Global Emissions of Mercury to the Atmosphere in 2005 and their 2020 Scenarios

J.M. Pacyna[a, b], E.G. Pacyna[a], K. Sundseth [a], J. Munthe [c], S.Wilson [d], and J. Leaner [e]
[a]NILU-Norwegian Institute for Air Research (NILU), Norway. [b]Faculty of Chemistry, Gdansk University of Technology, Poland. [c]IVL Swedish Environmental Research Institute, Sweden. [d]AMAP, Arctic Monitoring and Assessment Programme, Norway. [e]CSIR, Natural Resources and the Environment, South Africa.

Background

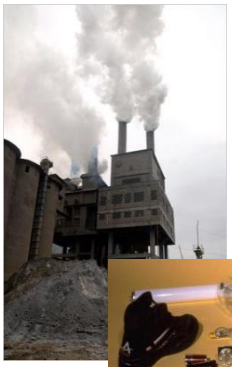
2007 United Nations Environmental Programme (UNEP) Governmental Council (GC) request:
"..to prepare a report,...addressing:

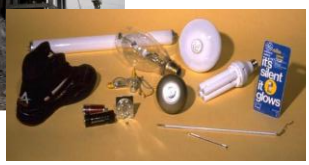
a) ...mercury atmospheric emissions and trends including where possible an analysis by country, region and sector,...;
b) Current results from modelling on a global scale...."

The results of this assessment were presented at the UNEP Governing Council meeting in February 2009. During that meeting, UNEP agreed a process to develop a legally-binding global instrument on mercury to be implemented by 2013.

What`s new in this study?

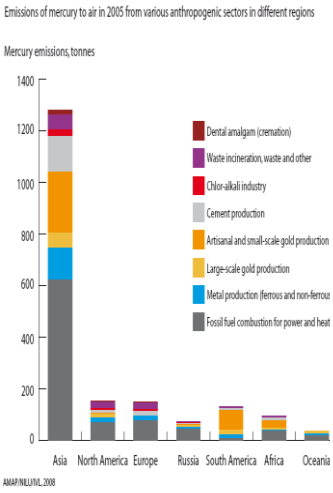
- Improved national reporting.
- Improved factors for estimating emissions
- Estimates for 'new' sectors not previously quantified
- Better information on location of point sources in some areas
- First attempt at emission scenarios on a global scale

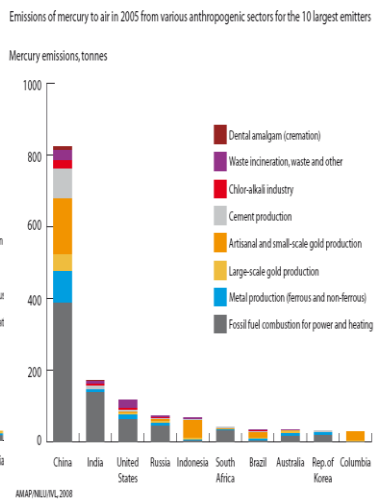




Global emissions of mercury to the atmosphere in 2005

About the three quarters of the total anthropogenic emissions of mercury in the year 2005 estimated to be 1958 tonnes comes from sources where mercury is emitted as a by-product, and the rest is emitted during various applications of mercury. The largest emissions of Hg to the global atmosphere occur from combustion of fossil fuels, mainly coal in utility, industrial, and residential boilers (almost 47 %), followed by artisanal mining (almost 17 %), non-ferrous metal production, including gold production (13.5%) and cement production (about 9.5 %).

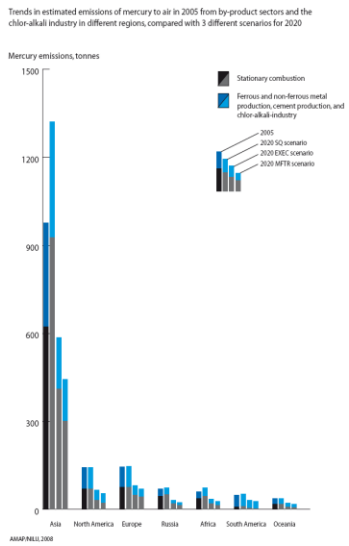




Scenarios

Three scenarios to explore implications of 'no action' vs 'action'

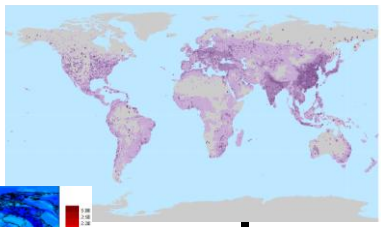
- Target year 2020
- Status Quo (SQ): Do nothing, current technology, continued economic and population growth. – Estimated increase in Hg emissions by about 25%.
- Extended Emission Controls (EXEC): Apply controls currently implemented or planned for EU to all countries. –Estimated decrease of 50% compared to SQ.
- Maximum Feasible Technological Reductions (MFTR): Employ best technology currently available in all countries. –Estimated decrease by about 60% compared to SQ.

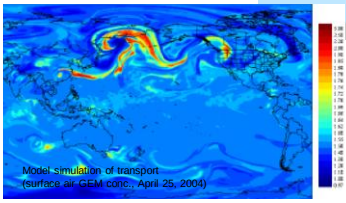


Sector	SQ 2020	EXEC 2020	MFTR 2020
Large combustion plants	Increase in coal consumption in Africa (20%), South America (50%) and Asia (50%). Application of current technology.	SQ 2020 plus: De-dusting: fabric filters and electrostatic precipitators operated in combination with FGD. Activated carbon filters. Sulphur-impregnated absorbents. Selenium impregnated filters.	SQ 2020 plus: Integrated gasification combined cycle (IGCC). Supercritical polyvalent technologies. 50% participation in electricity generation by thermal method.
Iron and steel production	Application of current technology.	In sintering: fine wet scrubbing systems or fabric filters (FFs) with addition of lignite coke powder. In blast furnaces: scrubbers or wet ESPs for BF gas treatment. In basic oxygen furnace: dry ESP or scrubbing for primary de-dusting and fabric filters or ESPs for secondary de-dusting. In electric arc furnaces: fabric filters and catalytic oxidation.	EXEC 2020 techniques in existing installations plus: Sorting of scrap. New iron-making techniques. Direct reduction and smelting reduction.
Cement industry	Increase in global cement production (50%).	SQ 2020 plus: De-dusting: fabric filters (FFs) and electrostatic precipitators (ESP).	SQ 2020 and EXEC 2020 plus: All plants with techniques for heavy metals reduction.
Chlor-alkali industry	Application of current technology.	Phase-out of mercury cell plants by 2010	

Modelling

Further, models can:
- Study sources-receptor relationships
- Estimate deposition and concentrations etc.





Contact Information
Jozef M. Pacyna, jp@nilu.no
NILU-Norwegian Institute for Air Research
P.O.Box 100, NO-2027 Kjeller, Norway
Ph. +47 63 89 80 00