

## ***Business Plan of the Mercury releases from coal combustion partnership area, 10 October 2011***

*(NOTE: This is the business plan version of 12 August 2010 with minor revisions proposed by UNEP. Partners will be consulted with on the revised business plan.)*

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This Business Plan describes the activities of the *Reduction of Mercury Releases from Coal Combustion* partnership area of the United Nations Environmental Programme (UNEP) Global Mercury Partnership. It serves as a planning and communication vehicle both for Partners and others.

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

- Mercury is found in trace quantities in coal. Mercury concentrations in coal vary significantly with geographical and crustal influences with significant differences being measured even between coals from the same coal-field. It is estimated that upwards of 60 %<sup>1</sup> of mercury emitted from anthropogenic sources to the atmosphere comes from coal combustion.
- The major pathway for mercury releases from coal combustion is via emissions to the atmosphere. To a lesser extent some mercury may be released in wastes/residues or water (in the case of coal washing, for example) and soil, and can be problematic if not properly controlled.
- Rapid development in many parts of the world has led to an unprecedented rate of construction of large coal-fired units. Consequently, they are increasingly considered the dominant source of global mercury emissions.
- Coal fired power emissions are a multi-pollutant challenge. In most instances, decisions related to coal fired utilities have been driven by energy security, resource availability, emissions of a variety of air pollutants (such as NO<sub>x</sub>, SO<sub>2</sub>, PM, CO<sub>2</sub>), and other considerations. Mercury emission reductions from coal combustion has occurred primarily as a result of priority efforts to address conventional air pollution impact for this sector or otherwise improve the efficiency of energy production. For example, flue gas cleaning technologies for particulates can reduce mercury emissions as a co-benefit of controlling other pollutants (often in the range of about 50-90%). More recently, mercury-specific control technologies are being applied, including injection of activated carbon and beneficiation of coal.
- Coal is used as a fuel in a variety of settings beyond large scale power plants. The nature of these settings may pose different challenges with respect to available response measures and proposed partnership activities:
  - Cement Production: The combustion of coal in cement production (and related release of mercury to the atmosphere) is believed to be a significant source of mercury releases to the environment from some raw materials. In addition, the use of fly ash in cement and gypsum in wallboard manufacture could potentially lead to the later release of some mercury into the environment.
  - Home Uses: In some regions of the world, coal is used for home heating and cooking where the coal is burned in simple, sometimes unvented, household stoves, directly exposing people to emissions of mercury, and/or other toxic pollutants.
  - Small scale boilers: Many small scale industrial facilities use coal fired boilers. The problems and needs associated with small scale industrial facilities may require special consideration under the partnership.

## II. Objective of the partnership area

The objective of this partnership area is continued minimization and elimination of mercury releases from coal combustion where possible.

The partnership area aims to supplement existing programs in key, strategically selected ways that ensure that reductions are globally significant as part of a multi-pollutant reduction approach. The partnership area aims to support such efforts while providing additional information on cost

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<sup>1</sup> This is an estimate for the year 2000. Reference : E. G. Pacyna *et al.* 2006. . Efforts are currently underway to update these estimates.

effective approaches for enhancing reductions of mercury emissions, particularly for developing nations and countries with economies in transition.

NOTE: Setting numerical targets to achieve under the partnership area has been discussed and may be revisited. Updated inventory information should enable the partnership to make a more advanced assessment of a baseline scenario and project a goal.

### **III: Priority actions**

1. Encourage use of best available technology and best environmental practices to reduce or eliminate mercury releases into the environment:
  - i) Prepare guidance document to guide countries. In doing so, review available information on best available techniques (BATs) / Best Environmental Practices (BEPs) for new and existing sources. Amend and supplement this information, as appropriate, with consideration of how it applies to various country situations.
  - ii) Provide information and technical assistance on methods to optimize pollution control systems to improve mercury control as a co-benefit. This would also include Hg removal as a co-benefit during the improvement of coal combustion efficiency in power stations (supercritical conditions, oxy-combustion, fluidized bed combustion, etc
  - iii) Identify mercury specific technologies and facilitate exchange of information on emerging technologies, for existing and new facilities.
2. Assist countries (including providing training) in evaluating the environmental impacts of coal combustion and evaluating the opportunities to achieve multi-pollutant emission reductions with associated benefits for reduction in both conventional air pollution (such as SO<sub>2</sub>, NO<sub>x</sub>, and PM) and mercury emissions, and to assist countries in assessing their situation, interests and needs. Assistance in evaluating the environmental, economic and societal (mainly human health) benefits from reduction of mercury emissions.
3. Support the development and/or improvement of mercury emission inventories to evaluate both mercury emissions and the effectiveness of emission reduction approaches.
4. Increase the awareness of mercury as a pollutant of concern through increased outreach efforts and collaboration with complementary programmes (such as at UNFCCC level), including consideration of alternative energy sources and energy efficiency.

### **IV. Ongoing and Planned Partner Efforts and Timelines**

“Reducing Mercury Emissions from Coal combustion in the energy sector”

- This is a three year project funded by the European Commission (1 million Euro) which started in 2009. The project has been extended in time to 2012. In-kind assistance has been provided by the US Environmental Protection Agency (US EPA) with respect to the use and promotion of the mercury measurement tool-kit during mercury measurement campaigns in South Africa and Russia and by the US Geological Survey (US GS) with respect to characterization of samples from Russia and South Africa. Specifically the project aims to:

1. Develop guidance material on how to minimize mercury releases by optimizing multi-pollutant control techniques, including improved energy efficiency to reduce mercury-emissions;
  2. Collect information to improve accuracy of future emissions inventories for the sector, including technical information on power plants and control technologies used, analysis of mercury concentrations in coals used by power plants and measurements of mercury in stack flue gases;
  3. Implement pilot studies to demonstrate the efficiency of multi-pollutant co-benefit techniques and by building local/national capacity on these issues, also with the aim of transferring information and lessons learnt to facilities and governments in other countries.
- The actions are focused on China, India, Russia and South Africa, but the results will be of interest to all countries with coal combustion power plants (duplicated below)
  - As part of the project above, the partnership is developing Guidance for mercury emissions from coal combustion, building on existing information known as the Process Optimisation Guidance - POG. This work was completed by end of 2010. It is available at the following web-link:
    - <http://hqweb.unep.org/hazardoussubstances/Mercury/PrioritiesforAction/Coalcombustion/ProcessOptimizationGuidanceDocument/tabid/4873/language/en-US/Default.aspx>

As a further development of this work, and with additional funding from Environment Canada, the information in the POG document is being combined with statistical data from coal-fired plants to produce the iPOG – an interactive modelling tool which will allow users to input plant-specific data and ascertain which mercury control options may be most appropriate for their specific situation. The tool is also flexible enough for non-experts to use it to provide an overview of the effectiveness of different control options and co-benefit effects for reducing mercury at full-scale coal-fired facilities. The iPOG is due for completion before INC3 in October 2011 and will be provided free of charge in data-stick form or will be available as a free download from the coal partnership web page.

- The Coal combustion partnership has received additional funding from the US Department of State to execute further activities in India and Indonesia. This new study will focus on both mercury and black carbon emissions and control within the region. .

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## V. Opportunities

Opportunities for enhancing information/knowledge that donors could consider funding:

- For Emissions Inventories: specialist assistance could be provided to allow the production of up to date emission inventories in target regions. This would include, where necessary, help with mercury measurement in both coals and stack gas emissions. Guidance could also be given on how to include current and impending emission legislation and control technology application in future emission estimates.
- Further complementary and specific projects including bilateral projects. These could include the application of any of the approaches outlined in the POG. Members of the coal partnership could be made available at national workshops in target countries to work with local authorities, utilities, researchers and interested parties to facilitate the

exchange of knowledge and information on mercury control options, from coal switching and cleaning to more complex plant modifications.

## **VI. Evaluation**

The partnership areas will report biennially to UNEP in accordance with the UNEP reporting format<sup>2</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).

Amongst other means, results will be characterized in terms of:

- Availability of guidance tools to assist countries in achieving emission reductions.
- Emission reductions achieved.

## **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.

The partnership has been able to generate significant and targeted actions with the funding from the European Commission from 2009-2011. The grant has been extended in time to 2012.

### **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.

An important opportunity to leverage resources lies in the significant partnership efforts currently underway to address conventional pollution (eg, SO<sub>x</sub>, NO<sub>x</sub>, CO<sub>2</sub>) from this sector. These efforts alone, or built upon with relatively little additional resources, can lead to increased awareness of mercury as a pollutant of concern and significant reductions in mercury emissions.

Partners are encouraged to contribute not only financially but also to offer in-kind assistance. The financial plan should be updated regularly to reflect experience and reassess funding requirements to achieve the objective of the partnership under II.

Developing countries and countries with economies in transition can also submit requests for funding to UNEP under the UNEP Mercury Small Grants Programme.

## **VIII. Business Planning Process**

The process in developing and reviewing business plans will be outlined in this section. Partnerships will take stock of efforts and test direction and productivity in moving forward and will adjust planning accordingly.

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Table 1: Administration and Management Support		Source of Support
Partnership Lead	<ul style="list-style-type: none"> <li>▪ Facilitation and support of the partnership.</li> </ul>	IEA Clean Coal Centre
UNEP Secretariat Support	<ul style="list-style-type: none"> <li>• Administrative and secretariat support.</li> <li>• Disseminate information to the Partners on relevant issues.</li> <li>• Assist the lead in following up activities by partners.</li> <li>• Other tasks as requested.</li> </ul>	In-kind support from UNEP
Face to face meetings	<p>Estimated one per year.</p> <p>All attempts will be made to host face to face meetings of the partnerships in the most cost effective way (e.g. back-to-back with other related meetings and have the ability to call in).</p>	UNEP will support some limited travel of developing countries/NGOs in face to face meetings, rest is in-kind support from partners for their own travel.
Teleconferences	Estimated 2 per year	In-kind support from USA

## IX. Linkages

**Asia Pacific Partnership** (Australia, Canada, China, India, Japan, Republic of Korea, United States). Under the Asia-Pacific Partnership (APP) on Clean Development and Climate, partner countries have agreed to cooperate on development and transfer of technology to address both greenhouse gas emissions and air pollution. A major focus of the APP is the coal fired power sector with the objective of improving both its energy efficiency and environmental performance. Progress made under the APP will reduce greenhouse gas emissions and emission of conventional air pollutants and, as a significant co-benefit, also reduce mercury emissions. Multiple projects are underway directed at SOx emission control, improved efficiency and demand reduction; these have significant mercury reduction co-benefits. Several projects are underway and planned including for the cement sector - efficiency improvements in existing facilities, use of alternate (non-coal) based fuels such as biofuels and waste materials. For more information see : <http://www.asiapacificpartnership.org/english/default.aspx>

**Development of Emission Inventories** – UNEP with support from the Government of Denmark recently updated the ‘Toolkit for Identification and Quantification of Mercury Releases’ based on initial experiences in using the toolkit. The toolkit is a key information gathering tool available to countries in assessing their national situation.

Contact person: Gunnar Futsaeter, UNEP Chemicals Branch, DTIE.

**Mercury Fate and Transport Partnership** – The partnership has a strong interest in improving emissions monitoring, data collection and reporting of mercury emissions; including contributing to published data dissemination to support modeling efforts assessing extent of problem, and against which to demonstrate progress. The coal partnership will link closely with the fate and transport partnership.

## X. Partners

Please see section vii of this document for the current list of partners that have submitted letters of support to the UNEP Global Mercury Partnership. There are a number of participating

partners that have not officially submitted support letters. For the list of participating partners, please go to the current business plans posted at the following web address:  
[www.chem.unep.ch/mercury/partnerships/new\\_partnership.htm](http://www.chem.unep.ch/mercury/partnerships/new_partnership.htm)

## **XI. Ongoing, completed and prospective projects**

- IEA Clean Coal Centre published a report entitled 'Economics of Mercury Control'. The full document is available from Lesley Sloss (partnership area lead). A summary of the report is available at: [www.chem.unep.ch/mercury/Sector-Specific-Information/Coal\\_combustion.htm](http://www.chem.unep.ch/mercury/Sector-Specific-Information/Coal_combustion.htm)
- The partnership is developing Guidance for mercury emissions from coal combustion, building on existing information known as the Process optimisation guidance document - POG. This work was completed by end of 2010. It is available at the following web-link: <http://hqweb.unep.org/hazardoussubstances/Mercury/PrioritiesforAction/Coalcombustion/ProcessOptimizationGuidanceDocument/tabid/4873/language/en-US/Default.aspx>
- The iPOG is an interactive modelling tool which will allow users to input plant-specific data and ascertain which mercury control options may be most appropriate for their specific situation. The iPOG is due for completion before INC3 in October 2011 and will be provided free of charge in datastick form or will be available as a free download from the coal partnership web page.
- A new inventory for mercury emissions from coal combustion in China has been produced by MEP in conjunction with Tsinghua University under the auspices of the coal partnership. The report is available at the following web-link:  
[http://www.unep.org/hazardoussubstances/Portals/9/Mercury/Documents/coal/FINAL%20Chinese\\_Coal%20Report%20-%202011%20March%202011.pdf](http://www.unep.org/hazardoussubstances/Portals/9/Mercury/Documents/coal/FINAL%20Chinese_Coal%20Report%20-%202011%20March%202011.pdf)
- A new inventory for mercury emissions from coal combustion in Russia is being finalised. The first ever measurements of mercury at full-scale plants in Russia were obtained with in-kind assistance from the US EPA. The new Russian inventory will soon be available in draft form.
- A new inventory for mercury emissions from coal combustion in South Africa is also being finalised. Again, the first ever measurements at full-scale plants in the country were obtained with in-kind assistance from the US EPA. The South African inventory will soon be available in draft form.
- Two parallel projects have been initiated at two separate coal-fired units in Russia to demonstrated mercury reduction. The first, led by the USEPA in collaboration with UNEP, Sweden and various Russian Institutes, is demonstrating the effectiveness of sorbent technologies whilst the other, led directly by UNEP, is trialling oxidation methods to enhance the performance of the existing scrubber system. The results should be available by early 2012.
- A coal-cleaning project has been proposed for mercury reduction demonstration in South Africa and this will hopefully commence before the end of 2011.
- India has now signed an agreement to work with the UNEP Coal Partnership and so it is hoped that work will commence late 2011 early 2012 on inventory work and activities demonstrating mercury reduction technologies.

### **Older but related projects:**

- China, Canada, Japan, the United States and UNEP held a workshop in Beijing in November 2005 on measurement and control of mercury from coal-fired power plants. The workshop increased awareness of the magnitude of mercury emissions from this sector, examined limited data currently available on the level of mercury exposure in China, and provided information on control approaches (funded through Mercury Trust Fund<sup>3</sup>, and also bilaterally funded through Canada, Japan, USA).
- China Follow-on Projects: The Governments of Canada and China, and Tsinghua University have prepared a study to compare the current China Mercury Emission Inventory with the UNEP mercury emissions toolkit, examine the status of coal washing technology and mercury removal in China, and examine coal combustion-related mercury emissions from small scale use in residential, commercial, and industrial sectors. The report is available at: [www.chem.unep.ch/mercury/useful-links.htm](http://www.chem.unep.ch/mercury/useful-links.htm)
- In 2007, Canada provided training to two trainees from China on measurement of mercury from fossil fuel combustion (including sampling and analysis of coal and coal residues, stack sampling methods and protocols and quality assurance and quality control requirements). The training included a one-month component in Canada and a ten-day follow up in China.
- China held a workshop in Hangzhou, China on November 10 - 14, 2008. The workshop focussed on cost effective controls that provide an integrated approach to the control of NO<sub>x</sub>, SO<sub>x</sub>, PM, Hg, and CO<sub>2</sub>. The first two days, sponsored by US EPA and China's Ministry of Environmental Protection (MEP), was open to all and provided up-to-date information on the effectiveness of various control technologies in addition to information about current regulations and policies for the US, China, and on UNEP's Mercury Programme. The second part of the workshop consisted of US vendor presentations, sponsored by US DOE and China's Ministry of Science and Technology (MOST), and was closed to all except US and Chinese citizens.
- The Russian Federation and the United States have worked together to develop low-cost technology for improved air pollution control at a power plant in Russia - it will optimize operations of a wet PM scrubber and look at the possibility of transferring to other facilities in Russia. Also, the Russian Federation, Ukraine, and the United States have partnered on a project to transfer a low-cost technology to improve the performance of ESPs at coal-fired plants and other industrial facilities in Russia and Ukraine.
- South Africa's Council for Scientific and Industrial Research (CSIR) is working with the University of Connecticut, USA to determine the fate and transport of mercury from coal combustion and its impact on water resources in the country. This activity also included using the UNEP mercury emissions toolkit to develop a South African Mercury Emissions Inventory.
- In 2007, South Africa's CSIR and Norway's Norwegian Institute for Air Research (NILU) initiated activity on assessing the current and future emissions of mercury from anthropogenic sources in South Africa.
- The United States and India worked together to provide information and other assistance to India to increase effectiveness of pollution controls on coal-fired power plants. Activities in India have included workshops outlining pollutant specific and multipollutant control technology alternatives, mercury monitoring technology, as well as specific training on an EPA developed software tool to help optimize electrostatic precipitator PM capture, with co-benefit mercury emissions reductions. In addition, an ESP at a power plant in India has been modified to improve its collection efficiency. The project was performed in cooperation with Asia Pacific Partnership Plan.

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<sup>3</sup> Mercury Trust Fund: approximate total funding for coal combustion work to date is \$ 6,000 US.