



WORKSHOP “ELEMENTS TO CONSIDER WHEN DESIGNING A GLOBAL MONITORING PLAN FOR MERCURY

13 to 14 February 2018, Rome, Italy



MEETING
REPORT

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Acronyms and abbreviations

COP	Conference of the Parties
GEF	Global Environment Facility
UN Environment	United Nations Environment Programme
HBM	Human BioMonitoring
PAS	Passive Air Sampler
CNR-IIA	Italian National Research Council - Institute of Atmospheric Pollution Research (CNR-IIA)
WHO	World Health Organization
SOPs	Standard Operating Procedures
QC/QA	Quality Control / Quality Assurance
GMOS	Global Mercury Observation System
Hg	Mercury
TGM	Total Gaseous Mercury
GEM	Gaseous Elemental Mercury
GOM	Gaseous Oxidised Mercury
TPM	Total Particulate Mercury
GAW	Global Atmosphere Watch
GOS4M	Global Observation System for Mercury
EMEP	European Monitoring and Evaluation Programme
NADP	National Atmospheric Deposition Program (from the USA)
AMAP	Arctic Monitoring and Assessment Programme
EU	European Union

First meeting day

1. Opening remarks

The workshop: “Element to consider when designing a Global Monitoring Plan for Mercury”, was organized by UN Environment’s Chemicals and Health Branch, the Italian National Research Council - Institute of Atmospheric Pollution Research (CNR-IIA) and the World Health Organization (WHO) European Centre for Environmental and Health. The meeting was hosted by the Italian National Research Council - Institute of Atmospheric Pollution Research (CNR-IIA) on 13 - 14 February 2018, in via Salaria Km 29.300, 00015 Monterotondo, Rome, Italy.

Mr. Nicola Pirrone (CNR-IIA), Irina Zastenskaya (WHO), and Jacqueline Alvarez (UN Environment) opened the meeting. The speakers provided the participants with some opening words and they welcomed the participants. They explained that the workshop serves as an important moment to present the first results of the project as well as to prepare, to put forward some highlights and to provide outputs to the ad hoc expert meeting established by the first meeting of the Conference of the Parties (COP) to the Minamata convention on Mercury that will have its first meeting from 5 to 9 March 2018, in Ottawa, Canada. Finally, they stressed the importance of the meeting for a discussion of mercury global monitoring and called for opened discussion of challenges and opportunities of setting the monitoring system.

2. Organization of the meeting

2.1 Adoption of the agenda and the chair of the meeting

Ms. Jacqueline Alvarez went through the agenda items (Annex 2: Agenda) and explained the proposition for the second day of discussion, and how the working groups will be organized.

Mr. Nicola Pirrone was elected as the workshop chair.

2.2 Introduction round

Mr. Nicola Pirrone invited all the participants to briefly introduce themselves. Details about the participant could be found in the participants list (Annex 3: Participants list). The workshop brought together national coordinators from the different countries involved in the pilot study, as well as the local and regional coordinators, representatives of international organizations, experts from around the world and different interested stakeholders.

3. Objectives of the meeting and expected outcomes

Ms. Jacqueline Alvarez elaborated on the objective of the meeting and the expected outcomes.

The main objectives of the workshop were to:

- Present and discuss the results, outcomes and lesson learnt of the GEF funded project.

- Discuss the implications of the results, Standard Operating Procedures (SOPs), and technical aspects of using human biological matrices for human biomonitoring (HBM) and passive air sampling to assess the concentrations and exposure to mercury in the light of the Minamata convention.
- Increase awareness and capacity to undertake monitoring of mercury.

Furthermore, the meeting was an important milestone in the discussion of the way forward for developing a plan for global monitoring of mercury in the light of the Minamata convention and the effectiveness evaluation. For this purpose, during the second meeting day three working groups were established to discuss the key scientific information generated by the project, lessons learned, and the element to consider regarding a Global Monitoring Plan for Mercury. Including general discussion of the importance of using: Air sampling, Human Biomonitoring, and Biota sampling as matrices in the light of the ad hoc expert group meeting on “effectiveness evaluation” that will take place on March 5-9 in Ottawa, Canada.

4. GEF Project “Development of a Plan for Global Monitoring of Human Exposure to an Environmental Concentration of Mercury” objectives and outcomes.

4.1. Elements toward a global Monitoring Plan for Mercury

The session was chaired by Mr. Nicola Pirrone.

Ms. Jacqueline Alvarez delivered a PowerPoint presentation, where she showed a summary of the project outputs and objectives. She explained that the main aims of the project were to harmonize approaches for mercury monitoring, and to strengthen the capacity for mercury analyses in humans and in the environment.

Afterward, she showed the three components of the project consisting on:



COMPONENT 1 - Review of existing information on human exposure to and environmental concentrations of mercury



COMPONENT 2 - Development of a monitoring plan on presence of mercury in ambient air



COMPONENT 3 - Development of a monitoring plan on human exposure to mercury



Regarding the Component 1 (lead by UN Environment), Ms. Jacqueline Alvarez presented the main results of the “Global Review of Mercury Monitoring Networks”. The review compiles and synthesizes available information on existing mercury monitoring networks, including (i) air monitoring, (ii) human biomonitoring, and (iii) biota monitoring.

Mr. Victor Estellano presented the main results related to the “Worldwide capacity to analyse mercury”. The document is a compilation of information of laboratories from all UN regions. The document aims to identify laboratories worldwide that perform mercury analysis, and collect information about their capacities, their equipment, the matrices they analyse, and the procedures they use to identify and quantify mercury species in biotic (human urine, hair, cord blood, fish, etc.) and/or abiotic (ambient air, water, sediment, etc.) matrices. Accreditations and quality management systems are also covered.

A web-based, searchable and publicly accessible databank is being developed. Mr. Santiago Riera showed how the web-based databank would look like. He showed some examples of laboratories included in the databank and presented how the information it displays and how the databank interface works. He also stated that the databank is a shared effort with the already existent databank on Laboratories performing Persistent Organic Pollutants analyses.

Mr. Victor Estellano explained that the next step will be the development of the first round of the intercalibration assessment, that would take place later this year.

The presentation and relevant documents can be found at: <http://www.iaa.cnr.it/en/unep-gef-workshop-elements-to-consider-when-designing-a-global-monitoring-plan-for-mercury/>

For biota monitoring, see also the presentation on fish monitoring in the following human biomonitoring (HBM) session.

4.2. Human Biomonitoring as a tool to assess the exposure to Mercury

The session was chaired by Ms. Dorota Jarosinska.

Ms. Irina Zastenskaya presented an overview of the main steps of the project implementation on mercury Human Biomonitoring including selection of biological matrices, development of Standards Operating Procedures (SOPs) for sampling and analysis and the SOPs for the monitoring of fish contamination, organization of the pilot surveys, data analysis and storage.

Each topic was then elaborated and presented by the national coordinators of the pilot surveys who gave highlights of the experiences, challenges and achievements throughout the project implementation at the national level.

The following aspects were specifically addressed:

- i. Ethical and cultural consideration, ethical committee’ approval (by Rigoberto Blanco)
- ii. Designing and planning of the survey: target population groups and sampling size (by Irina Ilchenko)
- iii. Selection of biological matrices and feasibility: applicability of different matrices (by Ainash Sharshenova)

- iv. HBM survey implementation: contacting and recruiting women and organization of the field work (by Edith Clarke)
- v. Analytical methods and capacity needs, QC/QA programmes (by Davaadorj Rendoo)
- vi. Positive experience of implementing mercury HBM survey (by Krishnendu Mukhopadhyay)
- vii. Fish contamination monitoring and interpretation of the results (by Philippe Verger)

It has been concluded by the national coordinators that: ethical and cultural consideration should be addressed carefully when planning the mercury HBM survey; selection of target populations depends on the survey objectives and should be based on the initial situation assessment; certain criteria can be applied to the selection of biological matrices, and analysis of mercury in hair, cord blood and urine as the proposed exposure biomarkers fully cover needs for assessment of exposure to different types of mercury, different population groups and exposure scenarios; good planning, trained staff and substantial financial resources are needed for the successful implementation of a survey; analytical methods are available for mercury analysis and national capacities can be built, but having quality assurance/quality controls (QA/QC) programs on place is critical for obtaining reliable results; fish monitoring is relevant to the interpretations of mercury HBM results.

The presentations and relevant documents can be found at: <http://www.iaa.cnr.it/en/unep-gef-workshop-elements-to-consider-when-designing-a-global-monitoring-plan-for-mercury/>

4.3. Main results of the pilot study on air concentration of Mercury

Mr. Nicola Pirrone presented an overview of this component of the project related with the concentration of Mercury in ambient air. He explained that the pilot study was based on the experience from the Global Mercury Observation System (GMOS- www.gmos.eu) which as a global network supported the development, objectives and goals of the component on atmospheric mercury measurements.

Followed the overview introduction, he presented, therefore, the GMOS network focusing on its characteristics, its major findings and the data management. Furthermore, he gave an overview of the recent and further development of air Hg monitoring activities highlighting the international framework in which the GMOS network is involved as one of the important component to support the overall goal of the GEO (Group on Earth Observations) activities with particular regards to the GEO Flagship on Global Observation System for Mercury (GOS⁴M - www.gos4m.org). He continued describing the project 'Integrated Global Observing Systems for Persistent Pollutants' (iGOSP - www.igosp.eu), funded under the European Union Horizon 2020 Framework Programme within the program 'European network for observing our changing planet' (ERA-PLANET - www.era-planet.eu). This is coordinated by the CNR-IIA, and aims to develop an integrated global observing system for mercury and Persistent Organic Pollutants (POPs).

Subsequently, he gave the floor to his colleagues of CNR-IIA, Ms. Alessandra Fino and Ms. Antonella Macagnano, who explained two different aspects of the conception of the pilot study regarding respectively 1) the number and types of monitoring sites selected worldwide and the experimental

design defined for air sampling and 2) the Passive air samplers (PASS) results of the pilot survey, describing their technical features and performance.

Finally, the floor was given to two selected national coordinators belonging to the WHO group and two selected GMOS site managers who shared the experience made with passive samplers of the component in Air of the pilot study: they were asked to present their experiences related with various aspects of the study, including their activities on Hg monitoring in the case of GMOS stations.

The presentations names and order were:

- i. GMOS network: characteristics and data management (by F. Sprovieri and N. Pirrone/ CNR-IIA)
- ii. Pilot survey: monitoring sites and experimental design for air sampling (by A. Fino / CNR-IIA)
- iii. Passive air sampling as a tool to measure mercury in ambient air: results of the pilot survey (by A. Macagnano / CNR-IIA)
- iv. Direct experiences of GMOS site managers and WHO national coordinators (by Lynwill Martin /SAWS South Africa; María C. Diéguez / CONICET – INIBIOMA Argentina; Krishnendu Mukhopadhyay / SRI Ramachandra Univ. India; Davaadorj Rendoo /IANPHI Mongolia).

The presentations and other relevant documents can be found and downloaded at: <http://www.iaa.cnr.it/en/unep-gef-workshop-elements-to-consider-when-designing-a-global-monitoring-plan-for-mercury/>

4.4. Worldwide initiatives of research with mercury and mercury compound

Ms. Sheila Logan, presented a debriefing and an overview of the Minamata Convention on Mercury and the ad-hoc expert group on “Effectiveness Evaluation” that will take place on March 5-9, 2018 in Ottawa, Canada.

Furthermore, four experts working with different aspect of research related to mercury were invited to present they experiences. The presentations order and names of the experts were as follow:

- a. Understanding the availability of global biotic Hg data – and what to do with all (by David Evers/BRI)
- b. Traceability of oxidised mercury – MercOx project (2017-2020) (by Milena Horvat / Jožef Stefan Institute)
- c. Health effects and HBM of populations exposed to elemental mercury vapor and methylmercury (by Mineshi Sakamoto/ National Institute for Minamata Disease)
- d. Levels and trends of mercury in humans in the Arctic Monitoring and Assessment Programme (AMAP) 2015 Human Health Assessment Report (by Pál Weihe/The Faroese Hospital System)

The presentations and other relevant documents can be downloaded at: <http://www.iaa.cnr.it/en/unep-gef-workshop-elements-to-consider-when-designing-a-global-monitoring-plan-for-mercury/>

Second meeting day

5. Opening of the second meeting day

Ms. Jacqueline Alvarez opened the second meeting day. She explicated how this second day and the working groups were organized. She continued saying that the participants would be grouped in three working groups to discuss the Key scientific information generated by the project, gaps and needs with regard to the elements to consider when designing a Global Monitoring Plan for Mercury in the light of the ad-hoc expert group meeting on “Effectiveness Evaluation” that will take place on March 5-9, 2018 in Ottawa, Canada. The three groups were organized in relation to the following topics: a) Air monitoring, b) Human Biomonitoring (HBM), and c) Biota monitoring.

6. Working groups

6.1. Key elements for discussion of the working groups and main highlights

Ms. Jacqueline Alvarez presented the objectives, the structure and she also gave some general ideas for the discussion that followed.

She explained that the ad hoc group of experts established by the First Meeting of the Conference of the Parties to the Minamata Convention on Mercury, decision MC-1/9, will have its First Meeting from 5 to 9 March 2018 in Ottawa, Canada. The ad hoc group will start to prepare a draft report including an outline, plan and elements of the effectiveness evaluation framework.

Accordingly, the objective of each working group was to discuss the documents prepared by the project and to provide input, in the form of highlights, to the ad hoc group of experts on relevant aspects needed when developing a global monitoring plan on mercury.

With this objective, the meeting participants were divided in three working groups on:

1. Air: a matrix to consider
2. Human Biomonitoring
3. Biota

Each group had:

- Selected a chair and a rapporteur
- Provided a summary of the discussion
- Used the following points as a guide to the discussions:
 - a. General discussion on needs in the light of article 19 and article 21 of the Minamata Convention, existing capacities / networks – gaps. What are the relevant policy questions?
 - b. What are the main elements to consider for an effectiveness evaluation framework and monitoring under the Convention?
 - Matrixes of relevance

- Mercury compounds
 - Frequency of monitoring
 - What type of results can be expected?
- c. Discussion on the comparability and need for correlations
- d. What can be obtained? Advantages and disadvantages including resources and costs.

6.1.1 Working group on Air: a matrix to be considered

6.1.1.1 General discussion in the light of article 19 and article 21 of the Minamata Convention

Recognizing the urgent needs for a framework for research, development and monitoring (Art. 19) and for the effectiveness evaluation (Art. 22) of the Minamata Convention on Mercury and after a general discussion on the relevance of air monitoring activities for the implementation of both articles, the working group on Air provided the following definitions of air monitoring:

Air concentrations of mercury are defined as:

- Total Gaseous Mercury (TGM)
 - Gaseous Elemental Mercury (GEM)
 - Gaseous Oxidised Mercury (GOM)
 - Total Particulate Mercury (TPM)
 - TGM = GEM + GOM (operationally defined)
- Precipitation mercury (Hg) – total mercury in precipitation samples.
 - Wet deposition – Precipitation Hg + rainfall (mm) to determine flux of Hg from atmosphere to surface
 - Other species of Hg can be measured in both air and water e.g. methylmercury – not considered here.

6.1.1.2 What are the main elements to consider for an effectiveness evaluation framework and monitoring under the Convention?

After a general discussion, the working group on Air provided the following elements:

Methods

Several different methods (and instrument suppliers, laboratories) are available for monitoring of air Hg. Selection of methods should be based on purpose of monitoring.

All methods employed in a monitoring program need to be tested, intercompared and validated to ensure quality of data used for effectiveness evaluation, research or other purposes.

Location – geographical coverage

- Monitoring activities under Minamata Convention should build on cooperation among existing programs e.g. GEO flagship GOS4M (Global Observation System for Mercury), EMEP, NADP, AMAP, EU, Asia, national and regional networks;

- Current programs do not cover all geographical regions – gaps need to be filled pragmatically and efficiently;
- Sustainability of initiatives to start-up monitoring – multiple years of monitoring necessary to detect trends;
- "Background sites" needs to be defined e.g. Regional background sites – global background sites (see definitions in the Global Atmosphere Watch (GAW) and Stockholm Convention – different types of background sites, agriculture, urban, industrial etc. – and political/UN regions);
- Co-location of sampling sites with Stockholm Convention Global Monitoring Plan for POPs (GMP) and Global Atmospheric Watch (GAW) – for other components (climate gases, Short-Lived climate pollutants (SLCP), ozone, POPs...);
- Benefits: experienced staff, compare trends with other global pollutants, co-measurements with reactants important for Hg.

Suggested site types:

- Global background sites
 - Purpose to support effectiveness evaluation – detect signals from emission reductions globally
 - Simple, low cost, integrating methods can be used – passive/diffusive sampling promising
 - Requirement of xx sites per defined region
- Regional background sites
 - Purpose to support effectiveness evaluation – detect signals from emission reductions regionally and globally
 - Simple, low cost, integrating methods or continuous methods for TGM recommended
 - Requirement of YY sites per defined region
- Master sites/super sites
 - Purpose to support model development and validation for source-receptor calculations
 - Provide supporting information to evaluate influence of confounding factors (climate change, unknown emissions etc) – and decouple from emission trends
 - Advanced continuous methods including speciation is recommended
 - Voluntary? Target of ZZ stations globally.

6.1.1.3 Discussion on the comparability and need for correlations

Harmonisation, Quality Assurance/Quality Control (QA/QC) parameters to be considered:

- Program for inter-comparisons of different monitoring methods are necessary. Is strongly recommended to include all steps: sampling, packaging/shipping, sample treatment, analysis and calculations/data management/reporting
- Traceable reference materials and standards are needed.
- Guidance document should be prepared
 - Purpose of different monitoring activities vs methods
 - Methods descriptions sufficient to establish new monitoring activities (necessary equipment, instruments for sampling, analysis and data management/reporting instructions)

- Standard Operating Procedures (SOPs), QA/QC etc. – partly are already existing and more will come from on-going projects, Integrated Global Observing Systems for Persistent Pollutants (iGOSP) and Metrology for Oxidised Mercury (MercOx).

Other **general Highlights** provided by the working group on Air are the following:

- Emission inventories – and measures to reduce emissions – is the starting point.
 - No emission reductions, no signal in air Mercury
 - Necessary basis for analysis of effects of confounding factors
- Recommendation to the Second Conference of the Parties (COP2)
 - Convention to establish formal cooperation with GEO
 - Convention to establish formal cooperation with other regional programs
 - Appoint regional organisation group (6 represents from 5 region), global organisation group (15) to organise monitoring.

Other **considerations** provided by the working group on Air

- What is the background concentration/deposition of air Hg? In relation to effectiveness evaluation...
 - Relates to background emissions and targets/ambitions for emission reduction
- To expert group at Ottawa meeting is suggested to formulate proposals/suggestions for activities and actions that COP2 can agree to – not just encouragement for continued research.

6.1.2 Human Biomonitoring (HBM)

6.1.2.1 Monitoring of human exposure to mercury

Human biomonitoring (HBM) of mercury is a reliable instrument for **monitoring and evaluating the exposure to mercury** (as per Article 19 of the Minamata Convention) and can be used as well for the purpose of evaluating the effectiveness of the Convention (Article 22).

According to Art 19 of the Convention, Parties shall endeavour to develop and improve monitoring of levels of mercury and mercury compounds in vulnerable populations and in environmental media. While there is no official definition of vulnerable populations, usually two groups are considered: vulnerable (susceptible) due to physiological, biochemical, and other specific characteristics (such as foetus and children), and those exposed to high levels of mercury (seafood and freshwater fish, or other food consumers; people living in contaminated sites; workers due to occupational exposure). The Minamata Convention regulates risk reduction measures for certain highly exposed population groups, e.g. populations in Artisanal and Small-Scale Gold Mining (ASGM), while Article 16 encourages Parties to identify and protect populations at risk, particularly vulnerable populations

To ensure that exposure of vulnerable groups (intrauterine exposure of developing foetus as the most vulnerable life-stage) is estimated at global and regional level, WHO developed a harmonized approach to assess pre-natal exposure to mercury which has been successfully applied in the pilot surveys in 7 countries globally.

During last 40 years a number of studies were conducted to estimate exposure to mercury and identify highly-exposed populations: few examples include cohort study on Faroe Island, Artic Monitoring and Assessment Programme (AMAP) monitoring system, population-wide survey in Mediterranean, the United States, Canada, Germany, etc.

To obtain reliable information on exposure to mercury a study design should be appropriate for the survey objectives (exposure or/and health impact assessment), local conditions such as mercury sources (contaminated fish, other food, soil, air, water), and existing resources. The design of studies in general population and in highly-exposed groups/contaminated sites can differ. Studies in general population commonly focused on assessment of exposure to methylmercury from seafood.

6.1.2.2 Biological matrices for Human Biomonitoring

Scalp hair and **Cord blood** are the two main matrices to be considered for assessment of exposure to mercury in the general population and population with high fish consumption. Sampling of both matrices is non-invasive, and both provide data on exposure to methylmercury (hair) and mercury and methylmercury (cord blood). Scalp hair is the first-choice matrix – easy to sample, transport and store.

Inclusion of cord blood in a survey provides several additional advantages such as: demonstration of pre-natal exposure to mercury (cord blood analysis characterizes both, exposure of a mother and a child to mercury during pregnancy); possibility to get more reliable results and exclude influence of external factors (external contamination of hair by mercury); provision of information on exposure to elemental mercury in addition to methylmercury; being an alternative biological matrix to hair in locations with cultural, ethical, religious specificities.

Reliable coefficients between mercury in hair and cord blood were derived from scientific studies. That means that the results obtained in studies with different matrices can be compared.

Urine is matrix of choice to assess exposure to inorganic mercury workers occupationally exposed to elemental mercury, and on populations exposed to elemental mercury in industrial hotspots.

6.1.2.3. Mercury compounds that can be analysed

Analysis of total mercury in hair and blood allows characterising exposure to methylmercury, since it is well-established that 95 % of total mercury in hair is methylmercury. For the purpose of mercury Human Biomonitoring total mercury analysis is a sufficient and cost-effective approach to obtain data needed to assess mercury risks to human health.

Methylmercury can be analysed for specific purposes; however, such analysis is much more complex, requires more resources, and is more costly.

6.1.2.4. Frequency of monitoring

To assess geographical and temporal trends periodic surveys should be considered with periodicity adjusted to the needs of different scenarios and types of studies (such as, general population vs highly

exposed groups). Statistical power, feasibility and practicability, and cost-effectiveness are other criteria to be considered when decision on the frequency of mercury HBM. However, to assess temporal trends HBM survey should be conducted at approximately 5 years intervals (considering the aim to identify statistically significant differences as well as the time such studies take to implement).

Exposure to mercury can vary during different seasons. Thus, it is strongly recommended that surveys in the same populations are conducted at the same season if temporal trends are planned to be analysed.

6.1.2.5 Highlights

Mercury Human Biomonitoring should be considered as an indicator for evaluation of effectiveness of the Minamata Convention implementation.

There are many advantages of mercury Human Biomonitoring confirmed in a number of scientific studies and national surveys. The following mercury HBM characteristics supports its applicability as an effectiveness indicator:

- Provides information of exposure to mercury from all types of sources;
- Integrates the results of the different types of risk reduction measures, e.g. measures to reduce emissions/releases with measures to reduce human exposure (e.g. advice on fish consumption), facilitating evaluation of the effectiveness of the Convention in achieving its objective to protect human health.
- Can demonstrate temporal trends during shorter period of time, compared to biota monitoring;
- Provides information on geographical distribution enabling identification of areas and population groups requiring urgent support in terms of risk reduction measures;
- Allows gathering new information on exposure to mercury on global and regional scale;
- Provides scientific bases and empowers policy-makers and others to implement risk-reduction measures.

Wide use of mercury HBM is feasible:

- WHO harmonized methodology for assessment of pre-natal exposure to mercury is available and has been applied in the pilot surveys successfully;
- Mercury HBM has long history and solid scientific bases; relevant capacities are available in many countries globally and can be created during short period in other countries; it has been demonstrated in the framework of UNEP/WHO project on mercury HBM.

6.1.3 Biota biomonitoring.

6.1.3.1 Overarching objectives for the use of biota for evaluating the effectiveness of the Minamata Convention

1. Determine the source of Mercury (Hg) for human exposure;
2. Identify biological Mercury (Hg) hotspots;
3. Track temporal trends of environmental Mercury (Hg) loads;

4. Improve environmental health.

Why use biota?

There is not a direct relationship between air Mercury (Hg) deposition and biota – so there is little confidence to estimate the impacts of Hg and subsequent methylation to biota (lichen Hg data programs are helpful and can help to close the gap).

Biota are important proteins source for humans – especially fish. Fish are key protein sources and have important nutritional value – we all want to be able to safely eat fish (vs. avoiding fish).

Need to evaluate environmental health using biota for:

- a) Ecotourism and economic value
- b) Intrinsic value of biological diversity

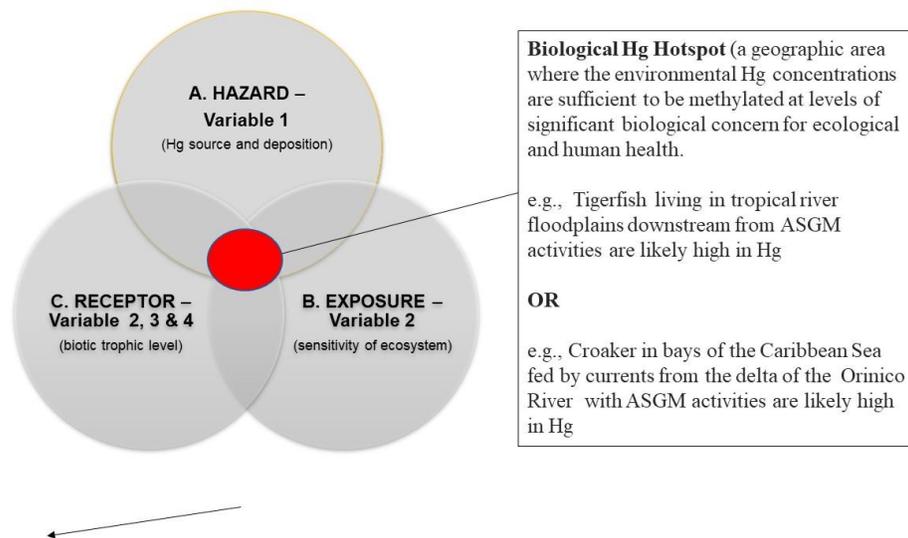
There are a lot of published data on biotic Hg (to help with baselines and tracking).

6.1.3.2 Overall Approach for biomonitoring

Identify biological Hg hotspots at a global level (see graphic below for Output 1).

Identify human exposure Hg hotspots at a global level – vulnerable populations (e.g., Faroe Islands).

OUTPUT 1. Relationship among key variables of the environmental Hg issue:
(A) Hazard; (B) Exposure; and (C) Receptor.



Conceptual global geographic matrix
(example of point source tracked within cell)

General Biome Type	Land	Freshwater	Marine
Arctic	Coal emissions	Coal emissions (some releases)	All emissions/ releases
Temperate	Industrial / coal emissions	Industrial / coal emissions	All emissions/ releases
Tropics	ASGM emissions / releases	ASGM emissions / releases	All emissions / releases

Can be monitored at national, regional and global scales

Overall approach – next steps

1. Use biome-ecosystem cell (within the matrix) to determine the:
 - a) biological Hg hotspots
 - b) Human exposure Hg hotspots
2. Then there would need to be a selection process for which ones to choose.
3. Then, once locations are chosen, then a more detailed sampling effort could be created to:
 - a) Evaluate and enhance food safety information required in different countries
 - b) Track short and long-term trends (using different bioindicator or even the same indicator – just different age/size classes)

6.1.3.3 Criteria for bioindicators (short list for both process and outcome endpoints)

- Species is common
- Easily captured
- Consumed by humans (regularly)
- High trophic level
- Monitoring programs can generate new data (e.g., EU food safety regulation program, which submits its mercury monitoring data to the global WHO GEMS/FOOD database)
- Is comparable (over space and time)

One example = Bluefish for temperate, Grouper for tropical

6.1.3.4 Group realizations about Mercury (Hg) biomonitoring in biota

- Biota are a core matrix for biomonitoring;
- Choice of bioindicators need to take into consideration many factors, but their comparability across regions and the globe can be made; (more detail can be found at Evers et. al 2016¹)
- Locations need to be identified. Once prime general area is the Arctic tundra (AMAP has some of the best designed and robust Hg datasets for tracking temporal trends);
- Timing needs to be identified and will vary according to objective, ecosystem type, and bioindicators chosen

¹ Evers., D., Keane S.E., Basu, N., Buck, D. 2016. Evaluating the effectiveness of the Minamata Convention on Mercury: Principals and recommendations for next steps. Science of the Total Environment, 888-903.

Annex 1: Concept Note

Workshop “Elements to consider when designing a Global Monitoring Plan for Mercury”

13 – 14 February 2018, Rome, Italy

Concept Note

1. Background and Context

The Chemicals and Health Branch of the United Nations Environment Programme (UN Environment) in close collaboration with the National Research Council of Italy - Institute of Atmospheric Pollution Research (CNR-IIA) and the World Health Organization, Regional Office for Europe – European Centre for Environment and Health (WHO - ECEH) are implementing the Global Environmental Facility (GEF) project entitled “Development of a Plan for Global Monitoring of Human Exposure to and Environmental Concentration of Mercury”. The main aims of the project are to harmonize approaches for mercury monitoring, and to strengthen the capacity for mercury analyses in humans and in the environment.

The workshop “*Elements to consider when designing a Global Monitoring Plan for Mercury*” will take place the 13-14 February 2018 in Roma, Italy. The workshop will discuss the results and lessons learned of the Global pilot studies of the measurement of the concentration of mercury using Human Bio-Monitoring and Passive Air Sampling. It has also the objectives to equip participants with the practical tools and knowledge to improve their performances in assessing mercury and mercury compounds. During the meeting, there will be a discussion of the methodologies and Standard Operating Procedures (SOPs) developed by the project.

Key scientific information generated by the project will be disseminated and it is expected to help shape appropriate, effective and sustainable plans to assess the human exposure to and environmental contaminations of mercury in the light of the Minamata Convention.

2. Overall Goal and Objectives

The main objectives of the workshop meeting are to:

- Present and discuss the results, outcomes and lesson learnt of the GEF funded project.
- Discuss the implications of the results, Standard Operating Procedures (SOPs), and technical aspects of using human biomonitoring matrices and passive air sampling to assess the concentrations and exposure to mercury in the light of the Minamata convention.

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- Increase awareness and capacity to undertake monitoring of mercury.

The meeting is an important milestone in the discussion of the way forward for developing a plan for global monitoring of mercury in the light of the Minamata convention and the effectiveness evaluation.

3. Participants

The workshop will bring together the partners of the project “Develop a plan for Global Monitoring of Mercury” (UN Environment, CRN-IIA and WHO), as well as the local and regional coordinators involved in the pilot study of mercury monitoring in human matrices and ambient air around the world, including those regional groups that show interest in monitoring mercury, experts and different interested stakeholders.

The tentative list of participants is attached to the note as Annex II.

4. Programme and Methods

The meeting will begin with a short introduction to the agenda items follow by a interactive session. During the first day of the meeting the outcomes of the projects will be presented, including:

The main results of the:

- Review of existing information on human exposure to and environmental concentration of mercury and the worldwide capacity to analyse mercury
- The global monitoring pilot study of the presentence of mercury in ambient air.
- The global monitoring pilot study of the human exposure to mercury.

During the second day, discussions in working groups will take place with regard to the key scientific information generated by the project, lessons learned, and the elements to consider regarding a Global Monitoring Plan for Mercury.

The provisional agenda for the workshop meeting of the Global Monitoring Plan for Mercury is attached to this note as Annex I.

5. Partners

This meeting will be organized by the National Research Council of Italy - Institute of Atmospheric Pollution Research (CNR-IIA) in a joint effort with UN Environment and the World Health Organization, Regional Office for Europe – European Centre for Environment and Health (WHO ECEH)).

6. Evaluation

At the end of the meeting, UN Environment, will promote discussion on the extent to which the meeting has achieved its objectives, the next steps will be identified and feedbacks obtained. Also, will be discussed the applicability of the methodologies developed to assess human exposure to and the environmental contaminations of mercury.

Annex 2: Agenda of the meeting

UN Environment / CNR-IIA / WHO

Workshop “Elements towards a Global Monitoring Plan for Mercury”

13 – 14 February 2018, Rome, Italy

Agenda

Day 1 – Tuesday 13 February 2018

(Conference Hall of CNR - AdR RM1 Montelibretti)

08:30 - 09:00 *Registration of participants*

9:00 – 10:30 Opening of the meeting by Nicola Pirrone (CNR-IIA), UN Environment and WHO

1. Organization of work for the meeting
 - a. Self introduction of participants
2. Objectives of the meeting and expected outcomes by UN Environment
3. GEF project “Development of a Plan for Global Monitoring of Human Exposure to and Environmental Concentration of Mercury” objectives and outcomes (UN Environment)

10:30 – 11:00 *Coffee break*

☒ - Group photo before the coffee break

11:00– 13:00

4. Human Biomonitoring as a tool to assess the exposure to Mercury (by WHO)
 - i. Overview of the project (by Irina Zastenskaya)
 - ii. Ethical and cultural consideration, ethical committee’ approval (by Rigoberto Blanco)
 - iii. Designing and planning of the survey: target population groups and sampling size (by Irina Ilchenko)

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- iv. Selection of biological matrices and feasibility: applicability of different matrices (by Ainash Sharshenova)
- v. HBM survey implementation: contacting and recruiting women and organization of the field work (by Edith Clarke)
- vi. Analytical methods and capacity needs, QC/QA programmes (by Davaadorj Rendoo)
- vii. Fish contamination monitoring and interpretation of the results (by Philippe Verger)
- viii. Positive experience of implementing mercury HBM survey (by Krishnendu Mukhopadhyay)
- ix. Outcomes of the HBM project (main achievement at regional and global level) (by Dorota Jarosinska)

13:00 – 14:15 *Lunch break*

14:15 – 15:30

- 5. Main results of the pilot study on air concentration of Mercury
 - i. GMOS network: characteristics and data management (by F. Sprovieri / CNR-IIA)
 - ii. Pilot survey: monitoring sites and experimental design for air sampling (by A. Fino / CNR-IIA)
 - iii. Passive air sampling as a tool to measure mercury in ambient air: results of the pilot survey (by A. Macagnano / CNR-IIA)
 - iv. Direct experiences of GMOS site managers and WHO national coordinators (by Lynwill Martin /SAWS South Africa; María C. Diéguez / CONICET – INIBIOMA Argentina; Krishnendu Mukhopadhyay / SRI Ramachandra Univ. India; Davaadorj Rendoo /IANPHI Mongolia).

15:30 – 16:00 *Afternoon break*

16:00 – 17:00

- 1. Briefing on Minamata Convention and the ad-hoc expert group on “Effectiveness Evaluation” (by Sheila Logan)
- 2. Worldwide initiatives of mercury and mercury compound monitoring.
 - a. Experiences in biota and human monitoring by David Evers /BRI
 - b. Presentation by Milena Horvat / Jožef Stefan Institute,

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- c. Health effects and HBM of populations exposed to elemental mercury vapor and methylmercury by Mineshi Sakamoto / National Institute for Minamata Disease
- d. Levels and trends of mercury in humans in the Arctic Monitoring and Assessment Programme (AMAP) 2015 Human Health Assessment Report by Pál Weihe / The Faroese Hospital System

17:00: End of day 1

19:00 Social dinner

Day 2 – Wednesday 14 February 2018

9:00 – 09:30 Recap of day 1, structure of day 2 by UN Environment (Conference Hall of CNR - AdR RM1)

09:45 – 10:30 Visit to the CNR-IIA sampling site A. Liberti and show-case event on available methodologies and technologies for monitoring and analysing mercury in ambient air (by E. Zampetti, P. Papa, A. Macagnano, F. Sprovieri / CNR-IIA).

10:30 – 11:00 *Coffee break*

11:00 – 12:30

1. Elements towards a global Monitoring Plan for Mercury (initial consideration by UN Environment)
2. Open Discussion on Key scientific aspects and Next steps to be considered on Global Mercury Monitoring Plan

Working groups discussions

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The participants would be grouped in several working groups to discuss the Key scientific information generated by the project, gaps and needs with regard to the elements to consider when designing a Global Monitoring Plan for Mercury in the light of the ad-hoc expert group meeting on “Effectiveness Evaluation” that will take place on March 5-9, 2018 in Ottawa, Canada.

12:30 – 14:00	<i>Lunch break</i>
14:00 – 15:30	Working groups discussions
15:30 – 16:00	<i>Afternoon break</i>
16:00 – 17:00	Presentations of the main highlights of the different working groups
17:00:	Closure of the meeting

Annex 3: Participant list

Workshop "Elements to consider when designing a Global Monitoring Plan for Mercury"

13-14 February, 2018

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