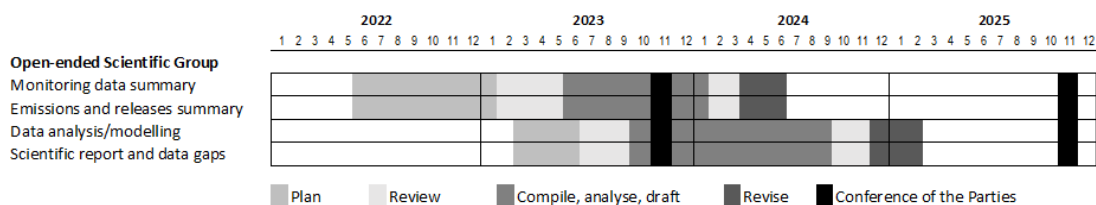
52. The Open-ended Scientific Group will produce a scientific report for submission to the Effectiveness Evaluation Group. In addition to the plans and final products noted above, the scientific report will contain an analysis of data gaps, including the identification of existing gaps as well as potential scientific actions to address identified gaps in information and knowledge related to monitoring, and lessons learned. The Open-ended Scientific Group will also analyse differences in scientific capacities, national circumstances, environmental conditions and demographic characteristics across parties and regions.

53. The results of the work of the Open-ended Scientific Group will be set out in two separate documents to be submitted to the Effectiveness Evaluation Group. One document will contain the main findings and conclusions of the Open-ended Scientific Group, including the documents mentioned in paragraph 15 of the present report, while a separate, forward-looking document will contain an analysis of the identified gaps and recommendations for future cycles of effectiveness evaluation and possible actions to address the identified gaps.

54. Furthermore, the Open-ended Scientific Group’s scientific report to the Effectiveness Evaluation Group will examine the interactions between available scientific data at a global level and the need for financial assistance, technology transfer and capacity-building to support future evaluation cycles.

VI. Schedule for further work

55. Based on the framework for the effectiveness evaluation adopted in decision MC-4/11, the Open-ended Scientific Group has been working under the assumption that the first effectiveness evaluation would be completed by the sixth meeting of the Conference of the Parties, which is expected to take place in 2025. The Open-ended Scientific Group’s scientific report will need to be completed in time for consideration by the Effectiveness Evaluation Group, whose terms of reference are expected to be agreed upon by the Conference of the Parties at its fifth meeting, to be held from 30 October to 3 November 2023. Therefore, the majority of the Open-ended Scientific Group’s work (including data collection, analysis and report writing, as well as the associated opportunities for review by parties) must be completed in 2023 and 2024. A draft schedule for the process is shown in the following figure.



56. In order to achieve its expected outcomes in accordance with the assumption that the first effectiveness evaluation will be completed at the sixth meeting of the Conference of the Parties, the Open-ended Scientific Group has a very ambitious timeline, particularly because a significant amount of time will be needed to collect existing data from multiple data providers, through a process which may require the secretariat to establish data use agreements with various data providers before data analysis can begin. With the current draft schedule, it is likely that only part of the available monitoring data and emissions and releases data will have been collected and harmonized in time to be analysed by the Open-ended Scientific Group.

57. Furthermore, the time available to harmonize and analyse the available scientific information is very limited, especially given that this is the first effectiveness evaluation for the Convention; the necessary data management infrastructure does not yet exist; there are limited financial resources available from the Convention to fund the work, which is almost entirely reliant on in-kind contributions of the Open-ended Scientific Group and its rostered experts; and multiple opportunities for review by parties have been built into the process to improve transparency, credibility and ownership. Although the Open-ended Scientific Group will not have the time or the resources to complete a comprehensive analysis of the relevant information, it will learn much from this initial attempt at effectiveness evaluation that can guide future investments in monitoring and capacity-building and be applied in future rounds.

58. Therefore, the approach being taken by the Open-ended Scientific Group is to strive to provide the Effectiveness Evaluation Group, and subsequently the Conference of the Parties, with the best information that can be compiled and analysed within the limited time and resources available for this evaluation cycle, and to outline how the scientific basis of effectiveness evaluation could be improved in future evaluation cycles.

Appendix

Monitoring objectives and associated guiding questions¹

1. *Estimation of mercury concentrations for areas without (i.e. background sites) or with (i.e. affected sites) local anthropogenic sources*
 - 1.1. What are the levels and form of mercury found in sites that are considered to be remote from anthropogenic sources?
 - 1.2. What are the levels and form of mercury found in sites that are expected to be affected by local anthropogenic point sources?
2. *Identification of temporal trends*
 - 2.1. Do the levels and form of mercury in the observed matrix (air, biota, human) at a given location change over time – for example, in the short term (< 5 years), medium term (5 to 20 years) and long term (> 20 years)? Is there a long-term trend or trajectory (a signal) that can be separated from the temporal variability (noise)?
 - 2.2. How do observed temporal variations and trends differ spatially, and how do they differ among matrices?
 - 2.3. How do observed temporal variations and trends in mercury compare to, or co-vary with, variations and trends of mercury in different forms (chemical species) or within other matrices?
 - 2.4. How do observed temporal variations and trends in mercury compare to, or co-vary with, variations and trends of mercury emissions and releases?
 - 2.5. How do observed temporal variations and trends in mercury compare to, or co-vary with, variations and trends of related pollutants/emissions or environmental variables?
3. *Characterization of spatial patterns*
 - 3.1. What are the levels and form of mercury in the observed matrix (air, biota, human) at a given location and time?
 - 3.2. Taken together, what do the available data suggest about spatial variability in environmental mercury concentrations?
 - 3.3. Taken together, what do the available data suggest about variability in mercury concentrations within and among human populations, wildlife populations and their habitats, and ecosystems?
 - 3.4. Do the observed spatial variations and patterns differ among forms (chemical species) of mercury?
 - 3.5. Do the observed spatial variations and patterns differ among air, biota and human matrices?
 - 3.6. How do the observed spatial variations and patterns or gradients compare to those of mercury emissions and releases?
 - 3.7. How do the observed spatial variations and patterns or gradients compare to those of related pollutants/emissions or environmental variables?
4. *Estimation of source attribution of anthropogenic mercury*
 - 4.1. Using models and statistical analyses consistent with observational data, how can the observed levels, temporal trends, spatial patterns and adverse impacts on species, ecosystem services, biodiversity and human populations be attributed to changes in mercury of anthropogenic, legacy or natural origin?
 - 4.2. Using models and statistical analyses consistent with observational data, how can the observed levels, temporal trends, spatial patterns and adverse impacts on species, ecosystem services, biodiversity and human populations be attributed to changes in anthropogenic sources (local, regional, global) of mercury?
 - 4.3. Using models and statistical analyses consistent with observational data, how can the observed levels, temporal trends, spatial patterns and adverse impacts on species, ecosystem services, biodiversity and human populations be attributed to changes influenced by the Convention?
 - 4.4. Using models and statistical analyses consistent with observational data, how can the observed levels, temporal trends, spatial patterns and adverse impacts on species, ecosystem services, biodiversity and human populations be attributed to changes not influenced by the Convention?
5. *Estimation of exposure and adverse impacts*
 - 5.1. How do the observed levels of mercury in air, biota and humans compare to established national and international benchmark levels associated with adverse effects on human health, wildlife and environmental sustainability?
 - 5.2. How significant are the observed changes in exposures for different types of impacts on humans and wildlife in regions that are remote from sources, as well as those that are locally impacted by anthropogenic sources?

¹ As per table 2.1 of the monitoring guidance (UNEP/MC/COP.4/INF/12), with minor adjustments in presentation.

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| <ul style="list-style-type: none">5.3. Are observed changes in exposure attributable to mitigation measures or changes influenced by the Convention?6. <i>Quantification of key environmental processes to improve understanding of cause-effect relationships</i><ul style="list-style-type: none">6.1. How do ancillary measurements contribute to establishing the level, spatial pattern or temporal trends of mercury and improve understanding about the relative importance of environmental processes and parameters driving transport and fate?6.2. How consistent are the observed levels, temporal trends and spatial patterns with the modelled estimates and what lessons can be learned from them to improve the existing models? |
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