

# *UNEP Global Mercury Partnership*

## *Business Plan of the*

### *Mercury Air Transport and Fate Research Partnership Area*

- 9 January 2008 -

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This Business Plan describes the activities of the United Nations Environmental Programme (UNEP) Global Partnership for Air Transport and Fate Research (F&T) during the period 2007-2009 and serves as a communication vehicle both for Partners and others. It updates the initial F&T business plan, developed at its January 2007 Gatineau, Quebec meeting and later posted on the Partnership web site.

The purpose of the business plan is to provide a framework for developing and implementing projects. The business plan is to serve as a resource for providing a common, cohesive structure for implementing the UNEP Global Mercury Partnership.

The partnership is open for government and stakeholder participation. In UNEP Governing Council Decision 24/3 part IV paragraph 27, UNEP is tasked with working in consultation with Governments and stakeholders to strengthen the UNEP Global Mercury Partnerships. New activities and partners are encouraged within the UNEP Global Mercury Partnership.

## ***I. Summary of the Issue***

An improved understanding of mercury emission sources, fate and transport is important in:

- (a) setting priorities at the national, regional and global levels,
- (b) developing and implementing policies and strategies, and
- (c) in establishing baselines to monitor and assess progress on mercury reductions.

Integrated global assessments, based on valid data and information from regional and national levels, are essential for global understanding and for predicting trends. However, there is a lack of global coverage and coordination in research efforts.

With competing resources and priorities at the national, regional and global levels, integrating the partners, countries and stakeholders in the field of atmospheric mercury research, aiming to achieve the objectives below would help facilitate a greater understanding of mercury uses and releases, and in achieving reductions in mercury contamination.

## **II. Objective of the Partnership**

F&T aims to increase global understanding of international mercury emissions sources, fate and transport by:

- Accelerating the development of sound scientific information to address uncertainties and data gaps in global mercury cycling and its patterns (e.g., air concentrations and deposition rates, source-receptor relationships, hemispheric-global air transport/transformation, emission sources).
- Enhancing sharing of such information among scientists and between them and policymakers.
- Providing technical assistance and training, where possible, to support the development of critical information.

At present, the scope of the Partnership's research activities is constrained to mercury in the atmosphere from the point of emission to the point up to and including deposition. Consideration of research on biochemical cycling and effects of mercury in aquatic or terrestrial systems is deferred.

### III. Long-Term Priority Actions

The following table identifies long term priority actions and then links them with various current partnership efforts (further described in Appendix B) and timelines.

Long-Term Priority Actions	Current Partnership Efforts and Timelines	Future Strategic Initiatives to be considered to fill the gaps
<ul style="list-style-type: none"> <li>• Coordination in conducting research projects related to partnership objectives and scope on national/regional/global scales on cross-cutting issues of the mercury cycle.</li> </ul>	<ul style="list-style-type: none"> <li>• Continue high altitude measurements in Mauna Loa, Hawaii during 2007 and 2008, to better understand globally cycling mercury and sharing that information thru the UNEP web site. (U.S.)</li> </ul>	<ul style="list-style-type: none"> <li>• Joint research proposal to be submitted in the framework of the European Commission FP7. (Italy)</li> </ul>
<ul style="list-style-type: none"> <li>• Develop global, coordinated network of measurements for assessing levels of mercury and its species in the atmosphere – improving the comparability among measurements and observations</li> </ul>	<ul style="list-style-type: none"> <li>• Conduct atmospheric monitoring and make summary data available (Canada, South Africa)</li> <li>• Share sampling and monitoring methodologies (U.S.).</li> <li>• Measure mercury in precipitation and make summary data available (Canada, South Africa)</li> <li>• Develop circumpolar network of TGM measurements (Canada)</li> <li>• Expand mercury measurements to include speciation (RGM, Hg(p)) (Canada, South Africa)</li> <li>• Develop common protocols for the measurement and estimation of Hg dry deposition (Canada),</li> <li>• Develop common protocols for the measurement and estimation of Hg wet deposition South Africa)</li> </ul>	<ul style="list-style-type: none"> <li>• Encourage joint initiatives to promote training on mercury measurements in ambient air and flue gases. (Italy)</li> <li>• Support international programs and initiatives (IGBP-IGAC, UNEP). (Italy)</li> <li>• Continue to support UNECE-LRTAP convention for shaping future international mechanisms aimed to reduce the mercury emissions to the atmosphere and its impact on ecosystems and human health. (Italy, U.S.)</li> </ul>
<ul style="list-style-type: none"> <li>• Develop global, coordinated network for research on source-receptor relationships effort that would allow for the creation of modeling framework for understanding global fate of mercury</li> </ul>	<ul style="list-style-type: none"> <li>• IPY projects on mercury transport, cycling and deposition of mercury to the Polar environment (Canada)</li> </ul>	
<ul style="list-style-type: none"> <li>• Develop a global, commonly accepted modeling framework for source-receptor relationships assessment at global and regional scales</li> </ul>	<ul style="list-style-type: none"> <li>• Canada has developed the global/regional atmospheric heavy metals model (GRAHM) for the distribution of atmospheric mercury</li> <li>• GRAHM used to estimate intercontinental transport of mercury to various regions (Canada)</li> <li>• South Africa is developing a MERIECO model (Bayesian Network) to determine the linkages between Hg from source to receptor.</li> <li>• Share worldwide meteorological data through the READY web-based system (U.S.).</li> <li>• Share various transport and air dispersion models (U.S.)</li> </ul>	
<ul style="list-style-type: none"> <li>• Develop global emissions inventories, e.g., by filling current gaps in geographic and source</li> </ul>	<ul style="list-style-type: none"> <li>• Maintain and make available national mercury emissions information (Canada, United States)</li> </ul>	

<p>coverage which includes information on regions not yet accounted for and on sources not yet accounted for in currently used databases, e.g. biomass burning, artisanal gold mining, coal-bed fires and natural sources</p>	<p>(ongoing; annual reports)</p> <ul style="list-style-type: none"> <li>• Develop and implement a program to quantify bi-directional mercury flux from oceans, lakes, soils and vegetation (Canada, U.S.).</li> <li>• South Africa is currently completing a Hg inventory for the country.</li> <li>• South Africa and Norway are working together on developing Hg scenarios for the country.</li> <li>• Share worldwide coal inventory (<a href="http://energy.er.usgs.gov/coalquality/wocq/collaborators.html">http://energy.er.usgs.gov/coalquality/wocq/collaborators.html</a>) (U.S.)</li> </ul>	
<ul style="list-style-type: none"> <li>• Build capacity, including through the provision of training programs, related to partnership objectives and scope monitoring, modeling and other tools in countries where necessary</li> </ul>	<ul style="list-style-type: none"> <li>• South Africa held a Hg analytical training programme in conjunction with international Hg experts</li> </ul>	
<ul style="list-style-type: none"> <li>• Build on existing international activities work already underway internationally, e.g., GEOSS, Arctic Council, UNECE-HTAP, WMO, AMAP</li> </ul>	<ul style="list-style-type: none"> <li>• Canada will co-author the next AMAP mercury assessment</li> <li>• Canada participated in two model intercomparison studies (led by EMEP and EPA) and will contribute to UNECE-HTAP interim and final assessment reports on the evidence for intercontinental transport</li> <li>• Through the CEC Canada and US are assisting Mexico to seek funding to continue and expand programs for mercury monitoring.</li> </ul>	

## IV. Current Partnership Efforts and Timelines

The Partnership has met three times. The 1<sup>st</sup> meeting was held in Madison, Wisconsin in conjunction with the 8<sup>th</sup> International Conference of Mercury as a Global Pollutant. The 2<sup>nd</sup> meeting was held in Gatineau, Quebec, Canada on January 9-10, 2007 with the main objective to discuss and define, for the Partnership, the elements included in Decision 23/9 IV. Since then, the Partnership has had two teleconferences. A 3<sup>rd</sup> meeting was held in Washington, D.C. on 10-11 October 2007.

Each country and organization's initial contributions are provided in the section "Specific Contributions" of the F&T website (<http://www.cs.ia.cnr.it/UNEP-MFTP/index.htm>) and indicated in Appendix B of this document. The following is a summary of salient examples of each contribution.

- Completion of a 3 year study by Italy on mercury emission control technologies and methodologies, including the development of national legislation in China, initiated with the Institute for Atmospheric Pollution of the Italian National Research Council. Training and capacity building activities will be offered to interested parties.
- Development of a circumpolar mercury measurement network building upon the long-standing Canadian data set of continuous measurements of atmospheric mercury in the Arctic.
- U.S./Canada collaboration in developing a network to estimate dry deposition under the Mercury Deposition Network (MDN).
- Collaborative research work in a South African mercury partnership initiated in 2006. Foci include emission inventory development, as well as research towards understanding mercury releases from coal.
- The United States contribution focuses on continuing taking high altitude measurements of atmospheric mercury (and other pollutants for two more years at Mauna Loa, Hawaii, to better understand globally cycled mercury and sharing that information with a notice of availability on the UNEP web site as well as sharing other data bases, such as the U.S. Geological Survey's World Coal Quality Inventory and various monitoring and modeling methodologies. The US Department of Energy's NETL will maintain its ongoing partnership with the Chinese Ministry of Science and Technology and Zhejiang University, which includes developing emission factors for coal-fired power plants.
- Initiation of Japan's pilot project in 2007 to monitor atmospheric mercury levels and obtain information on the long range transport of mercury and other trace elements in the Asia –Pacific region.
- Expansion of the Electric Power Research Institute's (EPRI) high altitude monitoring program involving measurements at Mount Bachelor, Oregon and with aircraft, to better understand transboundary transport.
- The Partnership is working together to assist UNEP by providing a report (see information in Appendix A) encompassing information on three topics falling within the F&T scope of activities (i.e., emissions, air modeling and air monitoring).

## V. Future Strategic Initiatives to be Considered to Fill the Gaps

Areas identified at the F&T meeting in January 2007 in Gatineau, Canada for further investigation/ unfunded proposals for further Partnership consideration include:

- Harmonization of greenhouse gas and mercury emission inventories;
- Possible partnership activities to further the understanding of atmospheric mercury through a measurement program at K2 Italian Research Station.
- Italy will investigate a special session related to F&T activities during the 2009 International Conference as a Global Pollutant to be held in Guiyang in China and possibly during the 14<sup>th</sup> International Conference on Heavy Metals to be held on 23-30 November 2008 in Taipei, Taiwan.
- Relevant information will be gained through International Polar Year 2008 activities. The partners are collaborating together to mutually benefit from the knowledge and information generated under this activity.
- Explore opportunities for 'mercury issue' outreach with International Polar Year 2008 activities
- Further coordination and liaison with various organizations and programs (such as United Nations Economic Commission for Europe, Arctic Monitoring and Assessment Programme, UNEP Regional Seas);

## VI. Evaluation

(This is to identify accomplishments of the activities undertaken by the Partnership)

The partnership areas will report biennially to UNEP in accordance with the UNEP reporting format<sup>1</sup>. Reporting will include monitoring performance (tracking partnership activities and partner contributions) as well as assessing effectiveness (measuring the impact of partnership activities on target beneficiaries).

Partners will also provide periodic reports to UNEP upon completion of priority activities.

## VII. Resource Mobilization

Partnerships and the associated business plans are a way of mobilizing funding in a systematic, focused and harmonized way. The Partnerships' objectives and business plans should provide clarity for potential donors and finance institutions. The business plans should encourage and facilitate donors to support activities and provide a tool to leverage funds.

### Funding for Partnership Activities:

Partners can develop specific initiatives, work with non-partners, or pursue projects consistent with partnership objectives.

It is hoped that the Partnership will serve as a mechanism to consolidate and leverage funding for large, strategic projects. If partners wish to leverage funding for particular projects, details should be outlined within this section.

Partners are encouraged to contribute not only financially but also to offer in-kind assistance. Developing countries and countries with economies in transition can also submit requests for funding to UNEP under the UNEP Mercury Small Grants Programme. UNEP could consult with the partnership area for expert advice when such proposals are developed.

The partnership area has proposed possible ways to engage international donor agencies and make them aware of Partnership activities and needs, such as:

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- informing other countries of opportunities to pursue possible financial support from different agencies, such as the Asian Development Bank, World Bank, other regional funding institutions, and that it is desirable that these agencies be involved in the beginning of the process, and
- considering ways to market the significance of mercury studies to major funding organizations so that the study of mercury pollution is included in their selection criteria as an issue with significant socio-economic implications.)

## **VIII. Business planning process**

The business plan will be reviewed regularly and adjusted accordingly by the partners. Ideas are welcome on how best to take stock of efforts, determine whether the direction of the Partnership for the various projects need to be re-considered, and measure the productivity of the efforts under the Partnership.

## **IX. Linkages with other Partnerships and with other entities**

The F&T Partnership serves to integrate and enhance the work of the other Partnerships and other programs by providing information within the scope of its objectives.

## **X. UNEP F&T website**

The F&T has established a website at <http://www.cs.ija.cnr.it/UNEP-MFTP>, to serve as a bulletin board for sharing information within the Partnership and provide up to date information to policy makers and stakeholders. It is linked to the UNEP website on which are available information on all Partnerships, [www.chem.unep.ch/mercury/partnerships/default.htm](http://www.chem.unep.ch/mercury/partnerships/default.htm)

## XI. Partners

*Other partners are welcome to join the partnership at anytime.*

**This list may need confirmation and added detail.**

Members:		
1.	ITALY (Chair)	Dr. Nicola Pirrone Director CNR Institute for Atmospheric Pollution - Division of Rende 87036 Rende Italy Tel: +39.06-90672694 (secretary); +39.0984.493239 (direct) Fax: + 39.06.90672660 E-mail: <a href="mailto:n.pirrone@cs.iaa.cnr.it">n.pirrone@cs.iaa.cnr.it</a> URL: <a href="http://www.iaa.cnr.it">http://www.iaa.cnr.it</a>
2.	Canada	Dr. Keith Puckett Director, Air Quality Research Environment Canada Tel: (416) 739-4836 <a href="mailto:Keith.puckett@ec.gc.ca">Keith.puckett@ec.gc.ca</a>
3.	Japan	Keiko Segawa Environmental Health and Safety Division Ministry of the Environment <a href="mailto:keiko_segawa@env.go.jp">keiko_segawa@env.go.jp</a>
4.	South Africa	Dr Joy Leaner Research Group Leader: Water Ecosystems Council for Scientific and Industrial Research <a href="mailto:jleaner@csir.co.za">jleaner@csir.co.za</a>
5.	USA	Stanley B. Durkee Office of Science Policy ORD-US Environmental Protection Agency <a href="mailto:Durkee.Stan@epamail.epa.gov">Durkee.Stan@epamail.epa.gov</a>
6.	UNEP Chemicals	Gunnar Futsaeter Tel: +41 22 917 8185 Fax: +41 22 797 3460 Email: <a href="mailto:gfutsaeter@chemicals.unep.ch">gfutsaeter@chemicals.unep.ch</a>
7.	Electric Power Research Institute (EPRI)	Leonard Levin <a href="mailto:llevin@epri.com">llevin@epri.com</a>
8.	NGO (new since GC 24)	Susan Egan Keane Senior Environmental Analyst, Natural Resources Defense Council 202-289-2389 <a href="mailto:skeane@nrdc.org">skeane@nrdc.org</a>
Corresponding members:		
	AMAP Mercury Experts (new since GC 24)	Rune Dietz, Dept. of Arctic Environment, National Environmental Research Inst. Tel:+ 45-46 30 1938



		<p>Email: rdi@dmu.dk</p> <p>Peter Outridge, Geological survey of Canada, Tel: + 1-613-996 3958 email: outridge@nrcan.gc.ca</p> <p>Simon Wilson AMAP, Secretariat s.wilson@inter.nl.net</p>
	Japan	<p>Dr. Noriyuki Suzuki National Institute for Environmental Studies (NIES) Tel: +81-29 850 2331 nsuzuki@nies.go.jp</p>
	Canada	<p>Ms. Grace Howland Environment Canada 819.956.9754 grace.howland@ec.gc.ca</p> <p>Ms. Cathy Banic Environment Canada 416.739.4613 Cathy.banic@ec.gc.ca</p> <p>Ms. Cheryl Heathwood Environment Canada 819. 953.7157 Cheryl.heathwood@ec.gc.ca</p>
	UNEP	<p>Brenda Koekkoek bkoekkoek@chemicals.unep.ch +41 22 917 88 67</p>
	USA	<p>Marianne Bailey EPA Office of International Affairs tel. 202-564-6402 Bailey.Marianne@epamail.epa.gov</p>

## Appendix A. Developing the F&T Report

The Governing Council of UNEP, in its decision 24/3, called for the UNEP Executive Director to prepare a report, drawing on, among other things, ongoing work in other forums addressing best available data on mercury emissions and trends including where possible an analysis by country, region and sector, including a consideration of factors driving such trends and applicable regulatory mechanisms; and current results from modelling on a global scale and from other information sources on the contribution of regional emissions to deposition which may result in adverse effects.

The Partnership recognizes that it is uniquely placed to contribute to the UNEP report. Accordingly, it will coordinate the development of a contributing F&T partnership report that will address sources of mercury released to the atmosphere, spatial coverage and temporal trends of mercury measurements, and understanding atmospheric mercury dynamic processes on hemispheric and global scales. The partnership report will be coordinated with UNEP, recognizing that UNEP is a partner in this Partnership. The Partnership report materials will be structured and written so as to be able to easily integrated into the UNEP report, with the text developed so as to communicate with policymakers as well as with the scientific community.

Drafts of the partnership report chapters will be provided to UNEP by 31 January 2008. Each leading author of the chapters will be invited to present his/her contribution at the workshop of F&T to be held in Rome in April 2008. The F&T workshop will be a joint workshop with the annual UNECE-HTAP Task Force meeting: this will allow the benefit of participation of a larger number of experts, and will assure a stronger consistency of results presented in the partnership report and a UNECE-HTAP report that is due in February 2009. The authors of each chapter will subsequently revise, within 4 weeks of the workshop, their chapter(s) based on the discussion during the April 2008 workshop and comments provided by partners and other experts, and resubmit the revised chapters to the Chair of the F&T. The Chair of F&T will circulate the revised draft chapters among all partners and will prepare the final draft edition of the partnership report in the second half of May 2008 and, following clearance by the F&T Partners, submit it to UNEP for information. Publication of the partnership report through other means will also be considered.

In order to assure a timely flow of information between F&T and the UNEP Report preparation, the F&T partners will remain active in responding as appropriate to review comments on the draft F&T report chapters, as requested by UNEP, that are received during the review of the draft UNEP report, and the Chair of the F&T will participate in the Coordination Committee overseeing the development of the UNEP report.

The preparation of the partnership report is a step forward from the UNEP 2002 GMA report and from the synthesis papers prepared by five expert panels at the last International Conference on Mercury as a Global Pollutant (ICMGP) held in Madison, USA in August 2006 which have been published in *Ambio* (February 2007). In particular the five papers of the Madison Conference are introduced by the Madison Conference Declaration in which a concise and up to date overview of major pending scientific and policy questions are presented (see *Ambio*, vol.36, 2-65).

In order to meet the time schedule and objectives of the overall UNEP Report, the F&T Chair will manage the preparation of the partnership report through the involvement of world leading scientists on different aspects of atmospheric mercury emissions, transport and deposition. The preparation of the F&T report will be developed through different steps as reported below, undertaken by the coordinating committee and supported by F&T partners where indicated:

- 1) Identification of the contributors for the information required for the partnership report.
- 2) Contributing and leading authors of each chapter will be formally invited to provide information in an appropriate format, with a mention of the 2008 workshop.

- 3) Contributors to submit required information to the coordinating committee by January 31, 2008. All contributions to be provided to F&T partners for their review.
- 4) Preparation of the draft UNEP report by coordinating committee or others designated by the committee as appropriate
- 5) Review of draft UNEP report (peer review by July 15, national review by July 30 2008). The UNEP report will then be finalized in a separate process.
- 6) Each leading author will be invited to present his/her contribution to the partnership report at the workshop of F&T to be held in Rome in April 2007. Possibility to elaborate the contribution in a chapter for the workshop (partnership?) report.
- 7) The F&T workshop will be a joint workshop with the annual UNECE-HTAP Task Force meeting, this will allow to get a great benefit by the participation of a larger number of experts and will assure a stronger consistency of results presented in the F&T report and UNECE-HTAP report. The latter due also on February 2009. Contact with the UNECE-HTAP Task Force co-coordinators, Dr. Andre Zuber of the European Commission and Dr. Terry Keating of the U.S.EPA have been established for the organization of the joint Mercury Sessions and for sponsoring the travel expenses of the invited experts. A financial contribution from UNEP Chemicals for the workshop will be highly appreciated. A meeting of the F&T partnership will be held concurrent with the April 08 workshop.
- 8) Based on the discussion that will take place during the April 2008 workshop and comments provided by partners and other experts, the authors of each chapter will revise within 4 weeks their chapter and send back to the Chair of the F&T for inclusion in the partnership report. F&T partners to also be provided with the revised chapters and summary chapters for final review and approval prior to publication.
- 9) The Chair of F&T will prepare the final draft edition of the partnership report in the second half of May 2008 and, following clearance by the F&T partners, submit it to UNEP for information.
- 10) In order to assure a timely flow of information between the partnership report and UNEP Report preparation, the F&T partners will remain active in responding, as appropriate, to review comments on the draft partnership report chapters, as requested by UNEP, that are received during the review cycle of the draft UNEP report.

### **Structure of the F&T Report**

The outline of the F&T Report accounts for an extensive discussion had within the F&T and inputs received by all F&T members.

The F&T report is structured in three parts, each part includes a summary of key elements highlighted in the chapters.

Part-1 is aimed to provide up to date information of mercury emissions from major industrial sources, including point and diffuse sources, and natural sources.

Part-2 will provide an overview of spatial and temporal distribution of mercury measurements performed in recent years at terrestrial and off-shore sites and key elements for future monitoring programs.

Part-3 is aimed to provide up to date information on global atmospheric mercury models currently available and will present a brief overview of the global mercury models intercomparison currently on-going in the UNECE-HTAP Task Force.

## Appendix B. Contributions of Partners

### B1 - Contribution from Italy

Italy is leading the UENEP F&T in cooperation with Canada, Japan, US and UNEP. The work plan of the Partnership along with a description of the progress made in 2006, the specific contributions of the partners and products of the Partnership are reported in detail on the Partnership's web site at: <http://www.cs.iaa.cnr.it/UNEP/index.htm>. Italy will continue to maintain and update the web site.

The Italian contribution to the Partnership is related to different aspects of atmospheric mercury emissions, transport and transformations on regional and global scales. Activities are carried out in the Mediterranean region, in China and in Polar regions as well. The specific projects and programs led by Italy in 2006 and planned for the following two years are briefly reported below.

*MED-OCEANOR Programme:* It has been /is supported by Italian CNR and European Commission. It is aimed to investigate the air-water exchange processes and MBL chemistry that influence the cycling of mercury in the region. The program was started in 2000 and is projected to continue in the future. It involved several Mediterranean countries i.e., France, Slovenia, Greece, Spain, Morocco, Egypt, Israel. Intensive atmospheric, surface and deep sea measurements were performed and training activities were provided to several participants on different state-of-the-art methods for assessing the mercury levels in air and water samples (see: [http://www.cs.iaa.cnr.it/research\\_project.htm](http://www.cs.iaa.cnr.it/research_project.htm)).

*MERCYMS project:* It was funded by the European Commission as part of the FP5 and was aimed to investigate on mercury cycling in the Mediterranean region. The projects ended in 2006 and now is continuing the distribution of its products to major national and international policy makers and stakeholders in EU and abroad (see at: <http://www.cs.iaa.cnr.it/MERCYMS/project.htm>).

*ESPreme project:* It was funded by the European Commission as part of the FP6 and is aimed to develop an assessment of atmospheric trace metals pollution, including mercury, in Europe and possibly to assess the relative contributions of EU countries compared to the long range transport contribution originated in other continents. More information can be found at: <http://www.cs.iaa.cnr.it/espreme.htm>.

*AME project:* It is a three-year project funded by the Italian Ministry of Environment and it is a joint project with SEPA in Beijing and other Chinese institutions at province level. It is aimed to assess spatial and temporal distributions of atmospheric mercury in the City of Suzhou, China and possibly the source-receptor relationships. The project includes tasks on measurements and modeling. Training activities will be carried out to interested parties. More information can be found at: <http://www.cs.iaa.cnr.it/AMSUCY/index.htm>.

*UNECE-HTAP Task Force, WG on Hg:* Italy is Leading the Working Group on Mercury. The major goals of this WG are to perform a modeling intercomparison for assessing the effectiveness of emission reduction measures and an assessment of the relative contribution of natural vs. anthropogenic sources on hemispheric and global scales. Preliminary tests of the models involved was carried in 2006. The final results will be part of the 2009 UNECE-HTAP report.

*Polar research program:* As part of the IPY in 2008, Italy will perform an intensive campaign in Ny-Alesund on the Svalbard Islands at the Italian research site. The aim of this project is to investigate on mercury depletion mechanisms that affect the transfer of mercury from the atmosphere to surface snow. More information can be found at: <http://www.htap.org>, <http://aqm.jrc.it/HTAP>.

### B2 - Contribution from Japan

Monitoring Project for Ambient Atmospheric Mercury and Other Heavy Metals in Remote Background Areas – Japan started a monitoring program that will provide background air monitoring data of mercury and other heavy metals to contribute to the understanding of their atmospheric long-range transport. For this purpose, the Ministry of the Environment started a pilot project at the Cape Hedo Atmosphere and Aerosol Monitoring Station in Okinawa, in February 2007. The objectives of the pilot project are to:

- Monitor current levels of toxic trace elements, including mercury, in air, particles, and precipitation;
- Obtain useful information on the long-range transportation of trace elements in Asia-Pacific region;
- Develop monitoring methodologies and measurement items;
- Contribute to the international efforts in ambient atmospheric monitoring.

#### Measurement items, sampling and analysis:

Mercury speciation in atmosphere such as gaseous elemental mercury (Hg(0)), divalent reactive gaseous mercury (RGM), and total particulate mercury (TPM) are continuously measured with Tekran mercury speciation system

- Airborne particles are collected on a polytetrafluoroethylene filter using a low-volume sampler. Toxic trace elements including Pb, Cd, Cu, Zn, As, Cr, V, Ni, etc..., in particles are analyzed with the inductively-coupled plasma mass spectrometer (ICP/MS) once a week.
- Precipitation samples are collected using an automatic wet-only sampler, and toxic trace elements are measured once a month. Toxic trace elements and their analytical methods are the same as those of particulates.

#### Modeling fate of mercury species in multimedia environment:

Long-range transport of mercury species has been simulated by a number of atmospheric transport and chemistry modeling frameworks. Although atmospheric transport and resultant deposition are believed to be the major source of entry into surface environment, inter-media processes between air and surface media including water, soil and others may not necessarily be described in existing modeling frameworks sufficiently. National Institute for Environmental Studies has developed a multimedia-modeling framework to assess the inter-media transport of mercury species through media-boundaries based on the multimedia-modeling framework for organic chemicals, which mainly focuses on the inter-media transport of media boundaries explicitly. By combining existing chemical/transport atmospheric modeling experiences to the inter-media transport simulation, more comprehensive fate modeling including both air and terrestrial/aquatic environment would be possible for more integrated assessment purposes. The objectives of the pilot project is to:

- develop inter-media transport scheme and process descriptions for mercury species by expanding the multimedia modeling frameworks from the monitoring outputs.

*Methods:* Multimedia fate model G-CIEMS is used as the basis of the study, which is now under POP model inter-comparison study by MSC-E/EMEP. Hg(0), RGM (Hg<sub>2</sub><sup>+</sup>), Particulate and MeHg are the first set of target chemicals for the study.

- Results of the existing and our atmospheric monitoring information are to be used in the process description and validation of simulation results.
- After box-model study of multimedia processes, integration to the atmospheric chemistry and transport scheme will be explored for the final goal of the project.

### **B3 - Contribution from South Africa**

A South African Mercury Assessment Programme (SAMA) was established during 2006 to serve as the principal programme through which mercury research in South Africa is co-coordinated. Its are: to co-ordinate

and facilitate high-quality research relating to Hg pollution in South Africa; to develop and execute a co-ordinated plan to achieve this, based on partnerships; and to provide opportunities for collaboration and training for young scientists. More information can be obtained at: [www.waternet.co.za/sama](http://www.waternet.co.za/sama). To date, partners of the SAMA Programme focused on different aspects of mercury research. As mercury acts differently in different systems, emphasis was placed on all systems (water, air, terrestrial environment, and human health). The projects undertaken by the partners are as follows:

CSIR: A few pilot studies, funded by the CSIR and National Research Foundation, were undertaken. The studies form part of a larger project that focuses on:

- A mercury inventory for South Africa, and developing scenarios on its emissions;
- A national survey of mercury pollution and impacts in South Africa to determine the sources, fate and transport of Hg in South Africa, in air and water resources;
- Mapping information obtained in national survey, using large-scale multidisciplinary mapping;
- Evaluating the impacts of artisanal gold mining on human health and environmental health; and
- Developing and/or identifying appropriate mitigation processes or actions for ameliorating the Hg pollution that has been identified.

A mercury inventory on coal combustion (its sources and emissions to the environment) was established during 2006, and information will be published in the peer reviewed literature during 2008. In order to complete the inventory and to provide updated information to UNEP, this study will be extended during 2007 to include other mercury sources (household appliances, landfill sites, cement factories, waste incinerators, etc).

A pilot study on the fate and transport of mercury in selected South African rivers in the Western Cape (Liesbeek, Black, Eerste/Kuils, Silvermine), and Gauteng and Mpumalanga (Steenskoolspruit, Vaal River) was undertaken. Total mercury and methylmercury analyses were made of all air, water, sediment and biota samples collected, in collaboration with the University of Connecticut, USA. Detailed Hg studies were undertaken in collaboration with University of Connecticut, USA, and as part of MERSA, Norway, during 2007. A historical analysis of mercury in sediment of selected water resources was undertaken during 2006, and will be continued during 2008.

A pilot study on mercury emissions from artisanal gold mining in South Africa was undertaken during 2007. The study focused on the Limpopo/Mpumalanga Provinces, where artisanal gold mining is believed to take place.

Department of Water Affairs and Forestry: Funded by the Department, total mercury in water resources has been measured since 1975, as part of South Africa's National Monitoring Programme. Monitoring of water resources will continue.

SASOL: Funded internally by SASOL, research has focused on understanding mercury released from coal during the Fischer-Tropsch process; and also focuses on the safe disposal of the elemental mercury that is recovered. Research will continue.

University of Stellenbosch: This group focuses on analytical method development for mercury speciation, with new methods for detecting elemental and inorganic mercury at low levels, being successfully developed. The method has been tested at the Cape Point Global Atmospheric Watch station, as a pilot study. The group is currently developing this method for other mercury species. Capacity is also being developed on a new technique to study the impact of humic acids on mercury and methylmercury bioavailability.

ESKOM: Funded internally by ESKOM, studies focus on the different mercury species emitted during coal combustion processes in electricity generation, since it is likely that species other than oxidized and particulate mercury is released during coal combustion.

The SAMA Programme envisages that in ten years from now, a completed baseline study will provide South Africa with a comprehensive view of mercury measurements in the country. Baseline data will be updated continuously and disseminated throughout a proposed mercury monitoring network.

#### **B4 - Contribution from USA**

U.S. Partners (to date): U.S. Environmental Protection Agency (USEPA) (Facilitator), U.S. National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Energy (DOE), U.S. Geological Survey (USGS), Electric Power Research Institute (EPRI).

USEPA will continue taking speciated measurements of atmospheric mercury (together with particulate matter and other criteria pollutants) at the U.S. National Oceanic and Atmospheric Administration's high altitude station at Mauna Loa, Hawaii. Data obtained during 2007 and 2008 are to be shared, at intervals deemed appropriate with notice of availability to be posted on the UNEP web site. USEPA will participate in additional monitoring, source receptor modeling and training activities as circumstances and resources permit, participate in various meetings among Global Partnership partners that would be facilitated by Italy (the lead country) and contribute to various reports under the Partnership. At Italy's request, USEPA will arrange teleconferences among Global Partners.

NOAA will 1/ share its monitoring data, through a web link to be placed on the Partnership website, for three new long-term mercury monitoring stations within the U.S. that will measure ambient concentrations of mercury species as well as other pollutants, e.g., SO<sub>x</sub> and PM, as well as mercury deposition 2/ continue to provide worldwide meteorological data through the READY web-based information system and various models for computing atmospheric trajectories and dispersion, including HYSPLIT and 3/ participate in additional monitoring, modeling and training activities, including technical advice to other countries on developing a mercury monitoring strategy.

USDOE's National Energy Technology Laboratory (NETL) will 1/ share atmospheric monitoring data it has collected within the U.S. and information about sampling and monitoring methodologies. 2/ continue its mercury work in China, developing and, after consultation with Chinese collaborators, sharing project information as deemed appropriate. As part of the latter project, NETL will maintain its ongoing partnership with the Chinese Ministry of Science and Technology (MOST) and Zhejiang University, which includes developing mercury emission factors for estimating emissions from coal-fired plants. To this end, speciated measurements have been taken at a sample of Chinese plants having different technologies. The dialogue with the Italian-led Suzhou project will be continued.

The USGS will share its World Coal Quality Inventory, a database of 2,800 samples of mercury (and other) contaminant concentrations from more than 80 country collaborators as well as 7,500 samples of US coals ([http://energy.er.usgs.gov/coal\\_quality/wocqi/collaborators.html](http://energy.er.usgs.gov/coal_quality/wocqi/collaborators.html)). These data were recently used to develop DOE's mercury emissions inventory in China (Streets et al, 2005). These data may be useful in combination with the International Energy Agency (IEA) Clean Coal Center's Coal Power 5 database (<http://www.iea-caol.org.uk/content/default.asp>).

EPRI will expand its atmospheric mercury measurement program to better understand transboundary transport through continued support of high altitude ground-based monitoring (Mt Bachelor, Oregon) and aircraft soundings, including an investigation of in-cloud processing of mercury in marine and continental environments. EPRI will continue its mercury global and regional modeling, using the "one atmosphere" models as well as studies on mechanisms. EPRI will also continue work on background mercury fluxes, including work at various impacted and natural sites and undertaking aircraft measurements to elucidate natural sources of emissions, e.g., volcanoes and wildfires. Finally, EPRI will continue its support for the Mercury Deposition Network (MDN) data analysis, data quality, data interpretation and data measurement

programs and will investigate further initiation of a background site in California. Results will be shared with the Partnership by posting reports at [www.epri.com](http://www.epri.com).

## **B5 - Contribution from Canada**

Canada maintains a domestic mercury emission database under the National Pollutant Release Inventory (NPRI) program.

Several sites across Canada have been measuring total gaseous mercury using the Tekran 2537A continuous measurement instrument since 1997. The data are publicly available in Environment Canada's NAiChem database. The standard operating procedure (SOP) is available upon request and has been used throughout Canada, the US and in Europe. A quality control (QC) procedure and a QC software package for measurements within this Network have been developed and can be shared. Atmospheric speciation measurements are being made with the Tekran 1130/1135 speciation system in research mode at several sites. A SOP, QC protocol and QC software package have been developed and can be available on request. This measurement system will be assessed for operational use in the network. Canada and the United States have initiated discussions leading toward the development of a mercury dry deposition network.

The level of mercury in precipitation is determined at sites across Canada as part of the Mercury Deposition Network (MDN). The data are publicly available on the MDN website. Canada conducts mercury processes research aimed at understanding environmental pathways by which mercury is cycled.

Canada works internationally through agreements such as the NAFTA CEC North American Regional Action Plan (NARAP) on mercury, New England Governors/Eastern Canadian Premiers (NEG/ECP) action plan on mercury, Great Lakes Binational Toxics Strategy and the Arctic Council Action Plan on Mercury and contributes to the Arctic Monitoring and Assessment Program and the United Nations Environment Program.

Canada is collaborating with other Arctic countries (Norway, Denmark, Russia and USA) to develop a circumpolar network of TGM measurements. Canada will be a co-author on the next Arctic Monitoring and Assessment Programme (AMAP) assessment. This document will report on the advances in knowledge made since 2002 on mercury depletion events and their contribution to elevated levels of mercury in the arctic environment. During the 2007-2008 International Polar Year (IPY) Canada has proposed to investigate the transport, cycling and deposition of mercury to the polar environment (using an interdisciplinary approach) and to collaborate with Chinese, Vietnamese and Japanese researchers on the transpacific transport of mercury from Asia.

Canada has developed the global/regional atmospheric heavy metals model (GRAHM) for the distribution of atmospheric mercury. Using this model, source-receptor relationships were developed to estimate the intercontinental transport of mercury to various regions. Canada participated in two model intercomparison studies (one EMEP study led by MSC-E and one North American study led by US-EPA). Canada is participating in developing the work plan of the use of the multi-model approach in support of the UN-ECE LRTAP task force on hemispheric transport of pollutants. Canada will be contributing to the interim report (mid 2007) and the final assessment report of the evidence for intercontinental transport (2009). GRAHM will be participating in the model evaluation and intercomparison study for mercury.

Through the Commission for Environmental Co-operation, Canada provided instrumentation and training to measure GEM concentrations at various sites in Mexico, aided the implementation of 2 MDN sites in Mexico and is assisting Mexico to seek funding to continue and expand these programs (with USA).



## B6 - Contribution from UNEP

### Development of Emission Inventories

UNEP is undertaking field testing of the 'Toolkit for Identification and Quantification of Mercury Releases' in the Asian region. In doing so, UNEP is working with Yemen, Pakistan, Cambodia, the Philippines and Syria in developing initial mercury inventories and associated action plans. Initial results from this project will start coming forward in early 2008 and will help provide valuable insights to these countries and to the UNEP Global Mercury Partnership in strategic activities in moving forward. Funded through the UNEP Mercury Trust Fund: approximate total funding is \$240,000 USD. There is some potential support from the Government of Japan for the results workshop, anticipated for March 2008.

*Contact person:* Brenda Koekkoek, UNEP Chemicals.

### UNEP Emissions Report

UNEP has collaborated with the partnership on the development of the UNEP Emissions Report required under Governing Council Decision 24/3 IV, paragraph 24. A first draft will be produced by May 2008. This deadline is critical in order to deliver results to the 25th session of Governing Council. The partnership will produce a mercury assessment report that will feed directly into the UNEP emissions report as a major contribution. A draft report will be produced by the partnership by 31 January 2008. In addition, the partnership, through its chair will participate in a 'Coordination Group' responsible for overseeing the process of developing and delivering the UNEP report, and for the coordination and harmonization as far as possible of the activities under the F&T partnership, AMAP and UN ECE HTAP.

*Contact Person:* Gunnar Futsaeter, UNEP Chemicals.