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Meeting of the Ad-hoc Technical Expert Group on

Effectiveness Evaluation

Minamata Convention on Mercury

Geneva, Switzerland, 8-12 April 2019

Overview of information submitted by parties and other stakeholders on effectiveness evaluation[[1]](#footnote-1)

1. The following parties and stakeholders submitted information relevant to the effectiveness evaluation of the Minamata Convention on Mercury for the deliberations at the seventh session of the intergovernmental negotiating committee held from 10 to 15 March 2016:
* Brazil
* Canada
* Colombia
* European Union and its Member States
* Japan
* Norway
* Switzerland
* United States of America
* Viet Nam
* Biodiversity Research Institute
* World Health Organization
1. These submissions are available from <http://www.mercuryconvention.org/Negotiations/INC7/INC7submissions/tabid/4754/Default.aspx>. The secretariat compiled and analysed these submissions as UNEP(DTIE)/Hg/INC.7/12.
2. The following parties and stakeholders submitted information for the deliberations at the first meeting of the Conference of the Parties held from 24 to 29 September 2017:
* Brazil
* Cambodia
* Canada
* European Union
* Japan
* Madagascar
* Norway
* Republic of Korea
* United States
* Arctic Monitoring and Assessment Programme
* Biodiversity Research Institute (Evers et al. 2016. Evaluating the effectiveness of the Minamata Convention on Mercury: Principles and recommendations for next steps.)
* Stony Brook University
* Syracuse University
* UN Environment (Global Review of Mercury Monitoring)
1. These submissions are available from <http://www.mercuryconvention.org/Negotiations/COP1/submissionsforCOP1/tabid/5535/language/en-US/Default.aspx> . Based on these submissions, the secretariat developed a report on the establishment of arrangements for providing comparable monitoring data, as set out as Annex II of UNEP/MC/COP.1/12. A report by UN Environment, the World Health Organization and Italian National Research Council – Institute of Atmospheric Pollution Research regarding the activities of the Global Environment Facility Project: Development of a Plan for Global Monitoring of Human Exposure to and Environmental Concentrations of Mercury was also made available as UNEP/MC/COP.1/INF/15.
2. For the first meeting of the ad-hoc technical expert group on effectiveness evaluation, held from 5 to 9 March 2018, the following pieces of literature were made available to the participants:
* Daniel A et al. 2018. The Contribution of Environmental Monitoring to the Review of the Effectiveness of Environmental Treaties. Available at <http://pubs.acs.org/doi/full/10.1021/acs.est.7b06148>
* Selin H et al. 2018. Linking Science and Policy to support the implementation of the Minamata Convention on Mercury. Available at <https://link.springer.com/journal/13280/47/2/page/1>.
1. A number of participants made presentations on mercury monitoring and other activities related to effectiveness evaluation. These presentations are available to the group on the document cloud <http://bit.ly/DoesMinamataWork>.
2. The secretariat developed a working document UNEP/MC/COP.2/13\* to report to the Conference of the Parties at its second meeting on the work of the group. The report from the group was published as UNEP/MC/COP.2/INF/8. Comments on an earlier draft of the working document were received from the following:
* Argentina
* Canada
* China
* Denmark
* EU and its Member States
* Japan
* Kenya
* Norway
* United States of America
* Centre de Recherche et d’Education pour le Developpement (CREPD)
* International POPs Elimination Network (IPEN)
* Maritime Aboriginal Peoples Council
* UNIDO
* Zero Mercury Working Group
* Mr. Nicola Pirrone
* Ms. Noelle Selin
1. These comments were made available at <http://www.mercuryconvention.org/Meetings/COP2/SubmissionsforCOP2/tabid/6325/language/en-US/Default.aspx>.
2. The Conference of the Parties in its decision MC-2/11 requested parties, other governments and relevant organizations to continue to provide information on their monitoring programmes. Argentina, Japan, the Secretariat of the Barcelona Convention and the Mediterranean Action Plan and the World Health Organization submitted relevant information. These submissions are attached as annexes 1, 2, 3 and 4 respectively.
3. In preparation for the second meeting of the group, the following pieces of literature were submitted by members and other experts, and have been made available to the group on the document cloud <http://bit.ly/DoesMinamataWork>.
* Angot H et al. 2018. Global and Local Impacts of Delayed Mercury Mitigation Efforts.
* EMEP. 2012. Long-term hanges of Heavy Metal Transboundary Pollution of the Environment (1990-2010)
* EMEP. 2018. Assessment of heavy metal transboundary pollution on global, regional and national scales
* Giang A and Selin N. 2016. Benefits of mercury controls for the United States
* Selin N. 2018. A proposed global metric to aid mercury pollution policy - The Minamata Convention needs policy-relevant insight
* Sharma BM et al. 2019. An overview of worldwide and regional time trends in total mercury levels in human blood and breast milk from 1966 to 2015 and their associations with health effects.
* Tørseth K et al. 2012. Introduction to the European Monitoring and Evaluation Programme (EMEP) and observed atmospheric composition change during 1972–2009
* Travnikov O and Ilyin I. 2009. The EMEP/MSC-E Mercury Modeling System. In N. Pirrone and R. Mason (eds.), Mercury Fate and Transport in the Global Atmosphere.
1. UN Environment published the Global Mercury Assessment 2018, available at <https://www.unenvironment.org/resources/publication/global-mercury-assessment-2018>. Key policy-relevant findings are attached as Annex 5.

**Annex 1: Submission from Argentina**

**Effectiveness evaluation**

This report is prepared in response of paragraph 4 of decision MC-2/10: “Effectiveness evaluation” of the Minamata Convention on Mercury. Regarding information on their monitoring programmes, Argentina has gathered information under the Minamata Initial Assessment developed in 2018. Chapter IX on the analysis and evaluation of the national capacities for mercury and its compounds monitoring is attached to this report. (Available from http://www.mercuryconvention.org/Meetings/Intersessionalwork/tabid/7857/language/en-US/Default.aspx)

The main conclusion on the information provided there are as follows:

Distribution of laboratories with technical capacity for analyzing mercury and mercury compounds is broad, however, the country does not have a network at the national level focused exclusively on the monitoring of mercury concentrations in the different environmental matrices on an integrated approach.

There are several existing networks at the national or subnational level (REDFEMA, REDARTOX, REDNALAB, etc). They have different approaches and look at different monitoring aspects. Regarding the difficulties encountered, we can conclude:

About the information:

* There is some difficulty in accessing municipal and provincial data. Among them, the characteristics of the monitoring plans (frequency, operators, technologies) and their results.
* The absence or lack of efficiency of harmonized information systems (for example, repositories of scientific documents and publications, and of directories of centers, laboratories or academic units) makes the collection of data complex.
* Disparity between different jurisdictions can be seen in terms of the amount of monitoring data and its openness to the public.

About the analytical capacity:

* Only two monitoring points for mercury in air are known, matrix considered of importance at the international level.
* The air mercury monitoring unit that is part of the consortium Global GMOS, encounters difficulties for its continuity and requires financial support.
* Regarding monitoring in hazardous waste disposal areas and in the disposal of solid urban waste, it was only possible to access public information in fillings of a single operator.
* The technological capacity of the private sector is guaranteed and most of the tests are accredited by the OAA.
* There is a need to deepen knowledge about the state of technological capacity and human resources of the public sector (state of equipment, availability of reagents and other inputs, amount of personnel, among others), taking into account that some institutions currently highlight certain difficulties in relation to this aspect. Although interlaboratory aptitude testing mechanisms are known, recognizes the need to strengthen institutional capacity to ensure the quality of the results.

On the articulation between government agencies of different levels and jurisdictions:

* Absence of a joint policy for the design of monitoring plans, the monitoring and control of the quality of the compartments between the various agencies involved
* Absence of cooperation networks between the different actors. Without documentary records of this type, it is expected that the results shown here will be useful in guiding the improvement efforts of the territorial coverage of the monitoring according to the national situation.

Although it has been possible to identify a good part of the technological capacity installed and / or in operation, it is essential to achieve harmonized work at the national level to ensure the continuity and improvement of monitoring programs, and the correct generation and dissemination of information. Future efforts could be aimed at deepening knowledge about the particular situation of institutions in relation to their resources (technological, human), and ensuring coherence among monitoring activities considering in their design the priority sources and the potentially exposed populations identified in the present report.

**Annex 2: Submission from Japan**

Pursuant to the Decision MC-2/10 of the COP2 of the Minamata Convention, parties, other governments and relevant organizations are requested to provide information on their monitoring programme to the secretariat. Hereunder, Japan submits relevant information to supplement document UNEP/MC/COP.2/INF/8. This submission supersedes Japan’s previous submission for the “information on the availability of monitoring data” for INC7 based on request for further work made at INC6.

Table 1. Monitoring conducted by Ministry of the Environment (MOE) Japan

| Programme | Media | Mercury species | Methodology / analytical method | Location / number of samples | Monitoring period and frequency | Details of available data (as of January 2019) |
| --- | --- | --- | --- | --- | --- | --- |
| Background Monitoring Survey for Atmospheric Mercury and Other Metal Element Concentrations in Aerosols[1] | Air | Speciated mercury- Gaseous elemental mercury (GEM)- Gaseous oxidized mercury (GOM)- Particulate-bound mercury (PBM) | Using Tekran- Cold vapor atomic fluorescence spectrometry with denuder collection for GOM and quartz fiber filter collection for PBM (heating vaporization method) | Cape Hedo (Okinawa pref.)Oga Peninsula (Akita pref.) | Cape Hedo: Since Oct. 2007 (GEM)Since Oct. 2009 (GOM, PBM)Oga Peninsula: Since Aug. 2014Continuous sampling- 16 measurements per day (hourly value for GEM)- 8 measurements per day (two-hour value for GOM and PBM) | Monitoring results until FY2017 are available as individual data. The dataset includes latitude/longitude, meteorological elements (wind speed and direction, temperature, humidity, precipitation, atmospheric pressure, etc.)\*1, and metals measuring results of 23 elements (lead, cadmium, copper, zinc, arsenic, etc.)\*2 **.** |
| Precipitation | Total mercury (THg) | Equivalent EPA method 1631, Revision E | Cape Hedo (Okinawa pref.)Oga Peninsula (Akita pref.) | Cape Hedo: Since Apr. 2008 Oga Peninsula: Since Sep. 2014Weekly7-day continuous sampling | Monitoring results until FY2017 are available as individual data. The dataset includes latitude/longitude, meteorological elements (wind speed and direction, temperature, humidity, precipitation, atmospheric pressure, etc.)\*1, wet deposition, and sample amounts. |
| Monitoring Surveillance of Hazardous Air Pollutants[2] | Air | Total gaseous mercury (TGM) | Atomic absorption spectrometry with gold amalgamation and heating vaporization (following “Monitoring Manual for Hazardous Air Pollution Survey” (MOE, 2011)) | Nationwide 261 sites (in FY2016) - Ambient air 214 sites- Stationary sources 18 sites- Roadside 39 sites | Since FY1998Monthly24 hour continuous sampling | Monitoring results until FY2016 are available as individual data.[3] The dataset includes latitude/longitude, sampling date, meteorological elements (weather, wind speed and direction, temperature, humidity, precipitation, and atmospheric pressure), detection limit, and measurement results of hazardous air pollutants (chromium, nickel, arsenic, beryllium, manganese, acrylonitrile, vinyl chloride, etc.).  |
| Water Quality Survey of Public Water Areas[4] | Water - River- Lake/Reservoir- Sea | THgAlkyl mercury | THg: Atomic absorption spectrometryAlkyl mercury: Gas chromatography analysis(following “Monitoring Manual for Water Quality Survey” (MOE, 1961)) | THg: River 2,928 sites, Lake/Reservoir 241 sites, Sea 834 sites (in FY2016)Alkyl mercury: River 505 sites, Lake/Reservoir 65 sites, Sea 167 sites (in FY2016) | Since 1971Monthly in general | Monitoring results until FY2016 are available as individual data.[5] The dataset includes latitude/longitude, sampling date, depth, and substances of environmental quality standards for water (cadmium, lead, chromium(VI), arsenic, total cyanide, etc.).  |
| Marine Environment Monitoring Survey[6], [7] | Seawater- Surface water- Deep waterSea sedimentBiota - Marine species | THg | Seawater: (a) Heated vaporization atomic absorption spectrometry with reduced vaporization and gold amalgamation(b) Atomic fluorescence spectrometry with Cr2+ reduced vaporizationSediment and biota: (a) After acid digestion, analyzed using the same method as water media (a)(b) Microwave digestion and ICP-MS measurement(following “Marine Environment Monitoring Guideline” (MOE, 2000)) | Seawater and sediment:- Coastal sea and offshore deep sea area around Japan- 8 survey lines (surveillance for land-based pollution)- 1-2 areas per year (surveillance on pollution caused by ocean dumping of wastes)Biota: - 4 bay areas and 4 offshore sea areas around Japan- Target organism: Mussles, Benthic sharks, Squids, Cods, Crustaceans | AnnuallySeawater and sediment: Since FY1975The survey is planned to cover Japanese water in 8 years (2-10 year intervals per survey line).Biota: Since FY1998Bay areas and offshore sea areas are surveyed alternately every year after FY2008. | Monitoring results until FY2015 are available as individual data.[3] The dataset includes:- latitude/longitude, sampling depth, water temperature, salinity, pH, dissolved oxygen, nutrient, chlorophyll a, cadmium, lead, copper, PCB, dioxins, etc. (seawater)- latitude/longitude, moisture content, median diameter, total nitrogen, total phosphorous, organic carbon, sulfide, cadmium, lead, copper, chromium, PCB, dioxins, etc. (sediment)- latitude/longitude, lipid content, PCB, dioxins, etc. (biota)  |
| Japan environment and children’s study (JECS)[8] | Human - Maternal blood | THgMethyl mercury (MeHg) | Blood samples collected at approximately 22th-28th week of pregnancy | Nationalwide 15 areasApproximately 100,000 pregnant women(60,000 blood samples were determined.) | Since 2014 | Monitoring results are available as statistics. Identified health conditions, ambient environment and lifestyles of participants (pregnant women and children) through questionnaires. |
| - Umbilical cord blood - Urine - Breast Milk - Hair | Start analyzing a part of cord blood samples |
| Survey of the Exposureto chemical compoundsin Human[9] | Human - Blood - Food | Blood: THgFood: THg, MeHg | Age: 40-59 yearsBlood (THg): Acid digestion and cold vapor atomic absorption spectrometryFood (THg): Freeze drying, acid digestion and cold vapor atomic absorption spectrometryFood (MeHg): Freeze drying, dithizone extraction, and GC-ECD measurement | Nationalwide (Urban, agricultural, and fishery area)Blood: Approximately 80 people per yearTotal 490 people in 2011-2016Food: 15 people per yearTotal 90 people in 2011-2016 | Since 2011Annually3 regions per year | Monitoring results until FY2016 are available as statistics: mean, standard deviation, median, and range. Tissues are also analyzed for lead, cadmium, total arsenic, copper, selenium, zinc, manganese, dioxins, POPs, etc.Information on personal medical history, residential history, occupational history, smoking habit, dietary history, lifestyle, and birth history are collected by questionnaire and individual interviews. |

\*1: Observation results in nearby meteorological observation stations. \*2: 7-day continuous sampling

References [1] MOE, 2018. “Results on Background Monitoring Survey for Atmospheric Mercury and Other Metal Element Concentrations in Aerosols”, Online: https://www.env.go.jp/en/chemi/mercury/bms2017.html

 [2] MOE. “Monitoring Surveillance of Hazardous Air Pollutants”, Online: https://www.env.go.jp/air/osen/monitoring/ (in Japanese).

 [3] National Institute for Environmental Studies. “Environment-GIS”, Online: http://tenbou.nies.go.jp/gis/ (in Japanese).

 [4] MOE. “Water Quality Survey of Public Water Areas”, Online: https://www.env.go.jp/water/suiiki/index.html (in Japanese).

 [5] MOE. “Water Environment Information”, Online: https://water-pub.env.go.jp/water-pub/mizu-site/ (in Japanese).

 [6] MOE. “Marine Environment Monitoring Survey”, Online: http://www.env.go.jp/water/kaiyo/monitoring.html (in Japanese).

 [7] MOE, Oct. 2009. “Present Status of Marine Pollution in the Sea around Japan”, Online: http://www.env.go.jp/water/kaiyo/monitoring/status\_report/en-1.pdf, http://www.env.go.jp/water/kaiyo/monitoring/status\_report/en-2.pdf

 [8] MOE. “Japan Environment and Children’s Study (JECS)”, Online: http://www.env.go.jp/chemi/ceh/en/index.html

 [9] MOE, 2017. “The Exposure to chemical compounds in the Japanese People”, Online: https://www.env.go.jp/chemi/dioxin/pamph/cd/2017en\_full.pdf

Table 2. Monitoring conducted by National Institute for Minamata Disease (NIMD)

| Programme | Media | Mercury species | Methodology / analytical method | Location / number of samples | Monitoring period and frequency | Details of available data (as of January 2019) |
| --- | --- | --- | --- | --- | --- | --- |
| - | AirPrecipitation | Air: Speciated mercury (GEM, GOM, PBM), PBM, TGMPrecipitation: THg, MeHg | Speciated mercury: Atomic absorption spectrometry with gold amalgamation and heating vaporization (following “Monitoring Manual for Hazardous Air Pollution Survey”, (MOE, 2011)) PBM: Filter pack methodTGM: Continuous mercury monitor using gold amalgamation and cold vapor atomic fluorescence spectrometry (Nippon Instruments Co., Ltd.)THg and MeHg: Equivalent EPA method 1631, Revision E | Minamata (Kumamoto pref.) | Speciated mercury: Jan. 2011- Dec. 2013, 6-8 days every month or seasonPBM: Since Sep. 2008, weeklyTGM: Since Mar. 2011, continuous samplingPrecipitation: Since Sep. 2008, weekly (MeHg finished measurement in May 2013) | Monitoring results are available as individual data. Heavy metal concentrations in atmosphere, carbon monoxide, and meteorological elements are also observed.  |
| Hirado (Nagasaki pref.) | Speciated mercury: Aug. 2011- Apr. 2014, 6-8 days every seasonPBM: Since Jun. 2011, weeklyPrecipitation: Since Sep. 2008, weekly (MeHg finished measurement in May 2013) | Monitoring results are available as individual data. Heavy metal concentrations in atmosphere and meteorological elements are also observed.  |
| Air: Speciated mercury (GEM, GOM, PBM), PBM Precipitation: THg | Speciated mercury: Using Tekran- Cold vapor atomic fluorescence spectrometry with denuder collection for GOM and quartz fiber filter collection for PBM (heating vaporization method)PBM: Filter pack methodTHg: Equivalent EPA method 1631, Revision E | Fukuoka (Fukuoka pref.) | Speciated mercury: Since Jun. 2013 (continuous sampling)PBM: Since Jun. 2013, weeklyPrecipitation: Since Jun. 2013, weekly | Monitoring results are available as individual data. Meteorological elements are also observed.  |
| Air: PBMPrecipitation: THg | PBM: Filter pack methodTHg: Equivalent EPA method 1631, Revision E | Omaezaki (Shizuoka pref.) | PBM: Since Dec. 2013, weeklyPrecipitation: Since Dec. 2013, weekly | Monitoring results are available as individual data.Precipitation is also observed. |

References [1] Marumoto, K. and Matsuyama, A. (2014). Mercury speciation in wet deposition samples collected from a coastal area of Minamata Bay. *Atmospheric Environment* **86**, 220-227.

 [2] Marumoto, K., Hayashi, M., Takami, A. (2015). Atmospheric mercury concentrations at two sites in the Kyushu Islands, Japan, and evidence of long-range transport from East Asia. *Atmospheric Environment* **117**, 147-155.

Table 3. Monitoring conducted by Japan Meteorological Agency (JMA)

| Programme | Media | Mercury species | Methodology / analytical method | Location / number of samples | Monitoring period and frequency | Details of available data (as of January 2019) |
| --- | --- | --- | --- | --- | --- | --- |
| Atmospheric and Marine Environment Monitoring[1], [2], [3] | Precipitation | THg | Cold vaper atomic absorption spectrophotometry (following method of World Meteorological Organization (WMO) (2004)) | Minamitorishima (Tokyo Metropolis)Ryori (Iwate pref.) | Minamitorishima: Since Jan. 1996Ryori: Jan. 1976- Dec. 2011Daily | Monitoring results until FY2016 are available as individual data. The dataset includes sampling date, precipitation, sample amount, pH, electrical conductivity, alkalinity, concentrations of cadmium, ammonium ion, sodium ion, potassium ion, calcium ion, magnesium ion, chloride, nitrite ion, nitrate ion, and sulfate ion.Meteorological elements (maximum wind speed and wind direction) are also observed.  |
| Seawater - Surface water - Deep water | THg | Water samples are collected at the depth of 0m and approximately 1,000m. Analysis: Flameless atomic absorption spectrophotometry | Sea area around Japan (9 sites) and the western North Pacific (long 137E and 165E observation lines.) | Since 1972(Reliable data is available since 1995. Several monitoring sites were altered in 2010.)Seasonally (1-4 times per year in each site) | Monitoring results until FY2016 are available as individual data. The dataset includes sampling date, latitude/longitude, sampling depth, water temperature, salinity, and concentrations of cadmium.  |

References [1] JMA. “Annual Report on Atmospheric and Marine Environment Monitoring Data”, Online: https://www.data.jma.go.jp/gmd/env/data/report/data/index\_e.html

 [2] JMA. “Chemical analysis of precipitation and dry deposition”, Online: https://www.data.jma.go.jp/gmd/env/acid/acid\_obs.html (in Japanese).

 [3] JMA, 2015. “Health Diagnosis of the Ocean, Comprehensive Diagnosis Result - rev. 2”, Online: http://www.data.jma.go.jp/kaiyou/shindan/sougou/index.html (in Japanese).

Table 4. Monitoring conducted by Japan Coast Guard

| Programme | Media | Mercury species | Methodology / analytical method | Location / number of samples | Monitoring period and frequency | Details of available data (as of January 2019) |
| --- | --- | --- | --- | --- | --- | --- |
| Report of Marine Pollution Surveys[1] | Surface sea waterSea sediment | THg | Seawater: Atomic fluorescence spectrometry (cold vapor method) with reduced vaporization and gold trap separationSediment: Atomic absorption spectrophotometry (cold vapor method) with heating vaporization, and in turn gold trap separation | 13 coastal seas, 53 sites (including Tokyo Bay, Ise Bay, and Osaka Bay) and offshore sea area 10 sites | Since 1973Annually | Monitoring results until FY2016 are available as individual data. The dataset includes sampling date, latitude/longitude, and depth. Sea water monitoring additionally include sampling depth, water temperature, salinity, pH, dissolved oxygen, chemical oxygen demand, concentrations of oil (Aliphatic Hydrocarbons) and cadmium. Sediment monitoring results include ignition loss, particle size distribution, bottom character, concentrations of oil (Aliphatic Hydrocarbons), PCB, TBT, cadmium, copper, zinc, chromium, and lead. |

References [1] The Hydrographic and Oceanographic Department, Japan Coast Guard. “Report of Marine Pollution Surveys”, Online: http://www1.kaiho.mlit.go.jp/KANKYO/OSEN/osen.html (in Japanese).

Table 5. Monitoring conducted by Ministry of Agriculture, Forestry and Fisheries (MAFF)

| Programme | Media | Mercury species | Methodology / analytical method | Location / number of samples | Monitoring period and frequency | Details of available data (as of January 2019) |
| --- | --- | --- | --- | --- | --- | --- |
| Monitoring for Chemical Hazards in Foods[1], [2], [3], [4] | Food- Agricultural products- Fishery products | Agricultural products: THgFishery products: THg, MeHg | Rice, wheat and soybeans were obtained from grain drying and processing facilities. Vegetables and fruits were obtained from fields and collection/shipment facilities. Fishery products were obtained at main fishing ports and edible portion was used for analysis.THg analysis of agricultural products:Wet digestion and atomic absorption spectrophotometry with reduced vaporization (Equivalent AOAC Official Method 971.21)THg analysis of fishery products:Using mercury analyzer HG-200 (Hiranuma Inc.) after digestion with nitric acid, perchloric acid and sulfuric acid.MeHg analysis of fishery products:Gas chromatography analysis after solvent extraction with solutions of chloric acid, benzene, cysteine | Agricultural products: 31 food items (grains, beans, vegetables, fruits, etc.)- Total 1,420 samplesFishery products: Tunas, Marlins, Splendid alfonsino, Blue shark, Cods- Total 1,800 samples (120 samples for each 15 fish species) within 4 fiscal years | Agricultural products: In FY2006Fishery products: In FY2007-2010 | FY2007-FY2010 monitoring results are available as statistics: mean, median, minimum, maximum, detection limit (0.01 mg/kg), and a number of undetected samples. |
| Food - Canned vegetables | THg | Cans were purchased at supermarkets and at retail stores in Tokyo region.Analysis: Microwave digestion and ICP-MS measurement | Sweet corns: 39 samplesRed beans: 39 samplesTomatoes: 33 sample | In FY2011 | FY2011 monitoring results are available as statistics: mean, median, minimum, maximum, detection limit (0.01 mg/kg), and a number of undetected samples. |
| Food- Agricultural products- Livestock products- Processed food | THg | Food samples were purchased at department stores and at local supermarkets all over Japan.Analysis: Microwave digestion and ICP-MS measurement | Agricultural products: Fruits- Total 101 samplesLivestock products: Milk- Total 40 samplesProcessed food: Dairy products, fruits juices, etc. - Total 90 samples | In FY2013 | FY2013 monitoring results are available as statistics: mean, median, minimum, maximum, detection limit (0.01 mg/kg), and a number of undetected samples. |
| Food- Agricultural products- Processed food | THg | Agricultural product: Celery, Asparagus- Total 120 samplesProcessed food: Canned soybeans, pickled vegetables, jams, fruits juices, etc.- Total 108 samples | In FY2015 | FY2015 monitoring results are available as statistics: mean, median, minimum, maximum, detection limit (0.01 mg/kg), and a number of undetected samples. |

References [1] MAFF, 2012. “Data Collection of the Results of Surveillance / Monitoring for Chemical Hazards in Foods 2003-2010”, Online: http://www.maff.go.jp/j/syouan/seisaku/risk\_analysis/survei/pdf/chem\_15-22.pdf (in Japanese).

 [2] MAFF, 2014. “Data Collection of the Results of Surveillance / Monitoring for Chemical Hazards in Foods 2011-2012”, Online: http://www.maff.go.jp/j/syouan/seisaku/risk\_analysis/survei/pdf/chem\_23-24\_.pdf (in Japanese).

 [3] MAFF, 2016. “Data Collection of the Results of Surveillance / Monitoring for Chemical Hazards in Foods 2013-2014”, Online: http://www.maff.go.jp/j/syouan/seisaku/risk\_analysis/survei/pdf/chem\_25-26.pdf (in Japanese).

 [4] MAFF, 2018. “Data Collection of the Results of Surveillance / Monitoring for Chemical Hazards in Foods 2015-2016”, Online: http://www.maff.go.jp/j/syouan/seisaku/risk\_analysis/survei/pdf/chem\_27-28.pdf (in Japanese).

Table 6. Monitoring conducted by Local Governments in Japan

| Responsible party | Programme | Media | Mercury species | Methodology / analytical method | Location / number of samples | Monitoring period and frequency | Details of available data (as of January 2019) |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Niigata Prefectural Government, Niigata Prefectural Institute of Public Health and Environmental Science | Water quality survey for public water body and groundwater[1] | GroundwaterSpring water | THgAlkyl mercury | Ground water and spring water samples are collected at solid waste landfill sites around factories. | Agano riverTotal 24 samples (in FY2017) | Since FY20063 times per year (in FY2017) | Monitoring results until FY2017 are available as statistics: range of mercury concentrations.  |
| Sediment Mercury Survey at the Agano River[1] | Sediment | THgAlkyl mercury |  | Agano river basinTotal 4 samples (in FY2017) | Since FY20084 times per year (in FY2017) | Monitoring results until FY2017 are available as statistics: range of mercury concentrations. |
| Mercury Content Survey in Fish at the Agano River[1] | Fish | THgMeHg |  | Agano river3 sitesTotal 45 samples (in FY2017)- Japanese dace | Since FY1987Annually | Monitoring results until FY2017 are available as statistics: mean and range of mercury concentrations and methyl ratio, range of body length, and a number of samples. |
| Mercury survey at the Seki River[1] | Fish | THgMeHg | MeHg analysis is performed if THg exceed interim regulation value of 0.4 g/g wet. | Seki riverTotal 45 samples (in FY2017)- Japanese dace | Since FY2006Annually | Monitoring results until FY2017 are available as statistics: range of mercury concentrations. |
| THgAlkyl mercury | Analysis of Alkyl mercury is performed if THg exceed interim regulation value of 0.4 g/g wet. | Seki riverTotal 90 samples (in FY 2017)- 9 fish species (Japanese fluvial sculpin, Amur minnow, Weather loach, Pale bleak, etc.)  | Since FY2003Annually | Monitoring results until FY2017 are available as statistics: average and concentration range of all species. Body length, total length, body weight, sex and age are also observed (not reported). |
| Saitama Prefecture | River Water Monitoring Survey[2] | Water- River | THgAlkyl mercury | THg: Atomic absorption spectrometryAlkyl mercury: Gas chromatography analysis(following “Monitoring Manual for Water Quality Survey” (MOE, 1961)) | Shingashi river2 sites- Upstream and downstream of industrial waste disposal sites | Since FY1995Annually | Monitoring results until FY2017 are available as individual data. The dataset includes water temperature, pH, transparency, odor, suspended solids, cadmium, lead, arsenic, dioxins etc. |
| Bureau of Social Welfare and Public Health, Tokyo Metropolitan Government | Mercury Contamination Survey in Seafood[3] | Seafood | THgMeHg | Seafood is obtained from central wholesale market in Tokyo (including fish and shellfish caught in various locations in Japan and foreign countries.) | Total 428 samples139 species of fish and shellfish | Since FY1973Annually | Monitoring results until FY2016 are available as statistics: mean, minimum, maximum, a number of samples positive for THg or MeHg, and geographic origin of fish and shellfish. |
| Kumamoto Prefectural Government, Kumamoto Prefectural Institute of Public Health and Environmental Science | Minamata bay Water Environment[4] | SeawaterGroundwaterSediment | THg |  | Minamata Bay- Seawater: 8 samples- Groundwater: 4 samples- Sediment: 3 samples (in FY2017) | Since FY1998Annually | Monitoring results are not published.Water samples are analyzed for 27 items: THg, turbidity, chloride ion etc. |
| Kagoshima Prefecture | Mercury analysis contained in human hair[5] | Human- Hair | THg |  | Residents in coastal area of the Siranui sea (member of fisheries cooperative association)Total 15 people (in FY2016) | Since 1977Annually | Monitoring results until FY2016 are available as statistics: mean, minimum, maximum, and sampling month. |
| Kagoshima Prefectural Institute for Environmental Research and Public Health | Mercury Content Survey in Fish[6] | Fish | THgMeHg |  | Kagoshima BayTotal 40 samples (in FY2016)- 7 fish species (Areolate grouper, Young Japanese amberjack, Red seabream, Japanese whiting, etc.) | Annually | Whether THg and MeHg exceed interim regulation values or not is reported. Monitoring results until FY2016 are available. |
| Public Water Supplier | Water Quality Inspection of Raw Water and Clarified Water[7] | Tap water | THg | The method determined by the Minister of Health, Labour and Welfare on the basis of the Ordinance of the provisions relating to water quality standards (Ministry of Health, Labour and Welfare Notification No. 261, 2003) | Raw water: 5,954 sites (surface stream water, lake/reservoir, and groundwater)Clarified water: 6,343 sites (surface stream water, lake/reservoir, and groundwater) | Annually | Monitoring results until FY2016 are available as statistics: mean, minimum, maximum, and a number of measurements [8]. Water samples are also analyzed for substances of environmental quality standards for water (cadmium, lead, chromium(VI), arsenic, carbon tetrachloride, Dichloromethane, etc.) and pesticides. |

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 [4] Kumamoto Prefectural Government, Kumamoto Prefectural Institute of Public Health and Environmental Science, 2017. “Annual Report Vol.47 (2017), Kumamoto Prefectural Institute of Public Health and Environmental Science”, Online:

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 https://www.pref.kagoshima.jp/ad08/kurashi-kankyo/kankyo/kankyohoken/shoho/documents/64396\_20180227161739-1.pdf (in Japanese).

 [7] Public Interest Incorporated Association Japan Water Work Association, 2018. “Water Supply Statistics FY2016, Volume 99” (in Japanese).

 [8] Public Interest Incorporated Association Japan Water Work Association. “Database of Water Quality of Aqueduct”, Online: http://www.jwwa.or.jp/mizu/index.html (in Japanese).

Table 7. Monitoring conducted in the past decade

| Responsible party | Programme | Media | Mercury species | Methodology / analytical method | Location / number of samples | Monitoring period and frequency | Details of available data (as of January 2019) |
| --- | --- | --- | --- | --- | --- | --- | --- |
| MOE | Soil Quality Monitoring in the Disaster Area of Great East Japan Earthquake[1], [2] | Soil | THg | Soil quality examination though leaching and content tests. | Primary survey: 78 sitesSecondary survey: 122 sites | Primary survey: In 2011Secondary survey: In 2012 | Monitoring results are available as individual data. The Dataset includes address, sampling date and depth. Soils are also analyzed for substances of environmental quality standards for soil pollution (cadmium, chromium(VI), cyanide compounds, lead, arsenic, etc.), dioxins, pH and electrical conductivity of soil suspensions. |
| National Institute for Environmental Studies, Niigata Institute of Technology | - | Air | Speciated mercury (GEM, GOM, PBM) | Using Tekran- Cold vapor atomic fluorescence spectrometry with denuder collection for GOM and quartz fiber filter collection for PBM (heating vaporization method) | Kashiwazaki (Niigata pref.) | 1 Nov.-17 Dec. 2013 | Monitoring results are available as individual data. |
| NIES | - | Yaizu (Shizuoka pref.) | Feb.-Mar. 2010, Jan.-Mar. 2011, Dec. 2011-Mar. 2012, Jan.-Mar. 2013 | Monitoring results are available as individual data. |
| NIMD | Survey of Mercury and Health Effects in Taiji Town[3] | Human - Hair | THg | Heated vaporization atomic absorption spectrometry  | Residents in Taiji town, Wakayama prerf. (Including members of fisheries cooperative association)Total 1,137 people:- 765 people only in summer; 120 people only in winter; and 252 people in both seasons | Jun.-Aug. 2009 and Feb. 2010 | Monitoring results are available as statistics: geometric mean, minimum, maximum, mean age by sex. Information on age, sex and seafood consumptions are collected by questionnaires. |

References [1] MOE, Aug. 2011. “Survey results of soil quality monitoring in the disaster area”, Online: http://www.env.go.jp/press/press.php?serial=14130 (in Japanese).

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**Annex 3: Submission by WHO**

WHO’s submission comprises the following:

1. Protocol for assessment of prenatal exposure to mercury
2. Standard Operating Procedures for the assessment of prenatal exposure to mercury
3. Information about the forthcoming publication of results of 6 pilot surveys, conducted through a UNEP/WHO GEF Project.
4. State-of-the science review of mercury biomarkers in human populations worldwide between 2000 and 2018
5. **Protocol for assessment of prenatal exposure to mercury**

*Assessment of prenatal exposure to mercury: human biomonitoring survey. The first survey protocol: a tool for developing national protocols.* Copenhagen: World Health Organization, Regional Office for Europe; 2018

<http://www.euro.who.int/__data/assets/pdf_file/0010/386893/survey-mercury-eng.pdf?ua=1>

**Abstract:** This publication describes the design of a survey for assessment of prenatal exposure to mercury using human biomonitoring. The selection of target populations and biological matrix, planning of the survey, recruitment and fieldwork, data management and communication, community involvement strategy and ethical considerations are addressed in the protocol. An informed consent form, eligibility screening form and a questionnaire for collecting epidemiological information are also included in the protocol. The protocol was used to guide pilot surveys for assessment of prenatal exposure to mercury in China, Ghana, India, Kyrgyzstan, Mongolia and the Russian Federation, and can be applied for mercury human biomonitoring surveys globally. The protocol has been approved by the WHO Ethics Research Committee.

1. **Standard Operating Procedures for the assessment of prenatal exposure to mercury**

*Assessment of prenatal exposure to mercury: standard operating procedures*, Copenhagen: World Health Organization, Regional Office for Europe, UN Environment; 2018.

<http://www.euro.who.int/__data/assets/pdf_file/0009/384174/prenat-exp-mercury-sop-eng.pdf?ua=1>

**Abstract:** Mercury is toxic for humans, and the toxic effects of different forms of mercury have been extensively studied. Human biomonitoring is recognized as the most effective tool for evaluation of cumulative human exposure to mercury. In-utero development is the most vulnerable stage for the long-term adverse neurodevelopmental effects of mercury. Characterizing prenatal exposure is critical for evaluating public health impacts of mercury and assessing public health benefits of exposure reduction measures. Approaches to estimating exposure to mercury include measuring mercury levels in different biological matrices. The level of mercury in tissues can be an indicator of exposure to various types of mercury. The validity, usefulness and meaning of such measurements depend on the form of mercury exposure, type of tissue measurement and other factors. This document consists of standard operating procedures describing the assessment of mercury in hair, cord blood and urine. Quality control is essential to get reliable results. The document also provides information on alternative methods that can be used for analysis of mercury.

1. **Information about the forthcoming publication of results of 6 pilot surveys, conducted through a UNEP/WHO GEF Project.**

Applicability of the WHO Survey protocol and the Standard Operating Procedures has been checked through the implementation of pilot surveys in six countries: China, India, Ghana, Kyrgyzstan, Mongolia, and the Russian Federation. The pilot surveys were conducted in the general population, i.e., populations with a high level of consumption of marine fish (Ghana) and fresh water fish (the Russian Karelia), in the vicinity of primary mercury mining (Kyrgyzstan) and ASGM (Mongolia), in an agricultural area located at the contaminated territories of former mercury mining (China), and populations exposed to emissions of coal power plants (India).

WHO site-specific protocols and protocols approved by national ethics committees guided the surveys in countries. In all countries, except the Russian Federation, three biological matrixes were investigated: maternal scalp hair and urine and cord blood. The number of samples varied from 106 in Kyrgyzstan (small sample size due to small population size) to 265 in Mongolia (two different ASGM locations). Investigators in Ghana faced cultural and ethical barriers to collecting hair samples; only 54 samples were collected representing one-fifth of the number of cord blood samples. However, reliable results on pre-natal exposure to mercury were obtained in all pilot surveys. There were large variations in the level of exposure, with the highest level of exposure in populations with high-level consumption of fish and rice produced in contaminated areas. The surveys confirmed the applicability of the WHO Protocol and SOPs for assessment of exposure in the most vulnerable population group – the fetus – to mercury.

The results of the pilot surveys are being prepared for publication in the peer reviewed scientific literature.

1. **State-of-the science review of mercury biomarkers in human populations worldwide between 2000 and 2018**

Basu N, Horvat M, Evers DC, Zastenskaya I, Weihe P, Tempowski J. A state-of-the-science review of mercury biomarkers in human populations worldwide between 2000 and 2018. In: Environ Health Perspect. 2018 Oct;126(10):106001. doi: 10.1289/EHP3904 (<https://ehp.niehs.nih.gov/doi/full/10.1289/EHP3904>).

This WHO-commissioned review of mercury biomarkers in human populations established a global benchmark for human exposure to mercury and identified vulnerable populations and geographical regions lacking data.

**Abstract**

*Background:*The Minamata Convention on Mercury provided a mandate for action against global mercury pollution. However, our knowledge of mercury exposures is limited because there are many regions and subpopulations with little or no data.

*Objective:* We aimed to increase worldwide understanding of human exposures to mercury by collecting, collating, and analyzing mercury concentrations in biomarker samples reported in the published scientific literature.

*Method:* A systematic search of the peer-reviewed scientific literature was performed using three databases. A priori search strategy, eligibility criteria, and data extraction steps were used to identify relevant studies.

*Results:* We collected 424,858 mercury biomarker measurements from 335,991 individuals represented in 312 articles from 75 countries. General background populations with insignificant exposures have blood, hair, and urine mercury levels that generally fall under 5μg/L, 2 μg/g, and 3 μg/L, respectively. We identified four populations of concern: a) Arctic populations who consume fish and marine mammals; b) tropical riverine communities (especially Amazonian) who consume fish and in some cases may be exposed to mining; c) coastal and/or small-island communities who substantially depend on seafood; and d) individuals who either work or reside among artisanal and small-scale gold mining sites.

*Conclusions:* This review suggests that all populations worldwide are exposed to some amount of mercury and that there is great variability in exposures within and across countries and regions. There remain many geographic regions and subpopulations with limited data, thus hindering evidence-based decision making. This type of information is critical in helping understand exposures, particularly in light of certain stipulations in the Minamata Convention on Mercury. <https://doi.org/10.1289/EHP3904>

Annex 4: Submission from the Secretariat of the Barcelona Convention and the Mediterranean Action Plan

**With regards to Effectiveness evaluation, and specifically relevant information about collecting information on the environmental monitoring programmes on mercury** (as stipulated in the email below), the following documents are attached. Summary information contained in these documents provided below:

We do have established effectiveness indicators. Please review the reporting format under BCRS

We do expect reports from the parties on total releases of mercury for the last biennium

1. **Reporting format under the Barcelona Convention Reporting System (BCRS):**
	* Decision on the Revised reporting format for the implementation of the Barcelona Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean and its Protocols attached.
	* Decision include a special section for reporting on the implementation of the Regional Plan for Reduction of inputs of Mercury.
	* As can be seen on page 113, information required includes releases of mercury from activities of Chlor alkali plants, ELVs and monitoring of releases, etc.
	* We do expect reports from the parties on total releases of mercury for the last biennium (2016-2017). In fact countries are in the process of submitting their reports at the present time.
2. **Fact sheets on industrial emissions which do have a section on heavy metals in particular mercury (2018):**
	* These fact sheets were developed for an updated set of indicators that serves to inform H2020/National Action Plans on the necessary measures to be funded for reducing impacts of industrial emissions on the Mediterranean marine environment. These indicators complement those proposed by other programmes and initiatives, particularly the SDGs. They address the requirements of the legally binding decisions on industrial emissions under the UNEP/MAP system, and the Basel and Stockholm Conventions. These fact sheets address loads of released toxic substances including mercury, disposal environmentally sound manner of hazardous wastes (including mercury), and compliance measures aiming at the reduction and/or elimination of pollutants generated by industrial sectors. Details of fact sheets numbers attached below:
		1. Industrial Emissions Indicator IND 6.2: Release of toxic substances from industrial sectors including heavy metals
		2. Industrial Emissions Indicator IND 6.3: Industrial hazardous waste disposed in environmentally sound manner
		3. Industrial Emissions Indicator IND 6.4: Compliance measures aiming at the reduction and/or elimination of pollutants generated by industrial sectors
3. **SAP-MED Implementation Evaluation - Implementation Status 2000–2015:**
	* Level of achievement of SAP-MED targets based on 2003, 2008 and 2013 NBB data and E-PRTR 2013 data and trends for mercury releases are included in Table 5.
	* Trends of SAP-MED reduction targets per category of pollutants at regional level from 2010 to 2025 are shown in Figure 17 including mercury.
4. **H2020 Mediterranean – toward shared environmental information systems, EEA-UNEP/MAP joint report (2014)**
	* Report provides data on mercury releases overview by sector (Table 5.2)
	* Number of records per mercury releases in gaseous and liquid forms in ENP-South countries (2003 and 2008) (Figure 5.7).
	* Figures 5.26 and 5.27, loads of emissions for Mercury gas per country and per sector in 2003 and 2008.
	* Figures 5.28 and 5.29, loads of emissions for liquid mercury per country and per sector in 2003 and 2008.
5. **Decision IG.20/8.1: Regional Plan on the reduction of inputs of Mercury in the framework of the implementation of Article 15 of the LBS Protocol (adopted in 2012):**
	* The Regional Plan specifically states that “The Parties shall ensure that their competent authorities or appropriate bodies monitor releases of Mercury into water, air and soil to verify compliance with the requirements of the above table”.

These documents are available from http://www.mercuryconvention.org/Meetings/Intersessionalwork/tabid/7857/language/en-US/Default.aspx

**Annex 5: Key policy relevant findings from Global Mercury Assessment 2018**

The Global Mercury Assessment 2018 is the fourth such assessment undertaken by The United Nations Environment Programme (UN Environment), following earlier reports in 2002, 2008, and 2013. It is the second assessment produced by UN Environment in collaboration with the Arctic Monitoring and Assessment Programme (AMAP). The assessment is supported by a technical background document, the chapters of which have been prepared by teams of experts and peer-reviewed for scientific quality. This summary document presents the main findings of the technical document in plain language. Recognizing the relevance of the results of the Global Mercury Assessment 2018 for policy makers, this section presents key findings of highest policy relevance.

1. A new global inventory of mercury emissions to air from anthropogenic sources in 2015 quantifies global emissions from 17 key sectors at about 2220 tonnes. There are also smaller anthropogenic sources that are not yet possible to quantify in the detailed global inventory. Emissions from these additional sources are evaluated to total on the order of tens to hundreds of tonnes per year. They would therefore not significantly change the total global emissions inventory but may be of local or regional significance.

2. Estimated global anthropogenic emissions of mercury to the atmosphere for 2015 are approximately 20% higher than they were in updated estimates for 2010. Continuing action to reduce emissions has resulted in modest decreases in emissions in North America and the European Union. Increased economic activity, notably in Asia, and the use and disposal of mercury-added products appears to have more than offset any efforts to reduce mercury emissions.

3. Emissions patterns in 2015 are very similar to those in 2010. The majority of the 2015 emissions occur in Asia (49%; primarily East and South-east Asia) followed by South America (18%) and Sub-Saharan Africa (16%). Emissions associated with artisanal and small-scale gold mining account for almost 38% of the global total and are the major contributor to the emissions from South America and Sub-Saharan Africa. In other regions, emissions associated with energy production and industrial emissions predominate.

4. Stationary combustion of fossil fuels and biomass is responsible for about 24% of the estimated global emissions, primarily from coal burning (21%). Main industrial sectors remain non-ferrous metal production (15% of the global inventory), cement production (11%) and ferrous metal production (2%). Emissions from waste that includes mercury-added products comprise about 7% of the 2015 global inventory.

5. Human activities have increased total atmospheric mercury concentrations by about 450% above natural levels. This increase includes the effects of mercury emitted from human sources in the past which is still circulating in the biosphere, known as legacy mercury. Historical emissions up to the end of the 19th century, mainly from gold and silver mining in the Americas, and mercury (cinnabar) mining and refining contributed more to the present-day anthropogenic mercury in soils and the oceans than all 20th century industrial sources combined. The presence of legacy mercury and the potential for climate change to influence its remobilization complicates our ability to assess potential future changes.

6. Artisanal and small-scale gold mining introduced about 1220 tonnes of mercury into the terrestrial and freshwater environments in 2015, but this amount cannot be reliably separated between discharges to soils and releases to water. Global releases of anthropogenic mercury from other sources to aquatic environments totalled about 590 tonnes in 2015. The major sectors contributing to these 590 tonnes are waste treatment (43%), ore mining and processing (40%), and energy (17%).

7. Natural production of methylmercury in the oceans and in some lakes is often not limited by the input of inorganic mercury. Other factors such as climate change and changes in terrestrial and aquatic ecosystem processes are playing increasingly important roles in the mercury cycle, affecting the distribution, chemical interactions and biological uptake of mercury in the environment.

8. Reductions in mercury emissions and resulting declines in atmospheric concentrations may take time to show up as reductions of mercury concentrations in biota. For some time to come, methylmercury will continue to be produced from the legacy mercury previously deposited into soils, sediments, and aquatic systems.

9. Mercury loads in some aquatic food-webs are at levels of concern for ecological and human health. Anthropogenic mercury emissions and releases, current and legacy, are the major contributors to increased mercury levels and exposure.

10. All people are exposed to some amount of mercury. For many communities worldwide, dietary consumption of fish, shellfish, marine mammals, and other foods is 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 some indigenous populations and other populations with high dietary or occupational exposure to mercury.

The Global Mercury Assessment 2018 is based on improved information for estimating emissions and releases and improved understanding of the mercury cycle in the environment. In addition, the 2018 report provides new information about mercury exposure in animals and humans. These improvements are the result of mercury research and monitoring around the world. They provide a strong base of knowledge to support actions to reduce mercury emissions and releases and to reduce ecosystem and human exposure.

Further improvements in our understanding of mercury can further refine the ability to identify efficient actions to reduce mercury pollution and its effects. Such improvements include basic research on aspects of the mercury cycle as well as systematic monitoring methods to expand the geographic coverage of measurements of mercury pollution. As a chemical element, mercury cannot be destroyed. Mercury removed from fuels and raw materials in order to reduce emissions will result in mercury-contaminated waste, which in turn can be a source of releases. Mercury removed from emissions and from releases must still be managed responsibly to avoid it becoming a waste management problem or a secondary source. Understanding how mercury removed from current uses and sources is currently managed and how it can be safely managed and stored in the future will help account for the full life-cycle of mercury that is mobilized through human activity, safeguarding the environment and humans when it is removed.

1. This document has not been formally edited. [↑](#footnote-ref-1)