

Status of UNEP Report on Emissions

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UNEP Report Production

- **UNEP Report:**
 - Response to UNEP Governing Council decision GC 24/3 IV, paragraphs 24a and 24b
 - UNEP-Chemicals responsible for organizing delivery of report, requested AMAP Secretariat to assist in this work
 - Due May 2008 (first draft), January 2009 (final report)
 - Target audience, policy-makers/decision-makers so will be drafted by a professional science writer based on technical drafts from 2 main expert drafting teams

Ongoing Mercury Assessments:

- UNECE Task Force on Hemispheric Transport of Air Pollutants, assessment of intercontinental transport of air pollutants (incl. mercury) (delivery in 2009 to EMEP Steering Body / Executive Body of the UNECE LRTAP Convention)
- AMAP Assessment of Mercury in the Arctic (delivery in 2011 to Arctic Council Ministers)
- Mercury Fate and Transport Partnership report, an input to the UNEP process (delivery in 2008 to OEWG, academic book publication)
- **Coordination Group (to coordinate activities with UNEP, AMAP and F&T Partnership/HTAP assessment activities):**
 - UNEP-Chemicals (John Whitelaw, Gunnar Futsaeter)
 - AMAP (Lars-Otto Reiersen, Simon Wilson)
 - F&T Partnership/HTAP (Nicola Pirrone)

UNEP Report Drafting Groups

Part A

- **Sources of mercury to the atmosphere**
- **Estimates of current global anthropogenic emissions to the atmosphere**
- **Trends in atmospheric mercury emissions to the atmosphere**

Lead Authors: Jozef Pacyna (Norway), John Munthe (Sweden)

Principal Contributors/Co-authors: Prof. Peter Nelson (Australia), Prof. Ming Wong (China-Hong Kong), Dr. Anne Pope (USA), Dr. Joy Leaner (South Africa), Dr. G.S. Ochoa (Mexico), Prof. Ramesh Ramachandran (India), Peter Maxson, Dr. Simon Wilson (AMAP)

Main F&T Contributions: Chapter 7 (Robert Mason: natural sources), Chapter 6 (K.Telmer/M. Veiga: artisanal gold), Chapters 2, 3 (D.Streets/X.Feng: emissions from China)

Part B

- **Atmospheric pathways**
- **Modelling atmospheric transport and deposition**
- **Environmental fate and trends**

Lead Authors: Henrik Skov (Denmark), Oleg Travnikov (Russia), Ashu Dastoor (Canada)

Principal Contributors/Co-authors: Dr. Jesper Christensen (Denmark), Dr. Russel Bullock (USA), Dr. Ki-Hyun Kim (Korea), Dr. Masahiro Sakara (Japan)

F&T Contributions: Chapters 9-13 (monitoring); 14, 15 (chemical processes); 18, 19, 21 (modeling results)

Structure of report A1: Natural sources

- Natural point sources. Summary of recent findings on emissions from volcanoes, forest fires etc.
- Emissions from natural surfaces. Includes discussion of both emissions/reemissions from soils, water and contaminated land.
- *Mainly based on F&T Report by Rob Mason + recent literature.*

Structure of report - A2 Anthropogenic sources

- Main anthropogenic source identification and update. Update of 2000 inventory (Pacyna et al., 2005)
- Estimate emissions from intentional Hg use:
 - Product use
 - Waste incineration
 - Artisanal gold mining (*Based on F&T contribution by Telmer and Veiga*)
- Trend analysis, scenarios, policy options, technology options

A3 Global anthropogenic emissions

- Revision update of emission factors, activity data
- Verification (measurement data)
- Uncertainties
- Scenario development
- Global inventory distribution, 2005 and scenarios

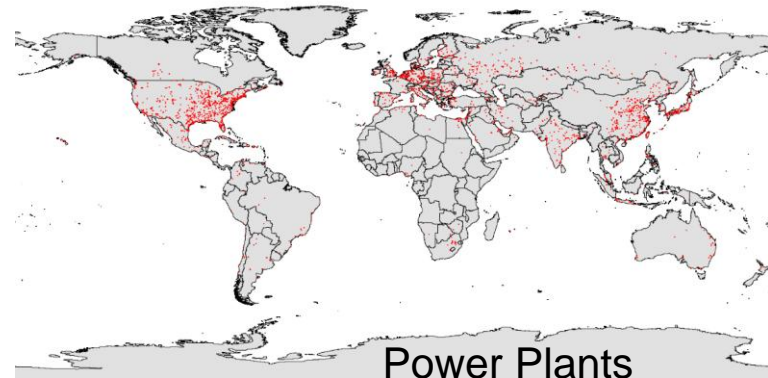
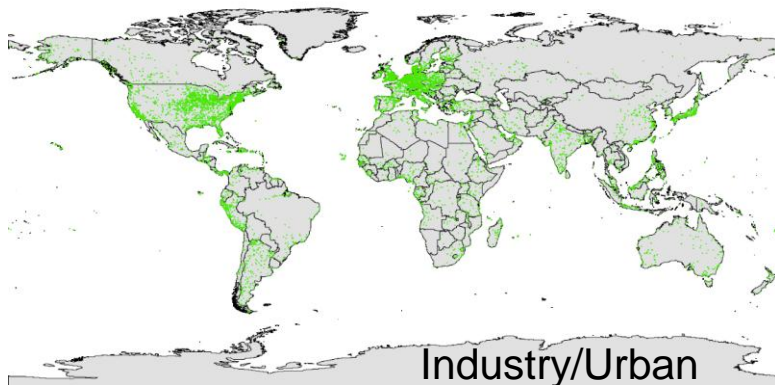
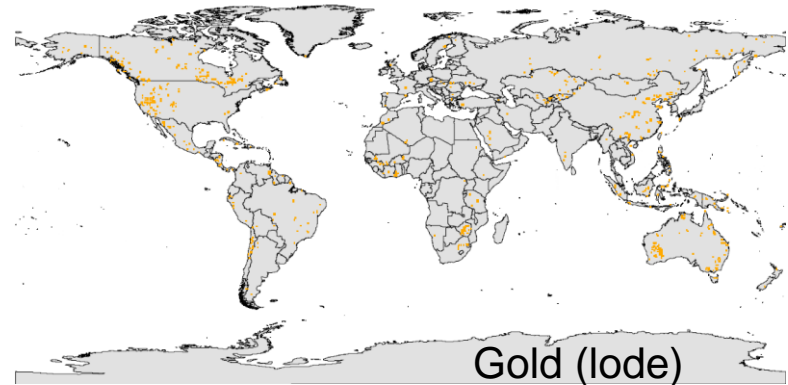
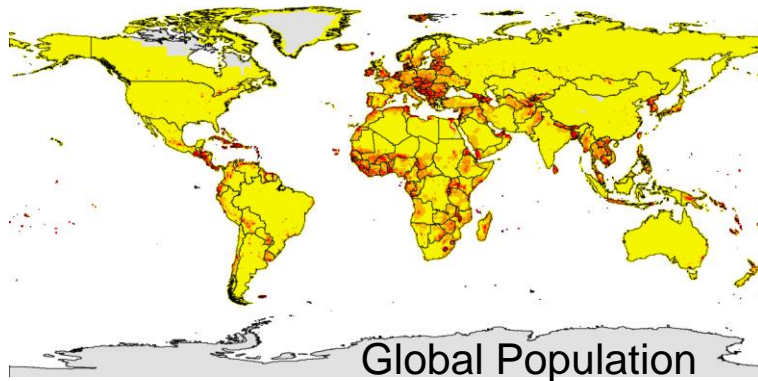
Anthropogenic sources

- Mainly based on information available from national statistics and official reporting.
- Additional input from National experts
- Fate and transport contributions (China etc..)
- Point source locations derived from replies to request for information from UNEP and national pollution release inventories.
- Geographical distribution based on population, location of major power plants, gold ores etc.

Spatial Distribution of Mercury Emissions Inventories

S. Wilson (AMAP) and F. Steenhuisen (Netherlands)

Previously 'global population distribution' was the only surrogate available for distributing mercury emissions from non-point source emissions (or emissions from point sources where coordinates of point sources are unknown) – result was distribution of emissions over entire populated territory
New 'distribution masks' being applied for distributing emissions from sectors such as stationary combustion sources, gold production, etc. where point source locations are unknown



Uncertainties, verification

- Request for information sent out January 2008
- Very few responses – currently being evaluated
- Uncertainty chapter in report will contain discussion of:
 - Uncertainties in main emission sectors
 - "Unknown" sources
 - Possible ranges in emission estimates

Some preliminary results

- Global emissions reduced in comparison to year 2000 (around 2200 tonnes/yr), mainly due to:
- Reduced emissions in Africa, more reliable data available for South Africa from Leaner et al. Also revised estimate for Dem Republic of Congo.
- Previous overestimation of emissions from gold production (not artisanal) in southern hemisphere .
- 2000 inventory needs to be updated for direct comparison with 2005.
- Need to update with new categories.

Emissions from intentional use of Hg

- Products
- Dental amalgam

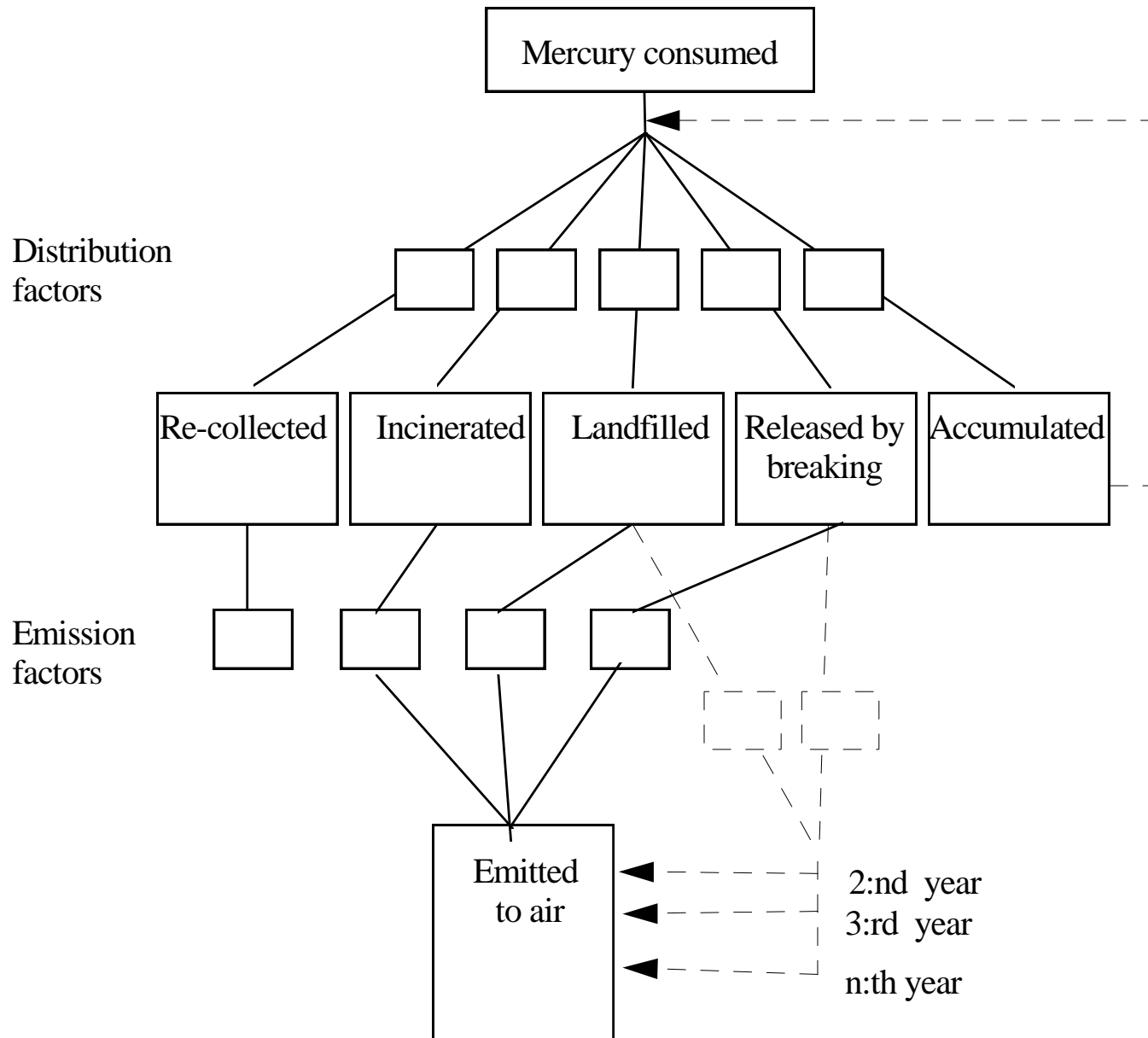
Global mercury consumption (Maxson, 2008)	East and Southeast Asia	South Asia	European Union (25 countries)	CIS and other European countries	Middle Eastern States	North Africa	Sub-Saharan Africa	North America	Central America and the Caribbean	South America	Australia New Zealand and Oceania	Total by use category
Artisanal gold mining	300	108	3	34	5	10	35	2	16	76	0	589
VCM production	700	0	0	15	0	0	0	0	0	0	0	715
Chlor-alkali production	50	42	175	45	25	10	2	50	10	35	6	450
Batteries	177	32	22	15	8	4	7	17	4	10	4	300
Dental use	50	20	95	11	4	2	2	36	4	12	4	240
Meas. control devices	100	50	40	15	3	1	1	34	1	3	2	250
Lighting	21	12	25	7	3	1	1	25	1	2	2	100
Electrical devices	52	28	30	6	1	1	1	28	1	1	1	150
Other	14	8	10	2	1	1	1	8	3	1	1	50
Total by region	1464	300	400	150	50	30	50	200	40	140	20	2844

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Emissions from product use of Hg

- Based on method previously applied for Europe (Kindbom and Munthe, 2007, available from www.ivl.se)
- Top-down approach based on global statistics on Hg consumption in different product sectors.

Emissions from product use of Hg



Emissions from dental amalgam production/use and cremation

- International statistics on number of cremations per country (available from the Cremation Society of Great Britain.
<http://www.srgw.demon.co.uk/CremSoc5/Stats/Interntl/2006/StatsIF.html>)
- Missing data scaled from population data or specific information available from national statistics or other sources
- Religious and cultural traditions taken into account (orthodox christian and moslems)

Emissions from dental amalgam production/use and cremation

- Very few countries include emissions from dental amalgam production or crematories in official statistics
- Sometimes included in categories "other" or "Waste incineration"
- Independent studies available for Northern Europe (OSPAR Convention on the protection of the North Sea).
- Also for Europe (Maxson, 2007 and the US Cain et al, 2007).

Emissions from intentional use of Hg (ASGM, Cremations and Products)

Region	ASGM	Dental amalgam (cremations)		Products	
		Min	max	min	max
Australia New Zealand and Oceania		0.011	0.019	0.5	0.9
Noth Africa				0.6	1.1
Sub-Saharan Africa		0.1	0.17	1.1	4
Central America and the Caribbean		0.07	0.12	0.4	1.4
CIS and other European countries		0.28	0.42	4.5	8.5
East and Southeast Asia		11	17	25.1	41.9
European Union (25 countries) (from previous study)		2	5	11.7	14.8
Middle Eastern States		0.003	0.006	0.7	1.3
North America		0.34	0.51	11.5	13.4
South America		0.28	0.43	0.7	1.7
South Asia		2.1	3	11.8	21.8
Total sums (tonnes)	330	19	27	69	111

Product emissions by region and product category

Emissions, Max	Batteries	Meas. control devices	Lighting	Electrical devices	Sum
East and Southeast Asia	14.43	13.39	3.39	10.67	41.9
South Asia	4.44	8.43	2.41	6.56	21.8
European Union	2.57	3.84	2.99	5.40	14.8
CIS+oth European count	3.35	2.43	1.22	1.47	8.5
Middle Eastern States	0.37	0.37	0.29	0.28	1.3
	0.43	0.23	0.23	0.25	1.1
Sub-Saharan Africa	2.91	0.29	0.29	0.47	4.0
North America	1.75	3.74	2.75	5.16	13.4
Central America and the Caribbean	0.69	0.20	0.20	0.33	1.4
South America	0.87	0.30	0.23	0.29	1.7
Australia New Zealand and Oceania	0.41	0.16	0.16	0.21	0.9
Sum	32.2	33.4	14.2	31.1	110.9

Product emissions by region and emission category

Emissions, Max	Release by breaking	Waste incineration	Waste landfill	Steel scrap	Waste recollected , recycling - handling	Sum
East and Southeast Asia	1.73	18.00	16.15	2.33	3.68	41.9
South Asia	0.84	8.57	11.60	0.66	0.19	21.8
European Union	0.62	9.03	2.40	2.37	0.38	14.8
CIS+oth European count	0.28	5.52	2.19	0.27	0.21	8.5
Middle Eastern States	0.09	0.21	0.91	0.07	0.03	1.3
North Africa	0.04	0.57	0.49	0.02	0.01	1.1
Sub-Saharan Africa	0.06	3.11	0.69	0.04	0.04	4.0
North America	0.51	7.45	2.77	2.07	0.61	13.4
Central America and the Caribbean	0.05	0.61	0.69	0.04	0.02	1.4
South America	0.09	0.74	0.78	0.07	0.02	1.7
Australia New Zealand and Oceania	0.05	0.49	0.20	0.12	0.08	0.9
Sum	4.4	54.3	38.9	8.1	5.3	110.9

Uncertainties and missing information related to product use of Hg

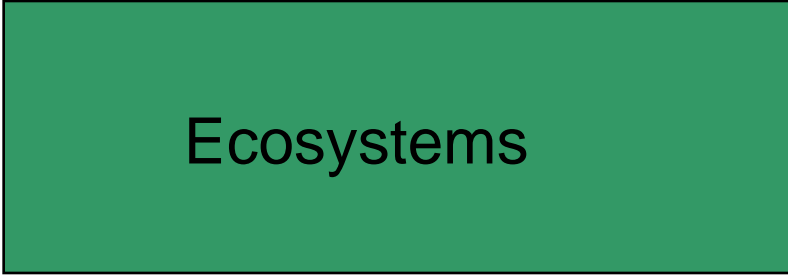
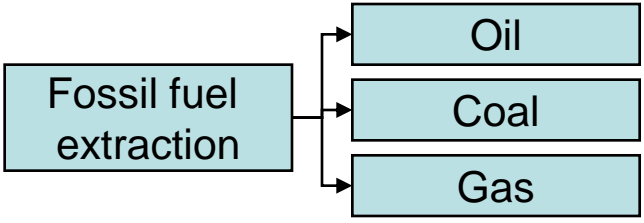
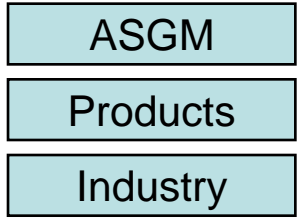
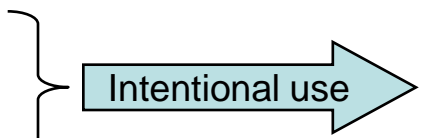
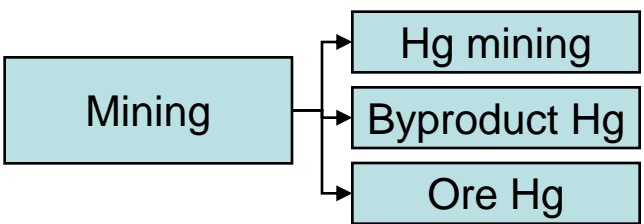
- Production phase not included. Assumed to be covered in national inventories (?)
- For dental amalgam, only cremation included. Estimates from Europe (Maxson) and USA (Cain + official reporting) will be used as a basis to discuss total emissions.
- Product emissions mainly via waste incineration. National reporting often incomplete. Need to compare and complement national data but avoid double counting.

Remaining work emissions.....

- Finalise emission inventory data 2005 + scenarios
- Spatial distribution
- New modelling runs (?)
- Compare with Fate and transport results – consolidate or explain differences
- Finalise evaluation of uncertainties
- Draft report by the end of April.

Primary anthropogenic sources

Secondary sources



Primary natural sources

