zero Hg
mercury working group

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Dear John,

Thank you for the opportunity to comment on the document entitled *Principles for Evaluation of Received Information and Preparation of Sectorial Scenarios in the UNEP Paragraph 29 Study*. This document provides an excellent start and solid general framework to the process of producing the Paragraph 29 study, which will focus on mercury emissions and controls for coal, cement, nonferrous metals processing and waste incineration.

The following are the consolidated comments of members of the Zero Mercury Working Group (ZMWG), on that draft document. We have a number of general comments, organized by the questions posed in your email of July 11, 2010, specifically,

- Are the Categories defined in a realistic and representative way?
- What are the most feasible and realistic measures to be taken to reduce mercury emissions to air in the selected sectors and in different regions (including pre-treatment of fuel or raw materials, co control with air pollution or mercury specific measures)?
- Which mercury specific measures are most likely to be introduced in facilities with only basic air pollution control e.g. in plants with only particle emissions control?
- What are representative mercury removal efficiencies (range and average) for the different Categories?

We have also have made several specific comments in comment boxes within the draft document itself, attached. Finally, we have provided several references that you may find useful, as described in the "additional resources" section below.

Question 1: Are the Categories defined in a realistic and representative way?

The categories of pollution control could be made more specific for many of the sectors. The general categories presented in this version could be further subdivided by process, configuration, or input characteristics. This would narrow down the removal efficiency ranges and allow for more precise estimates of local conditions and reduction capacity, and thereby facilitate more precise future global scenario estimates. The current general categories result in removal efficiency ranges that are so broad that they often result in overlapping ranges between categories. This obscures the relevant differences between the removal efficiencies of different control technologies and will make it difficult to estimate reduction potential due to adoption of more advanced pollution control technologies. Where relevant, the categories should start with 0% removal efficiency.

One specific consideration when creating categories is to consider size of the units to which the controls are applied. Industrial boilers should not be put in the same sector with much larger electric utility coal-fired boilers, mainly because of their huge difference in their sizes. A *very large* industrial boiler (say, 100 to 250 mm BTU/hr) is *much smaller* than a *very small* coal-fired electric utility boiler (say, 100 MW or about 1000 mm BTU/hr). The technical feasibility and cost effectiveness of mercury controls, such as activated carbon injection (ACI), as well as "co-benefit" controls (such as controls for SO_2 and PM) is quite often on different scales. For example, almost all of the coal fired industrial/commercial/institutional (ICI) boilers in the United States do NOT have SO_2 controls in place, whereas more than 40 percent of electricity generating units (EGUs) have either wet scrubbers or spray dryers for SO_2 control. ACI is currently being widely used on commercial scale for the larger EGUs but not on the smaller ICI boilers.

For EGUs, category B or C (both?) should include mercury oxidation technologies (to convert elemental mercury into oxidized mercury through additives or catalysts including Selective Catalytic Reduction (SCR) catalysts; to be subsequently captured in a wet or dry scrubber). It may be necessary to treat three major coal types (bituminous, sub bituminous, and lignite) separately, if data allow. ICIs should be addressed as a separate sector with their own three categories (with focus on ICIs that only have PM controls without NOx or SO_2 controls now or in the future).

Question 2: What are the most feasible and realistic measures to be taken to reduce mercury emissions to air in the selected sectors and in different regions (including pre-treatment of fuel or raw materials, co control with air pollution or mercury specific measures)?

A serious effort to control mercury emissions from coal combustion must evaluate the feasibility of mercury-specific measures as the *first* step instead of considering it as the "*last* step" as envisioned in the Paragraph 29 study. This is because even in the U.S., where overall air pollution control is relatively advanced, only 32 percent of the boilers have wet FGDs for SO_2 control and even a fewer number of units have SCR for NOx control (though almost 100 percent of the EGUs have PM control with cold- or hot-side ESPs or fabric filters). What this means is that it would take a very long time (to perhaps, 2030?) to get Hg control from 'co-control" on most units in the U.S. If co-control is to be considered, the Para 29 study should include an evaluation of the length of time for SO2 and NOx technologies not already in place to be implemented (including consideration of likely delays in regulatory implementation). Additionally, the pre-treatment technologies (coal washing, etc.) are only marginally beneficial in removing Hg. To obtain a certain and yet high (90 to 95 %) level of mercury control at a reasonable cost in a reasonable timeframe, mercury controls such as activated carbon injection (ACI) are a proven and cost effective technology for at least two categories included in Paragraph 29 study (coal-fired boilers and municipal waste combustors,which should be similar to waste incineration category).

Question 3: Which mercury specific measures are most likely to be introduced in facilities with only basic air pollution control e.g. in plants with only particle emissions control?

In this case, it is important to note that the PM control technology (especially a bag house) could be extremely useful air pollution control equipment if it is already in place. Application of mercury-specific ACI technology for this case would be much cheaper (say, at less than 4 to 9 dollars per KW, capital costs; see attached July 2010 NESCAUM report) than the application of wet FGD (at more than $250 to 300 per KW, capital costs) or an application of SCR for NOx controls (at about $ 100 to 150 per KW) if the objective is to obtain substantial near-term (say, by the years 2015-2020) Hg reductions without the "co-benefits". So, instead of waiting for "co-controls" to arrive, addition of simple ACI technology to a facility with a bag house/ESP already in place can result in substantial mercury reductions now, in some cases, as high as 90 to 95 %.

Note that in the cement manufacturing industry in the United States, particle control equipment only results in mercury reductions when the material collected by this air pollution control devices is removed from the system. When it is re-circulated in the manufacturing process, as is common in cement production, the removal efficiency is virtually zero.

Question 4: What are representative mercury removal efficiencies (range and average) for the different Categories?

The mercury control efficiencies included in the "Principles for evaluation…." are generally reasonable for both the range and averages for coal-fired power plants and waste incineration/municipal waste combustion.

However, as noted earlier, the presentation of broad pollution control categories results in large ranges in the removal efficiencies. This limits the degree to which the scenarios of emission control strategy deployment will reflect reductions in estimated emissions. Where possible, the factors that drive the large ranges should be identified and subcategories of pollution control equipment and/or process characteristics (i.e. input characteristics) should be developed. Where multiple data sources for removal efficiencies exist, a description of the degree to which they are consistent or vary would assist in the interpretation of the results presented.

Additional resources:

NESCAUM report: Attached is a recently completed July 2010 NESCAUM report *"Technologies for Control and Measurement of Mercury Emissions from Coal-Fired Power Plants in the United States: A 2010 Status Report."* The focus of this report is on ACI technology as well as on technologies to promote oxidation of elemental mercury to oxidized mercury in the flue gas for subsequent removal in a wet or dry scrubber (if there is one already in place). If the coal-fired boilers only have a PM control devices, then ACI may be an optimum control technology that can be installed now at a reasonable cost.

Hylander and Herbert 2008.[1] This study used data on copper, lead and zinc smelter feed characteristics and production to estimate global mercury emissions from this sector. The study concluded that previous studies underestimated emissions from this sector due to inaccuracies in reporting of mercury emissions and incomplete information on production processes. The study relied on copper, zinc, and lead concentrate market studies that included information on the production and supply of concentrates to smelters and pollution abatement technologies.

Mercury emission reduction potential for gold production facilities (Nevada Department of Environmental Production)

The Nevada DEP is in the process of developing a permitting program for sources of mercury emissions from gold production. This program has developed emissions limits and required control technologies for the retort, a component of the gold production process, and is in the process of developing the same for furnaces and kilns. Emission limits and the associated technologies for these sources are expected to be completed by the end of this year. This information is not currently available as a publically accessible resource but should be available through consultation with the agency officials developing this program.[2] Currently, NVDEP has shown that mercury specific control technology on the retort can result is 98% removal efficiency.

Biomass burning

Finally, we understand that unintended Hg emissions from biomass burning will not be among the targeted sources in this inventory, but we provide this information for inclusion in global estimates as appropriate. In a recent paper by Selin et al (2008, Global Biogeochemical Cycles, 22, BG2011, doi:10.1029/2007GB003040), the authors estimate biomass burning as contributing 100 – 860 Mg/yr. While this source is very difficult to address due to its dispersed nature (much of it household burning) there are solutions that can be considered such as fuel switching, filters or more efficient stoves, along with better insulated houses.

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[1] Hylander, LD and Herbert, RB. 2008. Global Emissions and Production of Mercury during the Pyrometallurgical Extraction of Nonferrous Sulfide Ores. Environ.Sci.Technol 42:5791-5977.

[2] Soletta, Tanya. 2010. Personal communication, Nevada Department of Environmental Protection Bureau of Air Quality Planning. Mercury Control Program. http://ndep.nv.gov/baqp/hg.html